Annex 2

Feasibility Study

For the GCF-FAO Project "Climate Resilient Agriculture in Somalia (Ugbaad)"

Figure 1: Project logo - Image generated by DALL-E

Abbreviations

Armed Conflict Location and Event Data (ACLED)
Agro-Ecological Zonation (AEZ)
Agricultural Stress Index System (ASIS)
Automatic Weather Stations (AWS)
Climate and Agriculture Risk Visualization and Assessment (CAVA)
Consecutive Dry Days (CDD)
Climate Hazards Group Infrared Precipitation with Stations (CHIRPS)
Coupled Model Inter-comparison Project (CMIP)
Coordinated Regional Downscaling Experiment (CORDEX)
CORDEX- Coordinated Output for Regional Evaluations (CORE)
Centre for Research on the Epidemiology of Disasters (CRED)
Climate Risk and Early Warning Systems (CREWS)
Climate Research Unit (CRU)
El Niño Southern Oscillation (ENSO)
Food and Agriculture Organization (FAO)
Famine Early Warning Systems Network (FEWSNET)
Federal Member States (FMS)
Flood Risk and Response Management Information System (FRRMIS)
Food Security and Nutrition Analysis Unit (FSNAU)
Green Climate Fund (GCF)
Global Climate Models (GCM)
Global Framework on Climate Services (GFCS)
Greater Horn of Africa Climate Outlook Forum (GHACOF)
IGAD Climate Prediction and Application Centre (ICPAC)
IGAD Drought Disaster Resilience and Sustainability Initiative (IDDRSI)
Inter-Governmental Authority for Development (IGAD)
Indian Ocean Dipole (IOD)
Integrated Food Security Classification (IPC)
Inter-Governmental Panel on Climate Change (IPCC)
Interim Poverty Reduction Strategy Paper (IPRSP)
IGAD Regional Climate Change Strategy (IRCCS)
Inter-Sectoral Impact Model Intercomparison Project (ISIMIP)
Inter-Tropical Convergence Zone (ITCZ)
Joint Market Monitoring Initiative (JMMI)
Land Degradation Neutrality (LDN)
Ministry of Environment and Climate Change (MoECC)
Ministry of Energy and Water Resources (MoEWR)
National Adaptation Plan (NAP)
National Climate Change Action Plan (NCCAP)
National Climate Change Committee (NCCC)
National Climate Change Response Strategy (NCCRS)
National Designated Authority (NDA)
National Determined Contributions (NDC)
National Meteorological and Hydrological Services (NMHS)
Ninth National Development (NDP)
Quasi biennial Oscillation (QBO)
Regional Circulation Model (RCM)
Representative Concentration Pathways (RCP)
Regional Office for Arab States (ROAS)
Resilience and Recovery Framework (RRF)
Rift Valley Fever (RVF)
Standardized Precipitation Index (SPI)
Shared Socioeconomic Pathways (SSP)
Somalia Water and Land Information Management (SWALIM)
Thermo-Neutral Zone (TNZ)
United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA)
United States Agency for International Development (USAID)

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1 Country and Local Context

1.1 National Context

1. Somalia is in the Horn of Africa, bordering Ethiopia to the west and the Gulf of Aden, the Indian Ocean to the east; approximately 3,025 km of Somalia's 647,540 km^2 of total land area is coastline.[1] Most of Somalia's land is flat with a mean elevation of 410m in the central and southern coastal lowlands.[2] Northern parts of Somalia, primarily Somaliland and Puntland, are dominated by highlands that form the spine of the Horn of Africa, with Mount Shimbiris being the highest point at 2,460m.[3] Arable land is extremely limited as over 80% of the country is considered arid and semi-arid land (see Figure 3 and Figure 4, below).[4] Due to the aridity, it is not uncommon for Somalia to experience extended periods of drought, extremely high temperatures, and extremely limited rainfall (discussed more in Section 2).[5]

Source: World Bank Cartography Unit, June 2023.

Figure 2 Somalia Geography; Source: World Bank, 2023[6]

[1] The World Bank. 2024. Climate Change Knowledge Portal: Somalia – Country Summary. Retrieved from: https://climateknowledgeportal.worldbank.org/country/somalia

[2] U.S. Central Intelligence Agency. 2024. The World Factbook: Explore All Countries – Somalia. Retrieved from: https://www.cia.gov/the-world-factbook/countries/somalia/#geography.
The World Bank. 2023. Somalia Climate Risk Review. Retrieved from: https://www.preventionweb.net/publication/somalia-climate-risk-review. Page 3.

[3] The World Bank. 2023. Somalia Climate Risk Review. Retrieved from: https://www.preventionweb.net/publication/somalia-climate-risk-review. Page 3.

[4] The Federal Republic of Somalia. July 2021. Updated Nationally Determined Contribution (NDC). Page 2.

[5] Directorate of Environment and Climate Change (DoECC), Somalia. February 2022. Somalia's National Adaptation Plan Framework. Page 1.

[6] The World Bank. 2023. Somalia Climate Risk Review. Retrieved from: https://www.preventionweb.net/publication/somalia-climate-risk-review. Page 3.

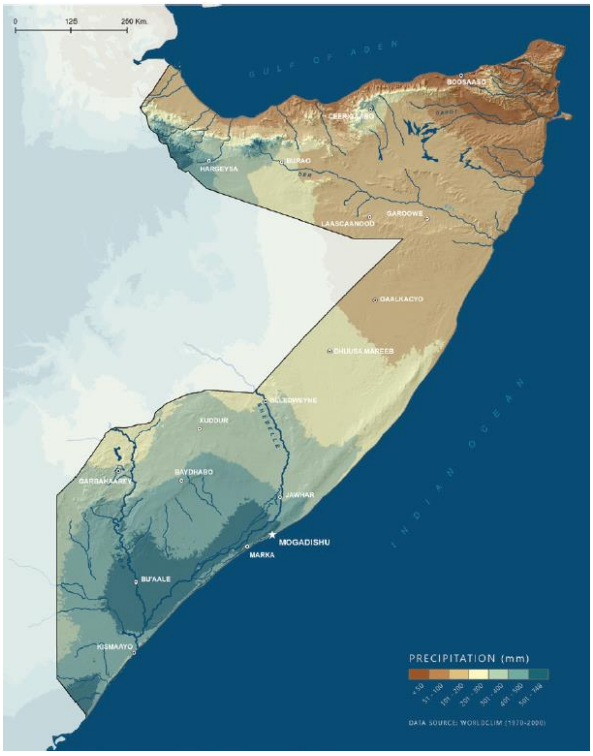


Figure 3 Somalia Annual Total Rainfall; Source: The World Bank, 2023[7]

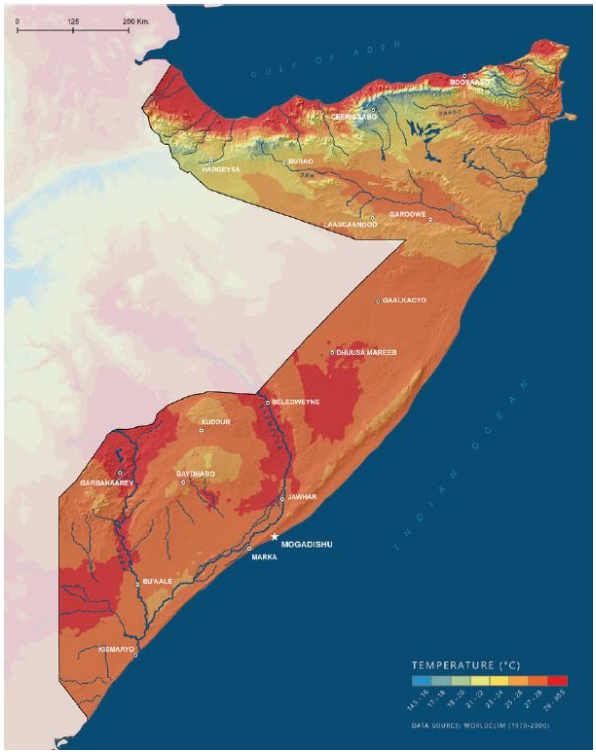


Figure 4 Somalia Annual Temperature; Source: The World Bank, 2023[8]

1.1.1 National Economic Context

2. Somalia is the poorest least-developed countries (LDC), ranking 193rd out of 193 nations in the UNDP Human Development Index (HDI).[9] Extremely impoverished, the impact of Somalia on global warming and climate change is negligible, though the country is extremely vulnerable to negative climate change impact pathways. This is reflected in the HDI's sub-category, 'Planetary Pressures-Adjusted HDI (PPAH),'[10] Somalia's PPAH is 0.375; considerably lower than the world average of 0.685 and the lowest of all nations.[11]

3. Most of Somalia's population is engaged in agriculture and livestock, accounting for more than 70% of livelihoods.[12]

1.1.2 Demographic profile

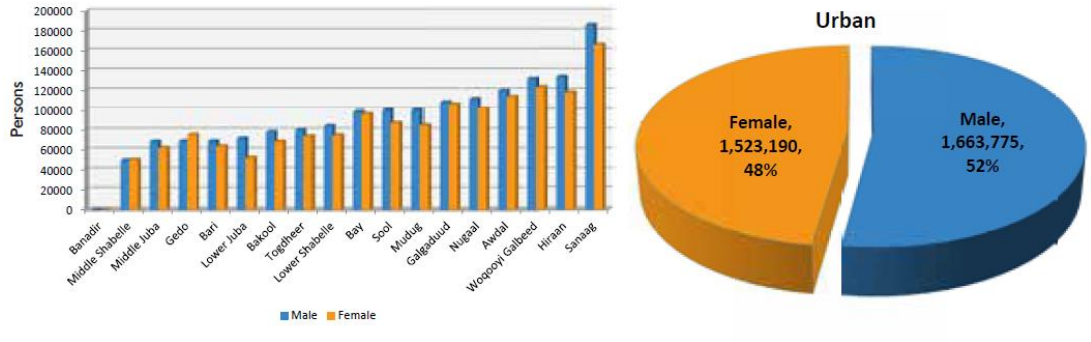
4. Somalia's population is extremely young and approximately 50/50 male-to-female. This patten is approximately repeated across all categories of population, (see Figure 5 below): i) Urban (48%

[7] The World Bank. 2023. Somalia Climate Risk Review. Retrieved from: https://www.preventionweb.net/publication/somalia-climate-risk-review. Page 4.
[8] The World Bank. 2023. Somalia Climate Risk Review. Retrieved from: https://www.preventionweb.net/publication/somalia-climate-risk-review. Page 4.
[9] UNDP. 2024. Human Development Reports. Retrieved from: https://hdr.undp.org/data-center/country-insights#/ranks.
[10] The PPAH is an HDI measure that measures the GHG emissions per person and material consumption as a gauge of how intensive a nation's consumption of Earth's resources is.
[11] UNDP. 2024. Human Development Reports. Retrieved from: https://hdr.undp.org/data-center/specific-country-data#/countries/SOM.
[12] The Federal Republic of Somalia. July 2021. Updated Nationally Determined Contribution (NDC). Page 2.
The World Bank. 2023. Somalia Climate Risk Review. Retrieved from: https://www.preventionweb.net/publication/somalia-climate-risk-review. Page 5.

female, 52% male), ii) Rural (49% female, 51% male), iii) Nomadic (48% female, 52% male), iv) IDPs (51% female, 49% male).[13]

5. Most of the population is extremely young with 45.6% of the population under the age of 15 and 52.3% of the population between the ages of 15 – 64 (see Figure 6 below).[14] Somalia's youth bulge is due to fast population growth, estimated at 2.8% in 2014.[15] Somalia's population is expected to its fast growth as the gender-disaggregated median age for all population categories was: i) Urban (17 – male, 18 – female), ii) Rural (15 – male, 16 – female), iii) Nomadic (17 – male, 17 – female), iv) IDPs (13 – male, 14 – female);[16] this information is presented in Table 1, below.

Figure 5 Somalia Population Gender-Disaggregated Percentage of Urban, Rural, Nomadic, and IDP population; Source: UNFPA, 2014[17]



[13] UNFPA. 2014. Somalia Population Estimation Survey 2014. Pages 40 - 41. Retrieved from: https://somalia.unfpa.org/sites/default/files/pub-pdf/Population-Estimation-Survey-of-Somalia-PESS-2013-2014.pdf. Note: results from Somalia's 2023 census are still being analyzed and until published, research on Somalia's population found that the most recent, complete data on Somalia's population comes from the UNFPA census conducted in 2014. The 2014 census uses population modeling instead of a true census (surveying each person in the country) due to funding, personnel, and insecurity constraints. While this is far from ideal, Somalia is still in the midst of recovering from decades of internal conflict with some regions still insecure – presenting unacceptable safety risks for census takers, making it impossible to implement a comprehensive census.

[14] UNFPA. 2014. Somalia Population Estimation Survey 2014. Pages 40 - 41. Retrieved from: https://somalia.unfpa.org/sites/default/files/pub-pdf/Population-Estimation-Survey-of-Somalia-PESS-2013-2014.pdf

[15] UNFPA. 2014. Somalia Population Estimation Survey 2014. Page 44. Retrieved from: https://somalia.unfpa.org/sites/default/files/pub-pdf/Population-Estimation-Survey-of-Somalia-PESS-2013-2014.pdf

[16] UNFPA. 2014. Somalia Population Estimation Survey 2014. Page 46. Retrieved from: https://somalia.unfpa.org/sites/default/files/pub-pdf/Population-Estimation-Survey-of-Somalia-PESS-2013-2014.pdf

[17] UNFPA. 2014. Somalia Population Estimation Survey 2014. Pages 40 - 41. Retrieved from: https://somalia.unfpa.org/sites/default/files/pub-pdf/Population-Estimation-Survey-of-Somalia-PESS-2013-2014.pdf

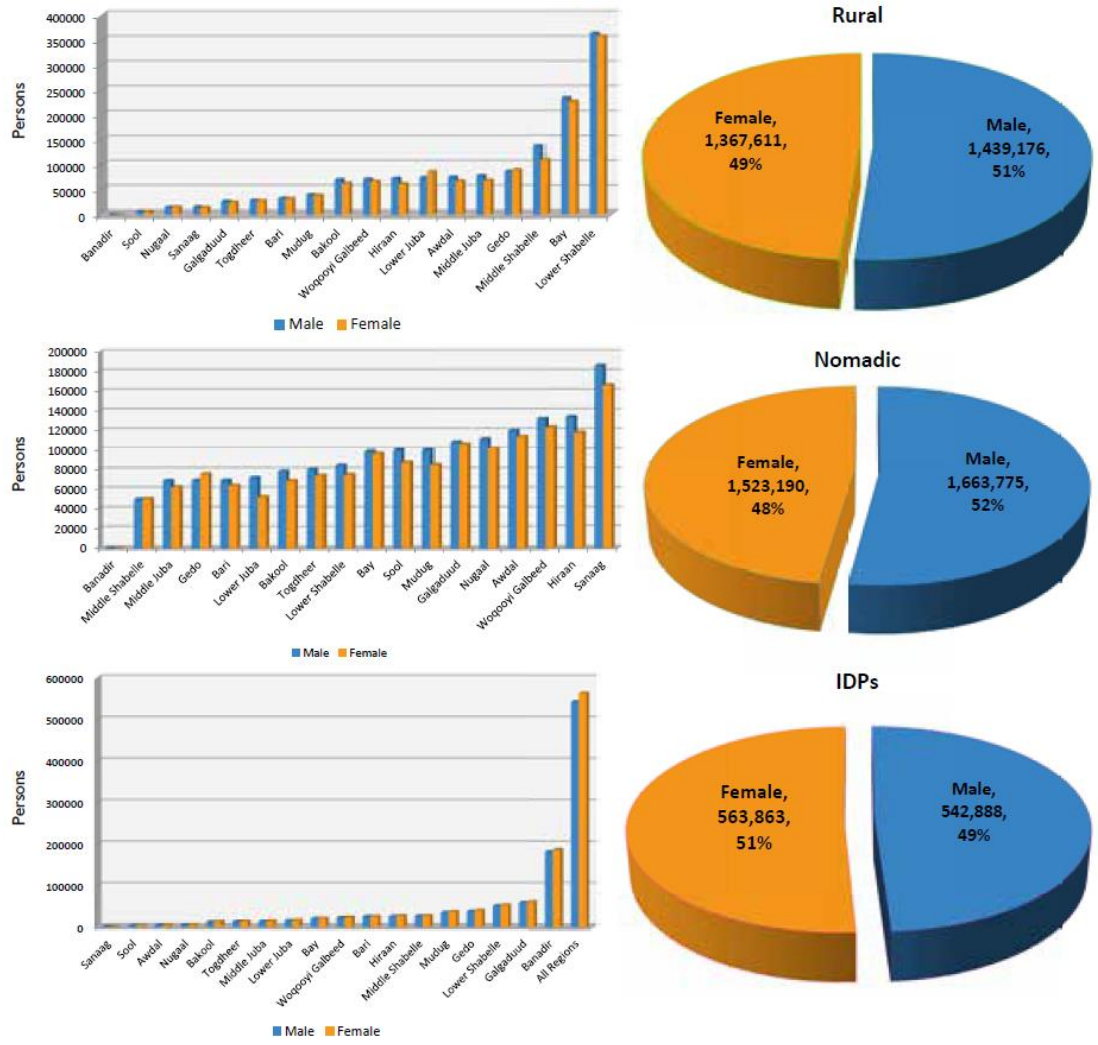
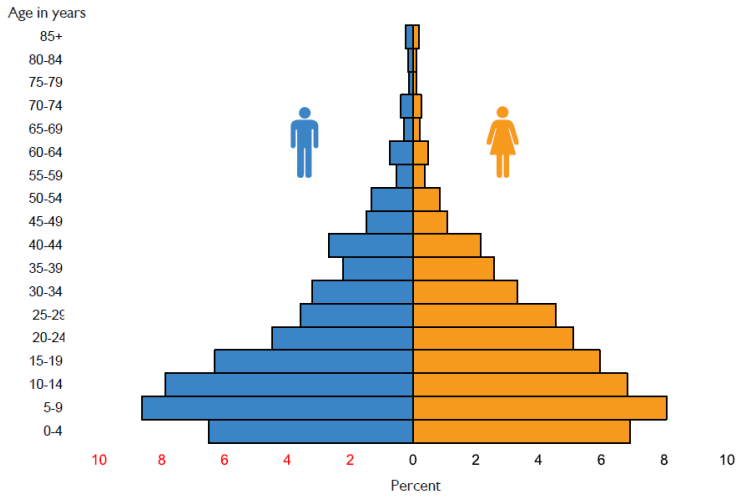
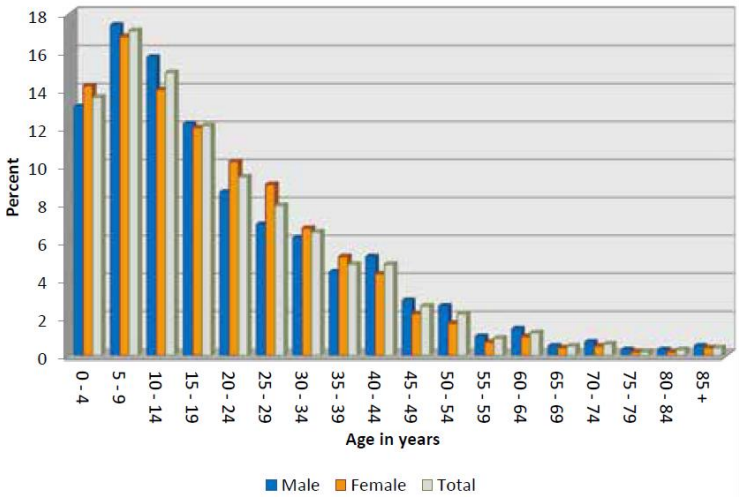


Figure 6 Gender and Age-Disaggregated Percentages of Somalia's population expressed as a) pyramid, b) bar graph, and c) age group bar graph; Source: UNFPA, 2014[18]



[18] UNFPA. 2014. Somalia Population Estimation Survey 2014. Pages 43 - 45. Retrieved from: https://somalia.unfpa.org/sites/default/files/pub-pdf/Population-Estimation-Survey-of-Somalia-PESS-2013-2014.pdf



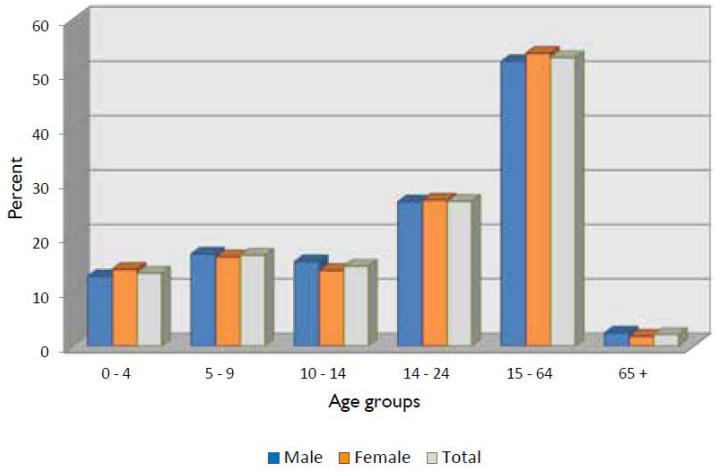


Table 1 Somalia mean and median ages for all population categories; Source: UNFPA, 2014

	Male		Female		Total	
	Mean	Median	Mean	Median	Mean	Median
Nomadic	21	17	20	17	21	17
Rural	20	15	19	16	20	16
Urban	21	17	21	18	21	17
IDPs	19	13	18	14	18	13

1.1.3 Agriculture Sector Profile

6. The agriculture sector plays a dominant role in Somalia's GDP, being a primary livelihood source for Somalis. According to the Somalia National Bureau of Statistics, 32.4 percent of Somalia's population is employed with 19.2 percent of the labour force employed in agriculture, forestry, and

fishing (see Figure 7 below).[19] A 2014 ILO study reported that 45.8 percent of employed people 15 years of age and older were employed in the agriculture sector, with 25.2 percent in crop production, 8.4 percent in livestock, and 7.2 percent in other agriculture-related activities.[20]

7. Somalia's agriculturalists can be broadly categorized into pastoralists, agro-pastoralists, and agriculturalists. [21] Pastoralists tend to be nomadic and make up 26 percent of Somalia's population.[22] Agro-pastoralists depend on a mix of crop and livestock rearing, and make up 23 percent of Somalia's population.[23] The rest, or 56 percent of the people who practice agriculture, are crop producers.

8. Multidimensional poverty is widespread in Somalia, with 75 percent of the population living in poverty and of that 75 percent, 20.9 percent live in extreme poverty.[24] Among people whose livelihood depends on agriculture, 95 percent of the population is classified as impoverished or living on $1.9 USD per day.[25]

9. Beyond its climate challenges, the agricultural sector faces a loss of localized agricultural knowledge, as farmers in prime agricultural areas such as Lower Shabelle, who were displaced by militias during the civil war, are unable to reclaim land due to lack of enforcement and arbitration by government, traditional, and religious leaders. Moreover, militias in the prime agricultural areas have little agricultural production knowledge.[26] Given the dominance of customary land tenure, administered by traditional and religious leaders, disputes over land use by pastoralists and farmers have increased.

10. Gender dynamics are also at play within the agriculture sector. In general, men are decisionmakers and main bread winners, with women and children working in processing. In the livestock sector, for example, depending on the animal, men will be in charge of buying and grazing, while women and children assist with creating animal byproducts, such as milk and ghee.[27] In crop production, women make up more than 60 percent of laborers and will assist in all aspects of trade, however, women have far less access to financial resource, land tenure, and decision making, subordinate to patriarchs.[28]

[19] Somalia National Bureau of Statistics, Federal Government of Somalia. 2019. Somali Labour Force Survey. Pages 15, 21. Accessed from UNHCR website. Retrieved here: https://data.unhcr.org/en/documents/details/99654

[20] ILO (International Labour Organization). 2014. Market Opportunity Mapping in Somalia: A Value-Chain Analysis and Rapid Market Assessment in Baidoa and Beletweyne Provinces. Geneva. Retrieved from: https://land.igad.int/index.php/documents-1/countries/somalia/investment-4/903-market-opportunity-mapping-in-somalia-a-value-chain-analysis-and-rapid-market-assessment-in-baidoa-and-beletweyne-provinces/file.

[21] World Bank. 2018. Country Economic Memorandum: Rebuilding Resilient and Sustainable Agriculture in Somalia. Page 4. Retrieved from: https://documents1.worldbank.org/curated/en/781281522164647812/pdf/124651-REVISED-Somalia-CEM-Agriculture-Report-Main-Report-Revised-July-2018.pdf

[22] UNFPA (United Nations Population Fund, formerly United Nations Fund for Population Activities). 2014. Population Estimation Survey 2014 for the 18 Pre-War Regions of Somalia. Pages 31, 56. Retrieved from: https://somalia.unfpa.org/sites/default/files/pub-pdf/Population-Estimation-Survey-of-Somalia-PESS-2013-2014.pdf.

[23] World Bank. 2018. Country Economic Memorandum: Rebuilding Resilient and Sustainable Agriculture in Somalia. Page 4.

[24] Somalia National Bureau of Statistics. 2023. Somalia Poverty Report. Page 27.

[25] World Bank. 2018. Country Economic Memorandum: Rebuilding Resilient and Sustainable Agriculture in Somalia. Page 4.

[26] World Bank. 2018. Country Economic Memorandum: Rebuilding Resilient and Sustainable Agriculture in Somalia. Page 29.

[27] World Bank. 2018. Country Economic Memorandum: Rebuilding Resilient and Sustainable Agriculture in Somalia. Page 31.

[28] World Bank. 2018. Country Economic Memorandum: Rebuilding Resilient and Sustainable Agriculture in Somalia. Page 32.

Branch of economic activity	Number	Percent
Agriculture, forestry and fishing	179,689	19.2%
Mining and quarrying	23,717	2.5%
Manufacturing	110,493	11.8%
Electricity, gas, steam and air	3,563	0.4%
Water supply, sewerage, waste manageme	9,420	1.0%
Construction	30,081	3.2%
Wholesale and retail trade; repair of	34,855	3.7%
Transportation and storage	20,194	2.2%
Accommodation and food services	38,168	4.1%
Information and communication	15,863	1.7%
Financial and insurance activities	7,528	0.8%
Real estate activities	7,486	0.8%
Professional, scientific and technical	37,492	4.0%
Rental and leasing activities	25,454	2.7%
Public administration and defence; com	15,905	1.7%
Education	52,984	5.7%
Human health and social work activitie	52,576	5.6%
Arts, entertainment and recreation	8,564	0.9%
Other services	172,607	18.4%
Activities of households as employers	31,105	3.3%
Activities of extraterritorial organiz	59,551	6.4%
Total	937,297	100.0%

Figure 7 Employed persons by branch of economic activity in main job; Source: NBS, 2019

1.1.3.1 Livestock Subsector

11. Somalia's livestock subsector is a pivotal component of the national economy, contributing 45% percent to Somalia's GDP in 2023 (see Table 2 below)[29],[30]. Livestock accounts for 83% of all agricultural production (see Figure 8 below)[31]. As of 2016, the sector was estimated to be valued at approximately $3.75 billion USD (see

12. Table 3 below).[32] Livestock also dominates exports, accounting for 93% of total exports and 79% of export earnings particularly with Gulf countries.[33] This sector continues to see growth.

13. According to IGAD Center for Pastoral Areas & Livestock Development (ICPALD)[34], 93.6% of the sub-sector's contribution to the agricultural GDP (i.e. livestock gross value added) was derived from conventional goods common in agricultural GDP and 6.4% from financial services provided by livestock. It estimated that milk is Somalia's most economically important livestock product, with a value of USD 6.58 billion in 2013, equivalent to 81% of livestock' contribution to economy.

14. The sector predominantly consists of camels, cattle, sheep, and goats, with an estimated livestock population of around 56.9 million[35]. In 2023, 2.17 million sheep/goats were exported, along with 94.5 thousand cattle, and 43.9 thousand camels;[36] with sheep making up 28.6% of Somalia's $569 million USD exports.[37] Main export markets were United Arab Emirates ($283M USD), Oman

[29] World Bank. 2018. Country Economic Memorandum: Rebuilding Resilient and Sustainable Agriculture in Somalia. Page 6.
30 International Livestock Research Institute. 17 August 2023. "Exploring investment opportunities for the livestock sector in Somalia." News article from website. Retrieved from: https://www.ilri.org/news/exploring-investment-opportunities-livestock-sector-somalia.
[31] World Bank. 2018. Country Economic Memorandum: Rebuilding Resilient and Sustainable Agriculture in Somalia. Page 7.
[32] World Bank. 2018. Country Economic Memorandum: Rebuilding Resilient and Sustainable Agriculture in Somalia. Page 8.
[33] World Bank. 2018. Country Economic Memorandum: Rebuilding Resilient and Sustainable Agriculture in Somalia. Page 9.
[34] https://icpald.org/wp-content/uploads/2019/08/Policy-Brief-on-The-Contribution-of-Livestock-to-Somalia-Economy-Jan-2016.pdf
[35] International Livestock Research Institute. 17 August 2023. "Exploring investment opportunities for the livestock sector in Somalia." News article from website. Retrieved from: https://www.ilri.org/news/exploring-investment-opportunities-livestock-sector-somalia.
By species, Somalia has 7.1million(M) camels, 5.3M cattle, 30.9M goats, and 13.6M sheep.
[36] Somalia Ministry of Financial Development. 2023. Trade Statistics Bulletin: Jan-June 2023. Retrieved from: https://slmof.org/wp-content/uploads/2023/09/Semi-Annual-Trade-Statistical-Bullletin-2023.pdf
[37] OEC World. 2024. Somalia. MIT Lab website tracking exports and markets. Retrieved from: https://oec.world/en/profile/country/som#yearly-trade

($173M USD), Bulgaria ($18.5M USD), India ($15.6 USD), and Kuwait ($13.5 USD).[38] However, the sector faces challenges such as over-reliance on traditional markets and seasonal fluctuations in demand, not to mention the ongoing degradation of rangelands.

15. Key challenges include recurrent droughts impacting water and pasture availability, prevalent livestock diseases, and underdeveloped market infrastructure. Opportunities for growth include investing in veterinary services, establishing water capture systems and stormwater management systems,[39] establishing meat processing facilities,[40] improving transportation infrastructure,[41] and increasing improving/diversifying export markets to reduce trade volatility.

Table 2 Agriculture's Shares of GDP in Somalia, 1980, 186-88, and 2013-16; Source: World Bank, 2018[42]

	1980	1986-88	2013-16
Agriculture	**64.4**	**62.0**	-
Livestock & Crops	**61.9**	**55.3**	**70.9**
Livestock and livestock products	43.7	37.2	60.7
Crop Production	**18.3**	**18.1**	**10.2**
Other	**2.4**	**6.7**	-
Forestry[a]	**2.1**	**6.1**	**1.5**
Fishing	0.3	0.6	-

Figure 8 Gross production value of livestock & crops in Somalia, 2013 - 2016; Source: UNIDO, 2021

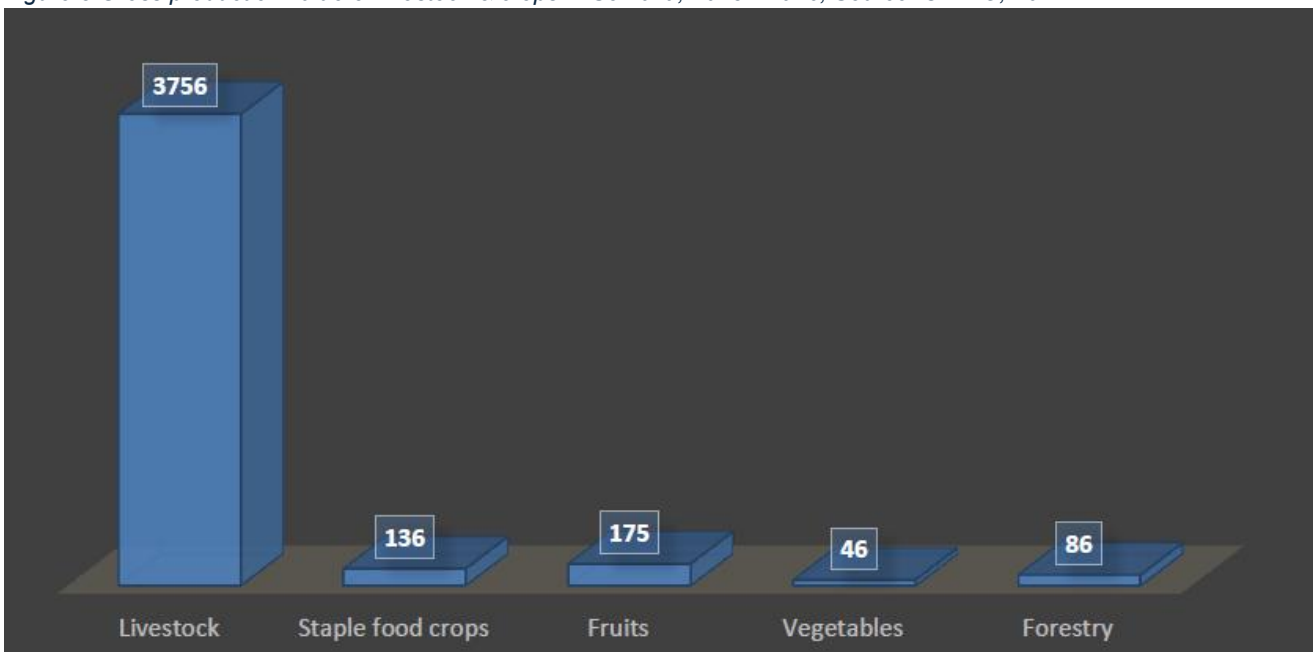


Table 3 Livestock Sector Gross Production Value with other Agricultural Sectors; Source: World Bank, 2018[43]

38 OEC World. 2024. Somalia. MIT Lab website tracking exports and markets. Retrieved from: https://oec.world/en/profile/country/som#yearly-trade

[39] World Bank. 2018. Country Economic Memorandum: Rebuilding Resilient and Sustainable Agriculture in Somalia. Page 17.

[40] World Bank. 2018. Country Economic Memorandum: Rebuilding Resilient and Sustainable Agriculture in Somalia. Page 23.

[41] World Bank. 2018. Country Economic Memorandum: Rebuilding Resilient and Sustainable Agriculture in Somalia. Page 24.

[42] World Bank. 2018. Country Economic Memorandum: Rebuilding Resilient and Sustainable Agriculture in Somalia. Page 6.

[43] World Bank. 2018. Country Economic Memorandum: Rebuilding Resilient and Sustainable Agriculture in Somalia. Page 8.

Annual Averages, US$ million	1986-88[a]	2010-12[b]	2013-16[c]	Deyr 2016 - Gu 2017[c]
Livestock and livestock products	**606**	**3,489**	**3,756**	
Meat (including exports)\[b]	366	761	1,051	-
Livestock products\[b]	240	2,729	2,704	-
of which: fresh raw milk\[c]			2,848	2,353
Crop Production	**198**	**355**	**751**	**329**
Staple food crops	**127**	**189**	**136**	**62**
Sorghum	36	88	48	25
Maize	55	59	35	23
Sesame Seed	24	15	33	6
Cowpeas		22	15	6
Rice	4	3	3	1
Legumes			1	0
Pulses\[d]	7		..	-
Groundnuts\[d]	1	2	..	-
Fruits	**23**	**46**	**175**	**56**
Banana	11	26	82	27
Grapefruit and Lime	2	4	26	12
Watermelon		7	32	8
Papaya			23	9
Dates			12	1
Other Fruits\[d]	9	9		-
Vegetables	**16**	**13**	**46**	**5**
Tomatoes		2	41	4
Onions		10	5	0
Other vegetables\[d]	16		-	-
Forestry	-	-	**88**	-
Frankincense (Boswellia)	-	-	88	73
Other	**32**	**24**	-	-
Roots and Tubers\[d]	25	24	-	-
Seed Cotton\[e]	1	-	-	-
Sugar Cane\[e]	6	-	-	-
Relative sector ratios, %				
Livestock and livestock products	**75%**	**91%**	**83%**	
Crop Production	**25%**	**9%**	**17%**	

Source: FGS (1989) for 1986–88, FAOSTAT for 2010–12, and FGS (2017a) for 2013–17.

1.1.3.2 1.1.3.2 Crop Production

16. Only 5% of Somalia's total land area is suitable for crop growing, with most crop production occurring in the southern regions (see Figure 9 and Figure 10 below).[44] Cereal production, primarily sorghum and maize (see Table 4 below), covers approximately 200,000 hectares. However, production is often hindered by erratic rainfall and traditional farming methods, leading to yield

[44] UNIDO (UN Industrial Development Organization). 2021. Sub-sector mapping and value chain analysis of the Fruits and Vegetables sub-sector in Somalia. Technical Report. Page 11.

fluctuations (see Figure 11 below). Local production can only meet 22 percent of per capita cereal needs and with the best growing conditions, only 40 – 50 percent of per capita production meet national needs.[45]

17. In 2016, cereal production accounted for nearly 60% of Somalia's agricultural output but met only 55% of the domestic cereal consumption needs due to post-harvest losses and inefficient farming practices. From 2017 – 2021, Sorghum production averaged 101 tons and Maize 72 tons, however, in 2022 Sorghum production reduced to 72 tons for the year and Maize dropped to 65 tons.[46]
18. Only 25% of Somalia's cropland is irrigated, with three quarters of cropland reliant on rainfall for irrigation.[47] In Lower Shabelle, the breadbasket of Somalia, crop cultivation takes places mostly in flood plains adjacent to the Lower and Middle Shabelle rivers,[48] exposing farmers to flood risk during storms, cyclones, and extreme rainfall.
19. Other issues faced by the crop sub-sector arise from negative climate change impacts, primarily in reducing precipitation and increasing temperatures. Both impacts have reduced availability of surface water resources, combined with the lack of irrigation and pumps, increased crop water demand, and diminished the availability of water for crops.[49] Combined with suboptimal use of farm inputs, such as fertilizers and water, and limited mechanization, this results in extremely low yields.

[45] UNIDO (UN Industrial Development Organization). 2021. Sub-sector mapping and value chain analysis of the Fruits and Vegetables sub-sector in Somalia. Technical Report. Page 11.

46 FAO. 7 April 2023. Country Synthesis Report: Somalia. Retrieved from: https://www.fao.org/giews/countrybrief/country.jsp?code=SOM&lang=fr

[47] UNIDO (UN Industrial Development Organization). 2021. Sub-sector mapping and value chain analysis of the Fruits and Vegetables sub-sector in Somalia. Technical Report. Page 14.

[48] World Bank. 2018. Country Economic Memorandum: Rebuilding Resilient and Sustainable Agriculture in Somalia. Page 82.

[49] World Bank. 2018. Country Economic Memorandum: Rebuilding Resilient and Sustainable Agriculture in Somalia. Page 84.

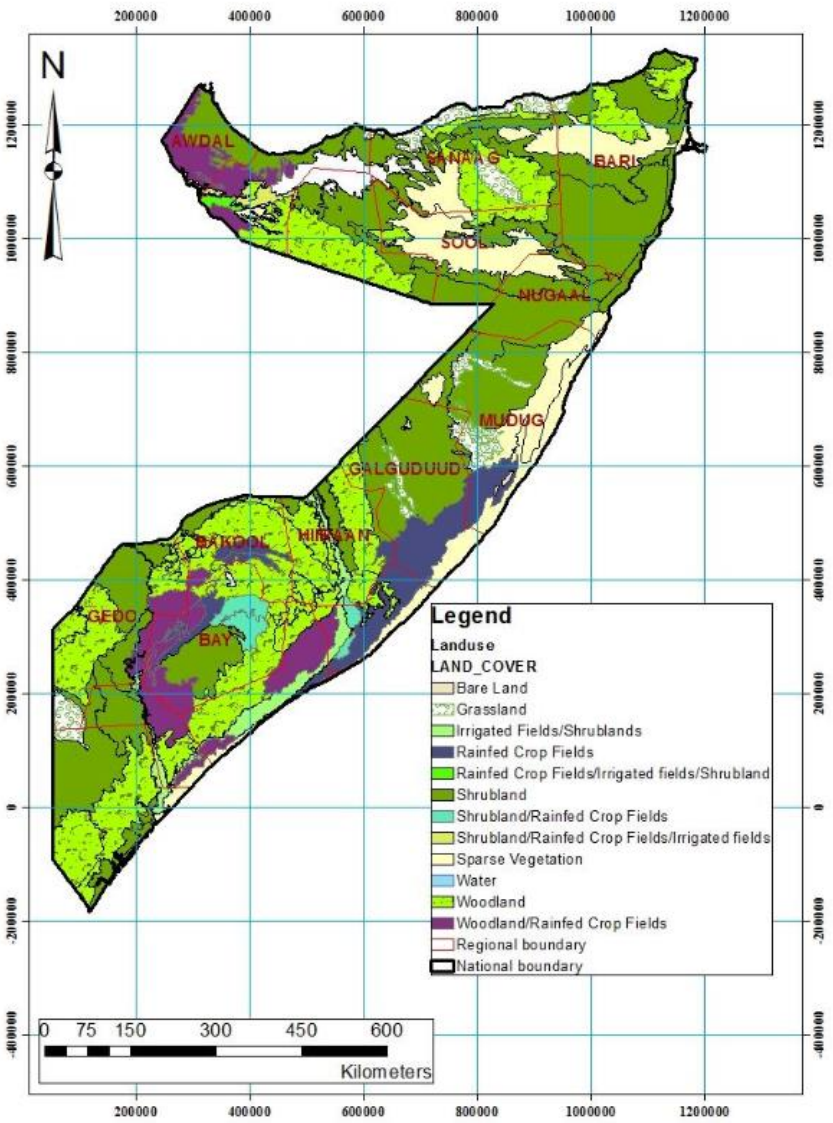


Figure 9 Land use pattern of Somalia; Source: Boitt, Langat, and Kapoi, 2018[50]

[50] Boitt, M. K., Langat, F. C., & Kapoi, J. K. (2018). Geospatial agro-climatic characterization for assessment of potential agricultural areas in Somalia, Africa. Journal of Agricultural Informatics/Agrárinformatika Folyóirat, 9(3).

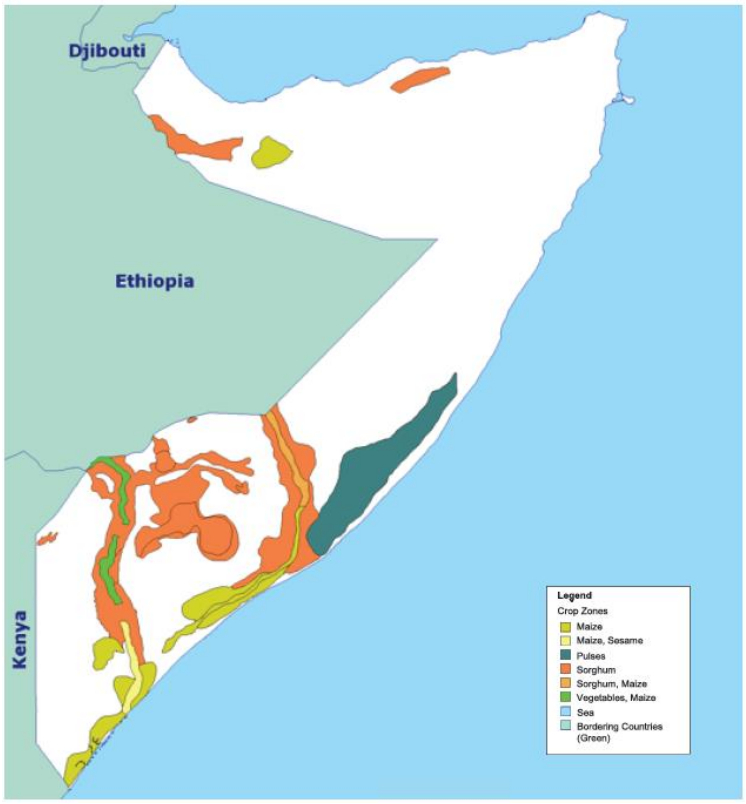


Figure 10 Crop Zones of Somalia; Source: World Bank, 2018[51]

Name of the crop	Production Volume (MT)	Cropped Area (ha)	Yield (hectogram/ha)
Maize	138716	92920	14929
Sesame seed	25788	46489	5547
Sorghum	129523	234403	5526
Sugar cane	209291	5537	378005
Bananas	1226	20905	170478
Beans, dry	26855	87892	3055
Cassava	92875	9695	95794
Coconuts	11074	3962	27951
Dates	13785	2666	51715
Fruit, fresh	143063	12975	110258
Grapefruit (incl. pomelos)	5442	1105	49255
Lemons and limes	7960	1312	60682
Tomatoes	23962	16276	14722
Vegetables, fresh	75382	6994	107775
Watermelons	6105	633	96367

Table 4 Agricultural crop production in Somalia, 2018; Source: UNIDO, 2021

[51] World Bank. 2018. Country Economic Memorandum: Rebuilding Resilient and Sustainable Agriculture in Somalia. Page 82.

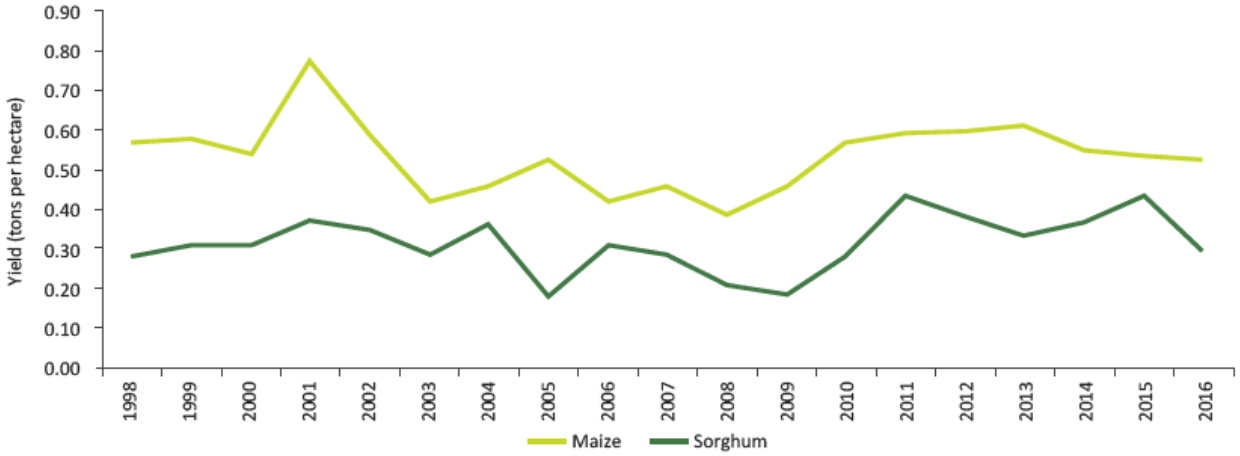


Figure 11 Maize and Sorghum Production 1998 - 2016; Source: World Bank, 2018[52]

1.2 Project regions

20. The project focuses on six regions and 11 districts in Somalia:

    1. Lower Shabelle: i) Afgooye, ii) Quoryooley, iii) Baraawe, iv) Kurtunwaarey
    2. Middle Shabelle: i) Cadale and ii) Jowhar
    3. Lower Juba: i) Kismayo
    4. Nugaal: i) Eyl, ii) Garowe
    5. Togdheer: i) Odweyne
    6. Mudug: i) Hobyo

21. These include the three regions identified as having the highest climate risk. The selection of these regions was made through consultations with the Somali government, aligning with areas of government interest that have recently been reclaimed from the control of Al-Shabaab in the states of Hirshabelle, Galmudug, Jubaland, and South West. These areas, which have not yet benefited from significant investment projects, exhibit considerable needs among rural communities for support in adapting to climate change.

22. The selection of targeted areas for the project was informed by an in-depth climate risk analysis that evaluated climate hazards, exposure, vulnerability, and the specific agro-ecological zones within Somalia. This multifaceted analysis incorporated several key components to ascertain areas of priority: (i) Hazard, capturing the frequency and nature of meteorological (e.g., extreme temperature), climatological (e.g., drought), or hydrological (e.g., flood) events or trends; (ii) The degree of human and natural exposure to these climate hazards, taking into account the climate zone, geographical features, population density, and prevalent agricultural and socio-economic activities; (iii) Vulnerability, reflected by the socio-economic conditions of the target population; and (iv) Adaptive capacity, determined by the availability of climate information, access to electricity and the internet, infrastructure development, and the level of national institutional support through policy and financial mechanisms for promoting climate-resilient agriculture.

23. The process of selecting these areas also involved extensive consultations with project partners and key stakeholders at both national and regional levels. This collaborative approach ensured that the selection was grounded not only in scientific analysis but also in the practical realities and insights of those directly involved in or affected by the project's outcomes. As a result of this comprehensive and inclusive methodology, a total of seven site areas (see below Table 5) were identified for the project's implementation. This selection strategy ensures that the project is

[52] World Bank. 2018. Country Economic Memorandum: Rebuilding Resilient and Sustainable Agriculture in Somalia. Page 92.

strategically focused on regions where it is most needed and where it can have the most substantial impact, addressing the pressing challenges posed by climate change in Somalia.

Table 5 Key Characteristics of Targeted Areas; Source: FAO, 2024[53]

Region	Key characteristics
Lower Shabelle	▪ Agro-pastoral zone, irrigated crops (maize, sesame)
Middle Shabelle	▪ Agro-pastoral zone, irrigated crops (maize, sesame)
Lower Juba	▪ Agro-pastoral zone, irrigated crops (maize, sesame)
Nugaal	▪ Pastoral zone and potential Agro-Pastoral areas
Togdheer	▪ Agro-pastoral zone, rainfed crops (+ flood irrigation from highlands)
Mudug	▪ Pastoral and Agro-Pastoral areas (cow peas), some irrigation with underground waters

24. Current population estimates and percentage of people in food security stress or crisis in each district are indicated in Figure 12.[54]

IPC Population Estimates: Current (Jan-Mar 2024)

Region	Somalia 2024 Total population	Somalia 2024 Urban population	Somalia 2024 Rural Population	Somalia 2024 IDP Population	Urban in Stressed	Rural in Stressed	IDP in Stressed	Urban in Crisis	Rural in Crisis	IDP in Crisis	Urban in Emergency	Rural in Emergency	IDP in Emergency	Total in Crisis Emergency and Catastrophe as % of Total population
North														
Awdal	636,108	125,694	490,817	19,597	44,000	211,110	6,080	18,860	65,780	3,430	0	6,430	2,120	15
Woqooyi Galbeed	1,447,484	182,631	1,133,321	131,532	63,920	437,950	35,690	27,390	147,590	29,760	0	21,200	12,070	16
Togdheer	860,684	48,384	608,918	203,382	15,440	204,950	75,110	7,250	65,880	39,300	0	20,550	17,410	17
Sanaag	428,699	55,477	329,849	43,373	16,640	110,540	16,640	5,550	48,710	9,210	2,770	190	3,170	16
Sool	548,975	59,314	362,808	126,853	15,280	122,990	47,010	9,710	50,250	23,610	5,490	4,080	9,120	19
Bari	1,232,231	148,691	912,432	171,108	47,040	292,520	51,640	22,300	105,570	35,530	8,650	31,900	18,580	18
Nugaal	631,810	33,702	474,414	123,694	11,790	148,980	37,830	3,370	72,350	23,290	450	1,980	10,910	18
North Mudug	891,279	138,560	616,545	136,174	55,420	216,890	53,680	42,420	104,890	52,100	6,920	1,110	12,840	25
Sub-total	**6,677,270**	**792,453**	**4,929,104**	**955,713**	**269,530**	**1,745,930**	**323,680**	**136,850**	**661,020**	**216,230**	**24,280**	**87,440**	**86,220**	18
Central														0
South Mudug	579,030	0	579,030	0	0	202,590	0	0	104,620	0	0	28,010	0	23
Galgaduud	812,638	91,374	665,611	55,653	33,350	232,860	22,000	23,770	120,880	21,200	3,200	28,850	5,300	25
Sub-total	**1,391,668**	**91,374**	**1,244,641**	**55,653**	**33,350**	**435,450**	**22,000**	**23,770**	**225,500**	**21,200**	**3,200**	**56,860**	**5,300**	24
South														0
Hiraan	504,816	87,242	338,684	78,890	29,190	95,020	23,670	18,330	53,880	16,940	5,720	2,130	4,530	20
Middle Shabelle	1,013,352	238,031	665,790	109,531	83,310	231,360	38,140	34,930	124,530	16,440	11,610	27,200	5,480	22
Lower Shabelle	1,593,117	462,600	1,027,143	103,374	109,420	351,840	31,970	83,570	222,460	25,840	14,440	43,690	9,270	25
Bakool	543,371	72,972	436,588	33,811	22,150	133,230	8,440	10,780	64,330	11,550	0	7,130	4,410	18
Bay	1,247,975	65,110	668,278	514,587	24,020	198,610	131,960	9,830	129,890	204,690	1,660	32,460	79,360	37
Gedo	975,586	147,958	519,078	308,550	51,780	149,690	99,550	14,800	79,260	61,510	7,400	9,720	37,770	22
Middle Juba	430,129	203,483	226,646	0	71,220	73,070	0	20,340	31,530	0	0	14,160	0	15
Lower Juba	1,158,256	240,898	691,805	225,553	96,360	168,120	75,480	36,140	64,820	62,020	0	25,590	30,070	19
Sub-total	**7,466,602**	**1,518,294**	**4,574,012**	**1,374,296**	**487,450**	**1,400,940**	**409,210**	**228,720**	**770,700**	**398,990**	**40,830**	**162,080**	**170,890**	24
Banadir	3,171,391	1,348,782	346,628	1,475,981	337,200	121,320	516,590	67,440	86,660	369,000	0	17,330	147,600	22
Grand Total	**18,706,931**	**3,750,903**	**11,094,385**	**3,861,643**	**1,127,530**	**3,703,640**	**1,271,480**	**456,780**	**1,743,880**	**1,005,420**	**68,310**	**323,710**	**410,010**	21

Figure 12: IPC population estimate 2024 (source: FSNAU)

1.2.1 Lower Shabelle

1.2.1.1 Socio-economic Characteristics

25. Lower Shabelle lies on Somalia's southern coastline (see below Figure 13) and is administratively divided into seven districts: Afgooye, Barawe (Brava), Kurtunwarey, Qoryoley, Marka (Merca), Sablaale, and Wanlaweyn, with Marka serving as the capital. Lower Shabelle is one of the most affluent regions due to its agriculture being irrigated. Aiding its affluence is its transportation routes, with roads connecting Mogadishu to Baidoa and Kismayo and relative proximity to Mogadishu, making Lower Shabelle a key region for trade.

    The population of Lower Shabelle is remarkably diverse and complex, incorporating indigenous[55] populations that have resided in the area since the pre-colonial era—comprising 55-60% Digil, 30% Hawiye, and 10% Bioyamaal clans—historical migrants from various Somali clans who arrived

[53] FAO. 2024. Annex 6: Environmental and Social Management Framework (ESMF). *Report for the GCF-FAO project "Climate Resilient Agriculture in Somalia."* Page 24.

[54] https://fsnau.org/ipc/population-table

[55] As specified in Annex 6, and throughout this document, Indigenous Peoples are understood as those minority and marginalized groups who face significant challenges, including protection issues, discrimination, limited access to basic services, and land.

during the colonial and early independence periods for employment or to invest in agriculture, and families of formidable clan militias established during the civil war era.

26. Educational facilities in Lower Shabelle vary in availability and quality, with primary and secondary schools concentrated in urban centers. Challenges include access to education in rural areas and the need for infrastructure and resource improvement. Healthcare services in the region are under-resourced, with limited access to medical facilities, especially in remote areas. Efforts to improve public health are ongoing, focusing on increasing healthcare access and addressing malnutrition and waterborne diseases.

27. Agriculture is the main source of employment, with land tenure systems varying between communal and individual ownership. Land disputes and access to agricultural land are significant issues affecting rural livelihoods and social stability.

28. Poverty is prevalent in Lower Shabelle, exacerbated by limited economic opportunities outside of agriculture, recurrent climatic shocks, and conflict. Rural communities, in particular, face challenges related to food security and access to basic services.

1.2.1.2 Environmental Characteristics

29. Lower Shabelle is characterized by a varied topography that includes coastal plains, riverine areas along the Shabelle River, and flat agricultural lands. The region's landscape is predominantly flat, facilitating extensive agricultural activities, especially along the fertile floodplains. Elevation varies minimally, which has significant implications for irrigation and drainage systems in the area.

30. The region experiences a semi-arid climate with two distinct rainy seasons: the Gu (April to June) and the Deyr (October to December). Temperatures in Lower Shabelle can be high, often exceeding 30°C, particularly before the onset of the rainy seasons. The climate is influenced by monsoonal winds and occasional cyclonic activities, contributing to variability in rainfall patterns.

    Soils in Lower Shabelle are highly fertile, especially in the riverine zones, making it an agricultural hub. The alluvial deposits from the Shabelle River enrich the soil, supporting the cultivation of various crops. However, soil erosion and salinization pose challenges to sustainable agricultural practices in some areas.

31. The Shabelle River is the lifeline of the region, providing essential water for both domestic use and irrigation. Numerous irrigation canals and systems have been developed along the river to support agriculture, but these have been severely degraded due to years of conflict.

32. Lower Shabelle hosts a variety of flora and fauna, supported by its riverine habitats and agricultural landscapes. The region's biodiversity includes several species of birds, reptiles, and mammals that inhabit its diverse ecosystems. However, habitat degradation and human activities pose threats to its biodiversity.

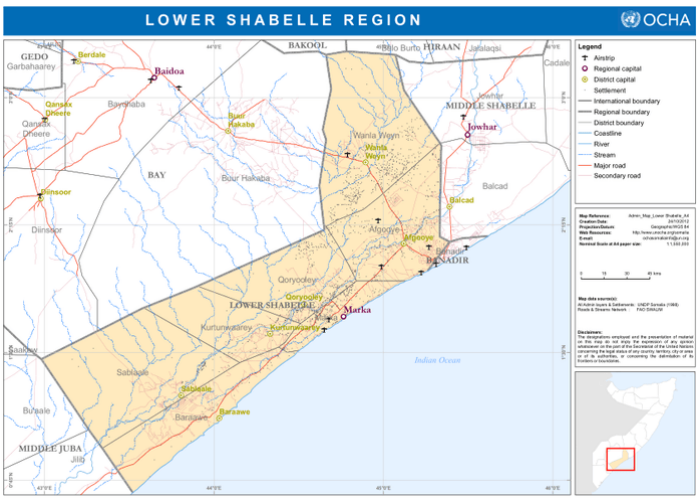


Figure 13 Lower Shabelle Region; Source: OCHA, 2024[56]

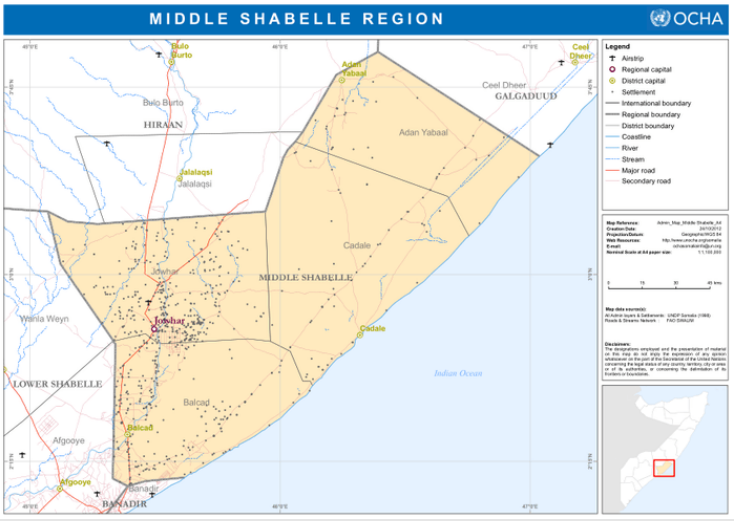
1.2.2 Middle Shabelle

1.2.2.1 Socio-Economic Characteristics

33. Middle Shabelle Region is in Somalia's southeastern border (see Figure 14 below) and borders the regions of Benadir/Mogadishu, Lower Shabelle, and Hiraan. It encompasses four districts — Adan Yabal, Balcad, Jowhar, and Mahaday — Jowhar stands as the regional capital.

34. Middle Shabelle plays a critical economic role due to its fertile lands that are key to agriculture, contributing significantly to Somalia's food security and agricultural output. Its strategic location, lying close to the capital Mogadishu, enhances its importance for trade and logistics, making it a vital conduit for goods moving to and from central and southern Somalia. This economic and strategic significance, combined with its diverse demographic makeup, positions Middle Shabelle as an essential region within Somalia's socio-economic and cultural landscape.

Figure 14 Middle Shabelle Region; Source: OCHA 2024[57]



35. Middle Shabelle has a diverse population, dominated by Hawiye sub-clans, particularly the Abgaal, Middle Shabelle is also home to other groups such as the Gaaljeel and the Bantu Shiidle, alongside various minority clans. Other ethnic groups and minority clans also contribute to the region's demographic complexity. Population distribution is influenced by agricultural practices and urbanization trends.

36. Educational services in Middle Shabelle face challenges such as limited access in rural areas and the need for infrastructure improvement. Efforts to enhance education, with a focus on increasing school enrolment and addressing gender disparities. Healthcare facilities in Middle Shabelle are under-resourced, with access to medical services varying significantly between urban and rural areas. Common health issues include malnutrition, infectious diseases, and waterborne illnesses. Strengthening healthcare infrastructure and services is a priority for improving public health outcomes.

37. Poverty is a significant concern in Middle Shabelle, with many communities facing challenges related to economic instability, limited access to basic services, and the impacts of climate variability

[56] FAO. 2024. Annex 6: Environmental and Social Management Framework (ESMF). *A report for the GCF-FAO Project "Climate Resilient Agriculture in Somalia."* Page 26.
[57] FAO. 2024. Annex 6: Environmental and Social Management Framework (ESMF). *A report for the GCF-FAO Project "Climate Resilient Agriculture in Somalia."* Page 28.

on agriculture. Rural areas, in particular, experience higher levels of poverty, affecting food security and overall well-being.

38. Agriculture is the main source of employment in Middle Shabelle, with land tenure systems including both communal and private ownership. Beyond agriculture, the land supports pastoralism and limited urban development, particularly around district centers. The region's agricultural output is critical to both local livelihoods and national food security.Land disputes and access issues are prevalent, affecting agricultural productivity and community relations. Labour opportunities outside agriculture are limited, highlighting the need for diversified economic development.

39. Middle Shabelle's strategic importance is underscored by its contribution to Somalia's agricultural sector and its proximity to Mogadishu. Social and economic development challenges include infrastructure deficits, environmental degradation, and the need for sustainable natural resource management.

1.2.2.2 Environmental Characteristics

40. Middle Shabelle features a diverse topography that includes riverine landscapes along the Shabelle River, flat agricultural lands, and areas of low-lying plains. The region's geographical layout supports a variety of land uses, primarily agriculture, due to its generally flat terrain conducive to farming and irrigation. Elevation variations are minimal, impacting water flow and drainage across different areas. The climate in Middle Shabelle is characterized by semi-arid conditions with two main rainy seasons: the Gu and the Deyr. Temperatures typically range from moderate to high throughout the year, with fluctuations influenced by the seasonal rains. The region is prone to climatic variations, which can affect agricultural cycles and water availability.

41. Soils in Middle Shabelle are fertile, particularly in the riverine areas, supporting the cultivation of a wide range of crops. This fertility is a result of sediment deposits from the Shabelle River, although issues such as erosion and nutrient depletion pose challenges. Conservation and sustainable land management practices are vital for maintaining soil health.

42. The Shabelle River is a crucial water source for Middle Shabelle, supporting both domestic needs and irrigation. Seasonal variations in river flow necessitate adaptive irrigation practices to ensure crop sustainability. Access to reliable water sources remains a significant challenge for some communities.

43. Middle Shabelle's biodiversity includes a range of species adapted to its riverine and agricultural environments, from aquatic life in the Shabelle River to various bird species and terrestrial fauna. The flora comprises both native and cultivated species, with the riverine forests and agricultural lands hosting diverse ecosystems.

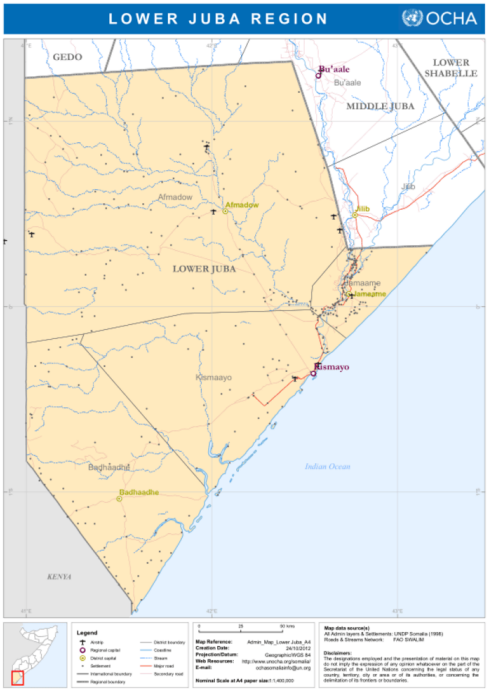
1.2.3 Lower Juba

1.2.3.1 Socio-Economic Characteristics

44. Lower Juba is the southernmost region of Somalia with four districts: Afmadow, Badhadhe, Jamane, and Kismayo, which is the region’s capital and administrative hub of Lower Juba’s state, Jubbaland.

Figure 15 Lower Region Juba; Source: OCHA, 2024[58]

[58] FAO. 2024. Annex 6: Environmental and Social Management Framework (ESMF). *A report for the GCF-FAO Project “Climate Resilient Agriculture in Somalia.”* Page 31.



45. Lower Juba stands out for its demographic diversity, home to a variety of clans and ethnic groups including the Somali Bantu (also known as Jareer), Biyomaal (Dir clan), Tunni (Digil-Mirifle), Mohamed Zubier/Ogaden (Darood clan), along with other Darood clans, Gaaljaal, Harti (Darood), Somali Bajuni, and smaller enclaves of other clans. Kismayo exhibits a dynamic and complex demographic structure, significantly influenced by the political, economic, and military predominance of the Ogaden clan, notably the Mohamed Zubier sub-clan, since 2012.

46. Educational services in Lower Juba face challenges, including limited access to schools, especially in rural areas, and a need for improved educational infrastructure and resources. Healthcare access in Lower Juba is limited, with insufficient medical facilities and services, particularly outside of urban centers like Kismayo. Common health concerns include malnutrition, infectious diseases, and lack of clean water, underscoring the need for improved public health initiatives.

47. Poverty is widespread in Lower Juba, exacerbated by limited economic opportunities, recurring climatic shocks, and ongoing security challenges. Rural communities are particularly vulnerable, with many relying on subsistence farming and pastoralism for their livelihoods.The economy of Lower Juba is primarily based on agriculture and pastoralism, with land tenure practices varying between communal lands and private ownership. Disputes over land rights and access to resources are common, affecting agricultural productivity and community cohesion.

1.2.3.2 Environmental Characteristics

48. Lower Juba's landscape is marked by a mix of coastal plains, riverine areas along the Juba River, and semi-arid bushland. The region's topography supports diverse ecosystems, from lush riverbanks to dry, sparsely vegetated areas. Its relatively flat terrain is punctuated by occasional hillocks and plateaus, providing unique ecological niches.

49. The region experiences a hot semi-arid climate, with two distinct rainy seasons: the Gu (April to June) and the Deyr (October to December). Temperatures are generally high year-round, with slight variations during the rainy seasons. Lower Juba is susceptible to climate variability, including droughts and floods that significantly impact local livelihoods.

50. Soils in Lower Juba vary from fertile alluvial soils along the Juba River to sandy and loamy soils in the hinterlands, supporting varied agricultural practices. Despite the potential for agriculture, soil erosion and degradation pose challenges. Sustainable land management practices are essential to maintain soil fertility and support agriculture.

51. The Juba River is a critical water source for Lower Juba, supporting both community water needs and irrigation for agriculture. Despite the river's importance, seasonal variability affects water availability, and irrigation infrastructure requires development to optimize agricultural production. Access to clean water remains a challenge in more remote areas.

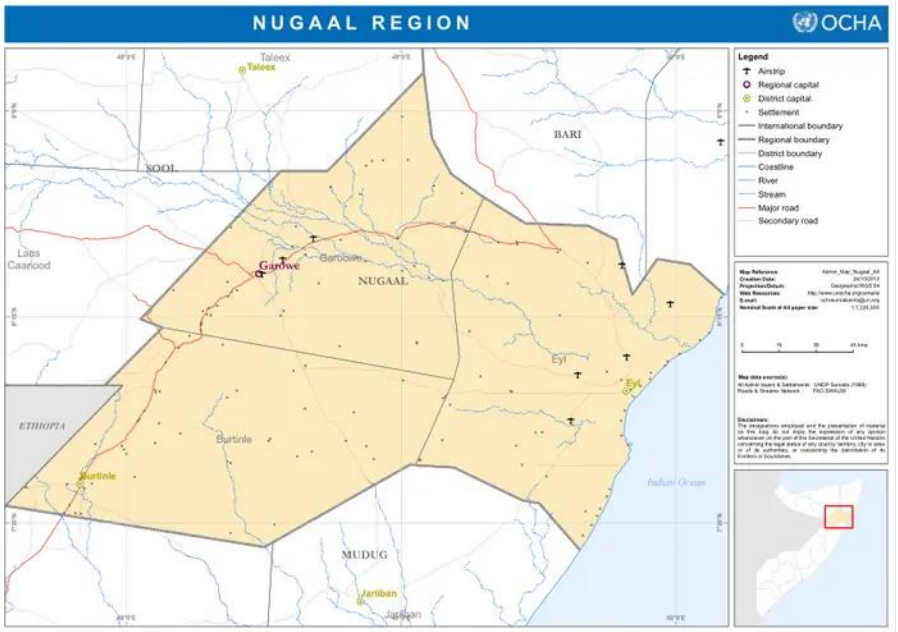
52. Lower Juba's biodiversity is rich, with a variety of plant and animal life thriving in its riverine and bushland habitats. The area is home to species adapted to both wet and dry conditions, including various birds, reptiles, and mammals. Conservation efforts are needed to protect these natural assets against habitat loss and degradation.

1.2.4 Nugaal

1.2.4.1 Socio- Economic Characteristics

53. Nugaal Region is in the northeastern part of Somalia, within the autonomous state of Puntland. It is composed of three administrative districts: Garowe, Eyl, and Dangorayo, with Garowe not only serving as one of the districts but also as the region's capital. Nugaal is pivotal due to its livestock trade, which is a central aspect of its economy, while Garowe, the capital, is emerging as a hub for education and telecommunications. Strategically positioned, Nugaal connects various parts of Somalia, making it vital for trade routes and mobility across the Somali Peninsula. The economic activities, coupled with the region's clan homogeneity, have contributed to a stable environment, making Nugaal a critical region within Puntland and Somalia for both economic development and strategic connectivity.

Figure 16 Nugaal Region; Source: OCHA, 2024[59]



54. The clan composition in Nugaal is relatively homogeneous, with the Issa Mahmud clan prominently established across the region. The Omar Mahmud clan, part of the larger Darood/Harti group, is notably influential in the southern areas of Nugaal and extends into northern Mudug. Near the coastal town of Eyl, the smaller Awrtable clan is situated. The demographic structure is influenced by pastoralism, migration, and urbanization trends. Garowe, as the region's capital, is a focal point for political and economic activities, attracting diverse population groups.

55. Educational facilities in Nugaal have been expanding, yet access remains limited in remote pastoral areas. Initiatives to increase enrolment rates, particularly for girls, are vital for the region's

[59] FAO. 2024. Annex 6: Environmental and Social Management Framework (ESMF). *A report for the GCF-FAO Project "Climate Resilient Agriculture in Somalia."* Page 33.

development. Garowe serves as an educational hub, hosting several higher education institutions and vocational training centers. Healthcare services in Nugaal are concentrated in urban centers like Garowe, with limited access in rural and nomadic communities. Primary health concerns include malnutrition, infectious diseases, and maternal health. Improving healthcare infrastructure and outreach services is critical for enhancing public health outcomes.

56. The economy in Nugaal is predominantly based on livestock rearing, with land tenure practices centered around communal grazing rights and limited agricultural land use. Urbanization has led to increased land tenure complexity, particularly in and around Garowe. Addressing land disputes and promoting sustainable land use are important for regional stability. Poverty in Nugaal is prevalent, particularly among nomadic and rural communities, driven by limited access to education, healthcare, and sustainable income sources. Economic diversification and development initiatives are needed to address the root causes of poverty. Social safety nets and development programs are essential for vulnerable populations.

1.2.4.2 Environmental Characteristics

57. Nugaal Region showcases a varied landscape, featuring semi-arid plains, rugged terrain, and occasional hills, particularly towards the interior. The topography facilitates pastoralism and limited agriculture, defining the livelihoods of its inhabitants. The region's elevation gradually increases from the coastal areas to the interior, offering diverse ecological zones.

58. Soil in Nugaal is generally sandy and less fertile, typical of arid and semi-arid lands, posing challenges for large-scale agriculture. Areas closer to seasonal watercourses may possess more arable land, supporting limited agricultural activities.. **The** predominant land use in Nugaal is pastoralism, with herding of goats, sheep, and camels forming the backbone of the local economy. Limited agriculture occurs near water sources, focusing on subsistence crops. Urban areas, particularly Garowe, serve as administrative and trade centers, with growing infrastructure development.

59. Water resources in Nugaal are primarily seasonal, with reliance on rainwater harvesting and shallow wells. The region's water scarcity challenges are exacerbated by the semi-arid climate, making sustainable water management a priority. Irrigation practices are minimal and typically localized, dependent on the availability of groundwater or seasonal rivers.

60. **Biodiversity (Flora/Fauna):** Nugaal's biodiversity is adapted to arid conditions, with flora including drought-resistant shrubs and trees, and fauna comprising nomadic wildlife species such as antelopes and various bird species. Efforts are ongoing to document and protect the unique biodiversity within the context of climatic challenges.

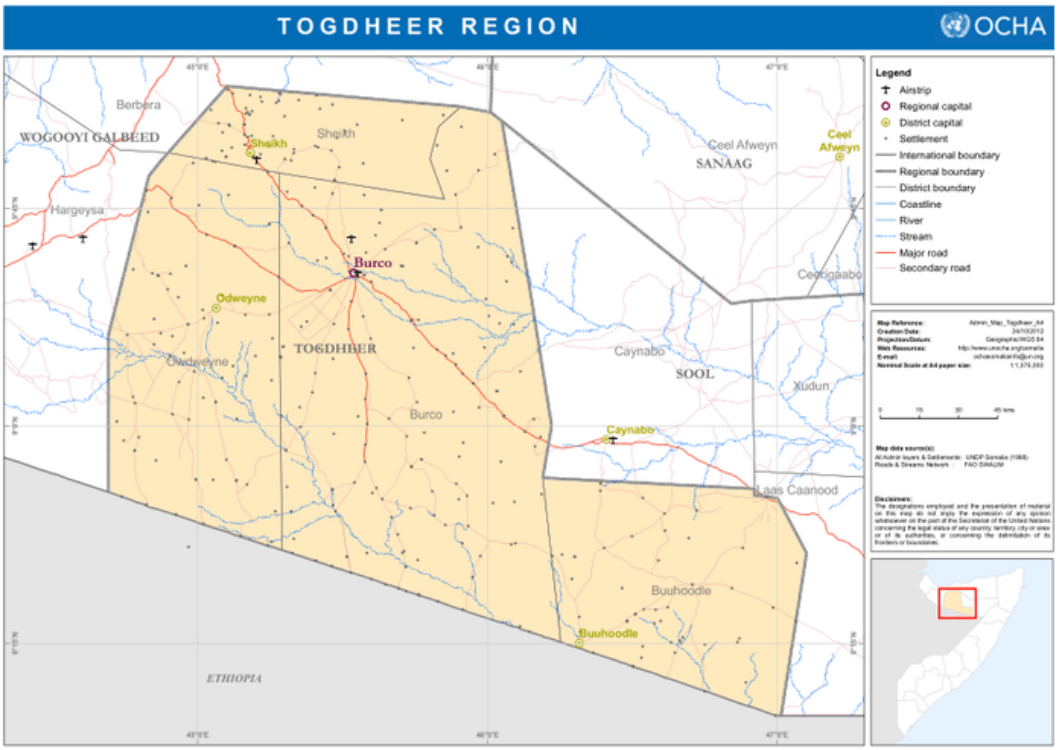
1.2.5 Togdheer

1.2.5.1 Socio-Economic Characteristics

61. Togdheer Region, which is segmented into four districts: Burco (the regional capital), Oodweyne, Buuhoodle, and Sheikh. Economically, Togdheer is significant for its contribution to the agricultural and livestock sectors, serving as a crucial hub for both trade and pastoralism within Somalia. The strategic location of Togdheer, especially its capital Burco, positions it as a vital commercial center, linking various parts of the country and facilitating trade routes that extend beyond its borders. The region's robust economic activities, coupled with its strategic position, underscore Togdheer's importance in Somalia's socio-economic landscape, contributing to its overall stability and development.

Figure 17 Togdheer Region; Source: OCHA, 2024[60]

[60] FAO. 2024. Annex 6: Environmental and Social Management Framework (ESMF). *A report for the GCF-FAO Project "Climate Resilient Agriculture in Somalia."* Page 36.



62. Togdheer's population is predominantly inhabited by the Habar Yunis and Habar Jeclo clans. The area to the west of Burco is home to the Idagalle and other smaller sub-clans, closely affiliated with the Habar Yunis. Meanwhile, Buuhoodle, situated in the southern part of the region, is primarily composed of members from the Dhulbahante clan. The region's demographic profile is influenced by rural-to-urban migration, particularly to areas like Burco, which is a major urban center. Clan affiliations play a significant role in social and political dynamics.

63. Access to education in Togdheer varies, with urban areas like Burco offering more educational facilities compared to rural and nomadic settings. Challenges include a shortage of schools, trained teachers, and educational materials. Healthcare services in Togdheer are limited, especially in remote and rural areas, with urban centers providing the majority of medical facilities. Common health challenges include waterborne diseases, malnutrition, and maternal health issues. Improving healthcare access and quality remains a priority for regional development.

64. Livestock rearing and agriculture are the main sources of labor in Togdheer, with land tenure systems traditionally based on communal grazing rights and agricultural land use. Urbanization and the development of towns like Burco are creating new employment opportunities. Poverty is prevalent in Togdheer, with many communities facing economic hardships exacerbated by environmental factors such as drought and limited access to resources. Rural and nomadic populations are particularly vulnerable. Development initiatives aim to improve livelihoods through economic diversification and support for sustainable practices.

1.2.5.2 Environmental Characteristics

65. Togdheer is characterized by its semi-arid landscapes, featuring a mix of flat plains and rugged terrains, with occasional hills and mountains that contribute to its varied topography. This diversity supports different types of land use, from pastoralism to limited agriculture. The region's elevation varies, influencing its climate and water flow patterns.

66. The region experiences a semi-arid climate, with hot temperatures throughout the year and two main rainy seasons that are crucial for replenishing water sources and supporting agriculture. Variability in rainfall and occasional droughts pose significant challenges to the livelihoods of local communities. The climate supports a nomadic lifestyle, with pastoralism being a primary economic activity.

67. The majority of Togdheer's land is used for pastoralism, with nomadic and semi-nomadic communities herding livestock as their main livelihood. Agriculture is practiced in areas where water availability allows, focusing on subsistence crops and some cash crops. Soil in Togdheer varies in quality, with areas of fertile land suitable for agriculture, particularly near water sources, and more arid zones where the soil is less conducive to crop production. Soil erosion and degradation are challenges in some areas, necessitating sustainable land management.Water resources in Togdheer are primarily seasonal, with reliance on the rainy seasons to fill catchment areas and shallow wells. Limited irrigation practices are employed in agricultural areas, dependent on the availability of surface water and groundwater. Water scarcity is a significant issue, affecting both human and livestock populations.

68. The region's biodiversity is adapted to its semi-arid conditions, with a range of drought-resistant plant species and wildlife that can survive in harsh environments. Fauna includes species such as antelopes, birds, and small mammals, which are integral to the ecosystem.. Preservation of these natural habitats is essential for ecological balance and sustainability.

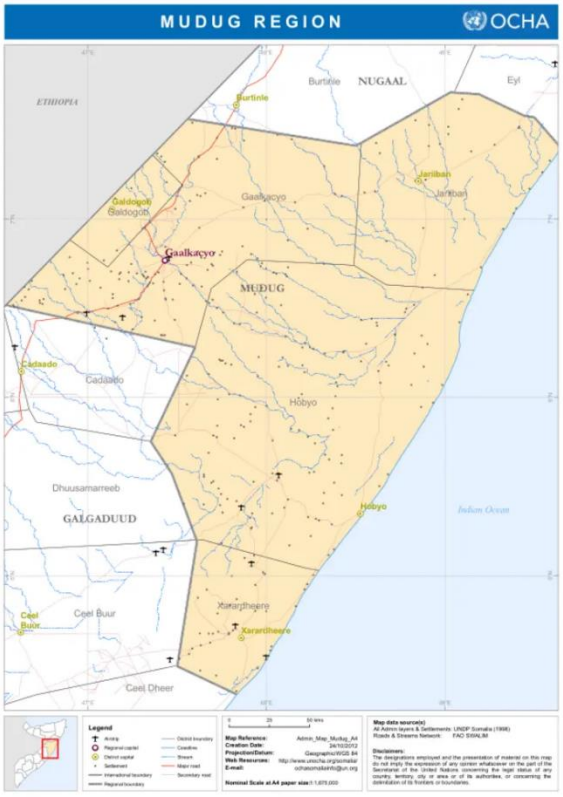
1.2.6 Mudug

1.2.6.1 Socio- Economic Characteristics

69. Mudug region is a unique area that straddles the administrative boundaries of Galmudug and Puntland, with Puntland administering the northern portion. Galkacyo, the regional capital situated in Mudug's western part, is notably divided between Galmudug in the south and Puntland in the north. The region encompasses five districts: Galkacyo, Hobyo, Jariban, Goldogob, and Harardhere. Economically, Mudug plays a critical role due to its coastal access and the presence of key ports like Hobyo, facilitating trade and fishing activities that contribute significantly to the local and national economy. Its strategic location, bridging the northern and southern parts of Somalia, enhances its importance as a commercial and logistical hub. The division of Galkacyo into two administrative areas reflects the broader geopolitical dynamics within Somalia, making Mudug pivotal in efforts towards stability, economic development, and inter-regional collaboration.

Figure 18 Mudug Region; Source: OCHA, 2024[61]

[61] FAO. 2024. Annex 6: Environmental and Social Management Framework (ESMF). *A report for the GCF-FAO Project "Climate Resilient Agriculture in Somalia."* Page 38.



70. Mudug's population is diverse, with the southern parts predominantly inhabited by the Saad sub-clan of Habr Gedir (Hawiye), and the north by the Omar Mohamoud sub-clan of Majerteen (Darood), each asserting dominance in their respective areas. Additionally, cross-border clan affiliations add to the region's complex social fabric. Population growth in urban areas, especially Galkacyo, challenges infrastructure and services.

71. Educational access in Mudug varies, with more established facilities in urban centers like Galkacyo and limited resources in rural areas. Efforts to improve education focus on increasing school enrolment, reducing gender disparities, and enhancing the quality of education. Challenges include a shortage of trained teachers and educational materials. Healthcare services in Mudug are concentrated in larger towns, with many rural areas lacking sufficient medical facilities. Common health challenges include malnutrition, infectious diseases, and limited access to clean water and sanitation. Improving healthcare access and quality is a priority for regional development.

72. Poverty is a significant issue in Mudug, with rural and nomadic populations particularly vulnerable due to limited access to education, healthcare, and stable income sources. Economic hardships are exacerbated by environmental challenges and insecurity in certain areas. Development initiatives aim to address poverty through economic diversification and support for vulnerable communities.

73. The economy of Mudug is based largely on livestock rearing, agriculture, and trade, with land tenure practices that include communal grazing rights and agricultural land use. Urbanization and economic development in areas like Galkacyo create new employment opportunities but also raise issues of land rights and tenure security. Addressing these concerns is crucial for economic stability and social cohesion.

1.2.6.2 Environmental Characteristics

74. Mudug's landscape is diverse, featuring coastal plains along the Indian Ocean, semi-arid bushlands, and the central plateaus that characterize much of Somalia's terrain. The region's varied topography supports a mix of pastoralism, agriculture, and urban settlement, particularly in and

around Galkacyo, the regional capital. Its geographical diversity also influences climate patterns and resource distribution across the region.

75. Soil quality in Mudug varies, with fertile areas along the seasonal riverbeds supporting agricultural activities and more arid, less fertile soils dominating the bushlands and plateaus. Soil erosion and degradation pose ongoing challenges, necessitating sustainable land management practices to maintain agricultural productivity. Conservation efforts are critical to combating desertification in the region. Land use in Mudug is primarily divided between pastoralism in the bushlands and agriculture in areas with better soil and water availability. Urban areas, notably Galkacyo, are centers of trade, services, and government activities, with land also used for residential and commercial purposes.

76. Water resources in Mudug are scarce, with reliance on seasonal rivers, shallow wells, and rainwater harvesting to meet both domestic and agricultural needs. Limited irrigation systems are utilized in agricultural areas, but these depend heavily on the unpredictable rainy seasons.

77. The biodiversity in Mudug includes a variety of plant species adapted to its semi-arid conditions and wildlife such as antelopes, foxes, and various bird species that inhabit its grasslands and bushlands. The coastal and marine biodiversity adds to the region's ecological richness, including fish and marine mammals.

2 Climate Change Risk & Vulnerability Analysis

78. This chapter is structured following the climate risk definition made by the Intergovernmental Panel on Climate Change (IPCC) sixth assessment report (IPCC, 2022). In the context of climate change, risks can arise from the potential impacts of weather hazards as well as the human responses to modulate its impacts. Climate risks also result from the vulnerability to which a system is susceptible to and unable to cope with the adverse effects of climate change and, lastly, by the ability of a system to adjust or cope with its consequences by modulating potential damages besides taking advantages of emerging opportunities.

79. The Chapter is structured according to the different components of risks, including the identification of relevant climatic and non-climatic contributing factors, as described by the WMO-GCF guidance document “Developing the Climate Science Basis for Climate Action” (WMO, 2021). This includes the identification of relevant climatic indicators, the variability and change of which they contribute, or could contribute, to socioeconomic or environmental impacts in the areas of intervention, as well as the identification of non-climatic contributing factors, including infrastructural assets, natural resources, governance systems and socioeconomic characteristics that may interact with climate variability and change.

80. To have a comprehensive understanding of the ocean-atmospheric factors underlying the mosaic of climates in Somalia, Section 2.1 focuses on the climate and agroecological baseline. Sections 2.2 and 2.3 describe the changes in key climatic indicators (e.g., daily mean Tmax and Tmin, precipitation, and relative humidity), including seasonality, and extremes (e.g., number of heavy/extreme rainfall days, dry-spells, and heat stress conditions) over the 1981-2010 period, as well as the projected changes across the century under different greenhouse gas emission scenarios (Representative Concentration Pathways (RCPs), namely RCPs 2.6 and 8.5).

81. Chapter 2.4 analyses the physical presence of people, livelihoods, economic and social assets that have already and could be adversely affected by weather hazards. Geospatial datasets on flood and drought prone areas further support the analysis on livelihood’s exposure to observed and projected weather hazards. The predisposition of livelihoods and agricultural systems to be harmfully affected by climate change is described in Chapter 2.5. Chapter 2.6 analyses the capacity of a system to modulate the adverse effects of weather hazards. References that support the climate impact potential assessment are provided at the end of the document.

Box 1. Adopted framework for the analysis of climate change.

Climate information
The CAVA tool developed by FAO makes use of the best gridded products for both past and projected climate data. For the historical period, CAVA uses the W5E5 dataset, while for climate projections, the outputs of dynamically downscaled climate models, which are part of the CORDEX-CORE initiative.

- W5E5 is an observational gridded dataset (about 50km) with global coverage. W5E5 provides information for twelve variables over the 1980-2019 period and, thus, used as the reference in ISIMIP activities. This dataset is built from ERA5 reanalysis adjusted using the global observational datasets CRU TS4.03 and GPCCv2018.

- CORDEX-CORE provides homogeneous regional climate projections for most inhabited land regions using nine CORDEX domains at about 25km resolution for 1970-2100 (North, Central and South America (NAM, CAM, SAM), Europe (EUR), Africa (AFR), East, South and Southeast Asia (EAS, WAS, SEA) and Australasia (AUS)). Three GCMs (HADGEM2-ES, MPI-ESM, and NorESM) for high, medium, and low equilibrium climate sensitivities representing the full CMIP5 ensemble were selected to drive the regional simulations for two scenarios: RCPs 2.6 and 8.5. Two RCMs have contributed so far to this initiative (REMO and RegCM4), providing an initial homogeneous downscaled dataset to analyze mean climate change signals and hazards.

Choice of Representative Concentration Pathways
The CORDEX-CORE initiative provides climate model outputs for two RCPs, namely RCP 2.6 (low emission scenario) and RCP 8.5 (business-as-usual scenario). Given the computational constraints (running RCMs requires supercomputers and computational times of up to years) of RCMs, the CORDEX-CORE initiative decided to provide results for two RCPs only. The choice of RCPs 2.6 and 8.5 covers the IPCC range of greenhouse gas concentration pathways for the 21st century. The projected changes under RCP 4.5, an intermediate scenario with an aim to stabilize global temperature increase between 2 to 3 °C, are considered to fall within the range provided by simulations using RCPs 2.6 and 8.5.

Agricultural drought frequency
This analysis involved Bayesian Change-Point detection methods that allowed us to statistically detect changes in the frequency of drought events, where drought is defined according to the Agricultural Stress Index System (ASIS) methodology (Rojas, 2021)

Impacts on crop productivity
This analysis was done using the Inter-Sectoral Inter Model Intercomparison Project (ISIMIP) results for maize and sorghum modelled with different impact models namely CROVER, CYGMA1p74, DSSAT-PYTHIA, LPJML, pDSSAT and CYGMA and LPJML for maize and sorghum, respectively. Each of these models was forced with five CMIP6 climate models downscaled and bias-corrected using W5E5 gridded product as per ISIMIP methodology. To assess inter-model variability, which is the variability between crop models in this context, the results from the same crop model forced with different climate models were averaged. The impact models were selected based on whether they accounted for drought and heat stresses in the simulation of crop yields.

Impacts on livestock
The Thermo-Humidity Index (THI) for ruminants, which comprise the biggest fraction of livestock kept in Somalia, has been calculated using the following equation by Hahn et. al. (2009):

THI ruminant= (1.8 Tmax+32)-((0.55-0.0055 RH) (1.8 Tmax-26.8))

2.1 Baseline information

2.1.1 Atmospheric circulation

82. The main synoptic scale systems affecting Somalia's climate are the Inter-Tropical Convergence Zone (ITCZ), monsoonal winds and ocean currents, jet-streams including the 'Somali jet-stream', easterly waves, tropical cyclones, neighboring Indian Ocean, and Red Sea conditions, as well as teleconnections with various regional and global scale ocean-atmospheric systems. Some of this large-scale ocean-atmospheric systems include the Quasi biennial Oscillation (QBO), El Niño Southern Oscillation (ENSO), and the Indian Ocean Dipole (IOD), among others. An additional geographical factor affecting rainfall is the country's location on the leeward side of the Kenyan and Ethiopian highlands, resulting in high regional rainfall concentrations occurring just outside of Somalia but responsible for providing much of the river flow entering Somalia via the Juba and Shabelle River Basins.

83. Rainfall in Somalia has a large spatial and temporal variability (**Figure 19**). Seasonal rainfall is dominated by the north and south displacement of the ITCZ. As a result, Somalia's climate can be characterized into four seasons:

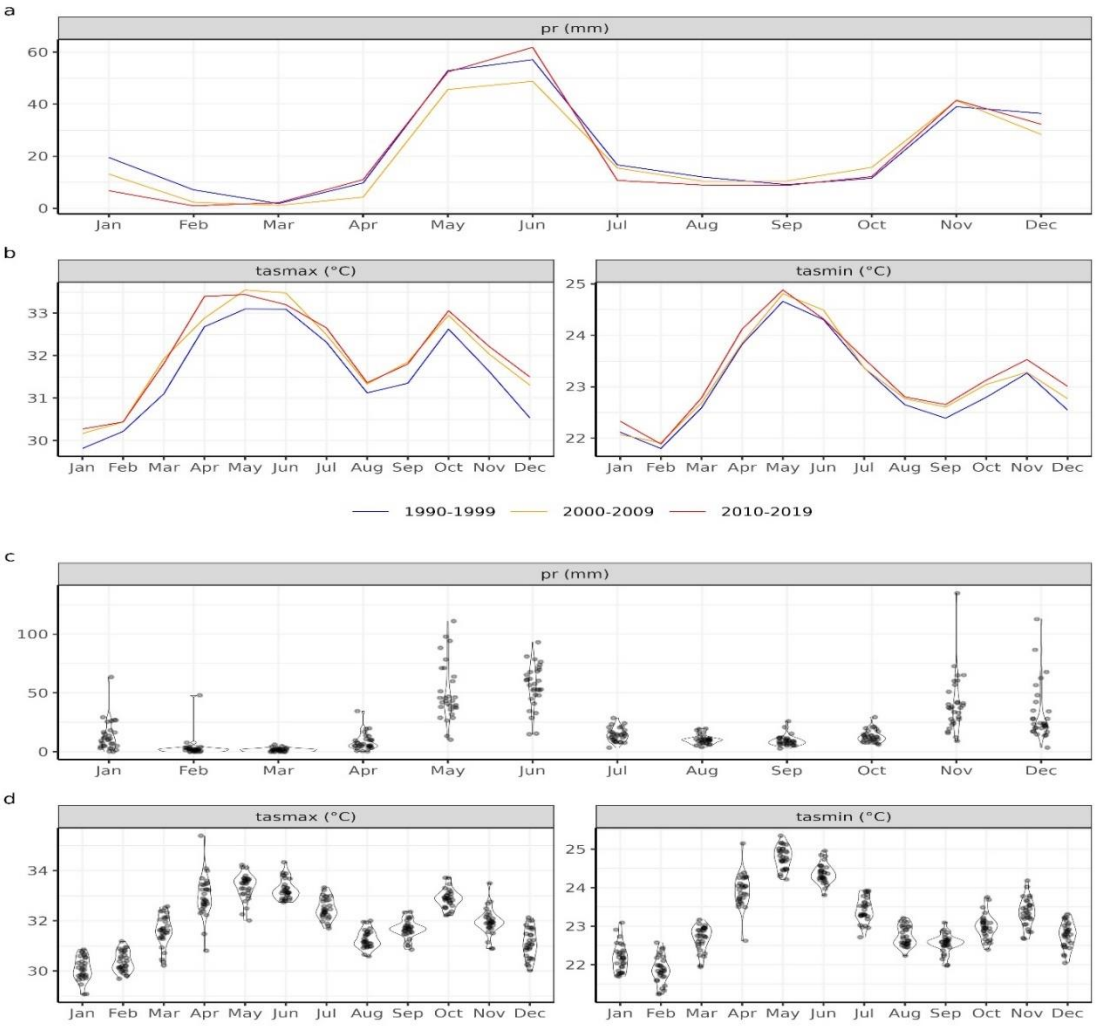
- The *Jiilaal* dry season from December to March. During these months, the north-east monsoon is in dominance and conditions are generally dry and hot. The northern parts of the country experience some cool and dry air during this season, while the central and southern parts experience very hot conditions.

- The *Gu* is the major rainy season and lasts from April to June. During these months, relatively wet and hot conditions prevail. The southern regions receive more rains than the north. Occasionally the *Gu* season extends into June or July because of the *Haggai* rains, which are produced by the onset of moist onshore winds.

- The *Xagga* dry season lasts from July until September. During these months, the south-west monsoon dominate, bringing relatively cool conditions with showers along the coast and, on the other hand, with dry conditions inland.

- The *Deyr* rainy season occurs between October and November. At this time, the low-pressure system, which carries air moisture, known as the Arabian ridge, intensifies over the Equator, and the central parts of the country receive moisture inflow from the Indian Ocean. During this period, the northern part of the country is under the influence of dry air from the Arabian Peninsula and, thus, experiencing less precipitation The rainfall received at this time of the year is less than during the *Gu* rainy season. The precipitation both during *Gu* and *Deyr* seasons displays high variability, especially during the months of May and June and November and December, respectively

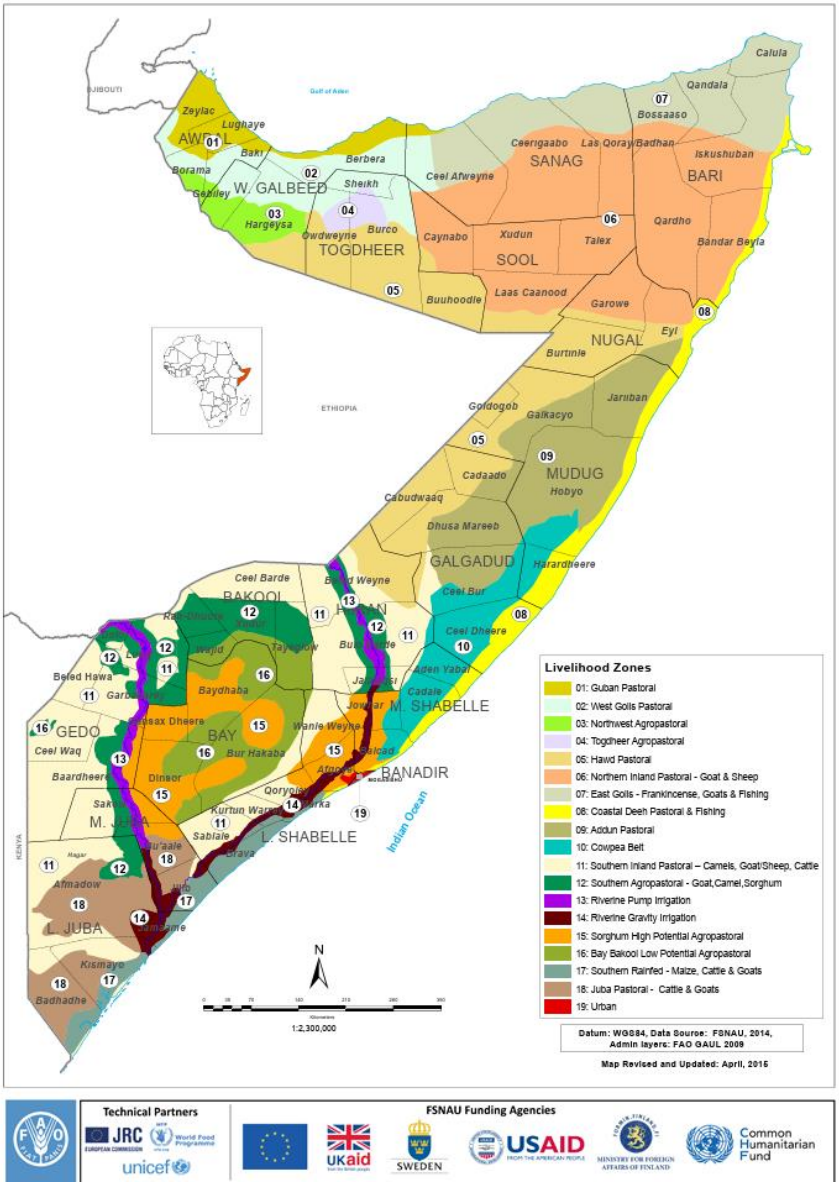
Figure 19. *Observed annual precipitation, maximum and minimum temperature along targeted regions over the 1990-2019 period. (a-b) Line colours highlight time ranges. (c-d) Violin plot shows the distribution of the data (e.g. the wider the more frequent), while points identify individual yearly data values for the whole period. Violin plots are useful for assessing interannual variability and data distribution.*



2.1.2 Agroecological baseline

84. There are four main land use systems in Somalia. Over 50% of the country supports only extensive and nomadic pastoralism. A paltry 13% of the country's total land area is suitable for cultivation, including seasonal agropastoralism and a much smaller irrigated agropastoralism zone located along the two main river valleys (Shabelle and Juba). A limited zone of oasis-based production lies along the central northern coast, and there are agricultural areas in every district where water is present, even in limited amounts. There is also a small area of denser forest in the extreme south and scattered pockets of mangroves mostly along the northern coast. Population distribution within the country is strongly influenced by the location of agricultural zones. Agriculture is mostly possible where there are alternative groundwater sources to support irrigation, particularly within the alluvial plains where shallow wells and permanent springs provide supplementary water for irrigation. Most of the northern part of Somalia is dry and cannot support rain-fed crop production. In the south, rain-fed crop production is practiced in the Shabelle and Juba River basins. About two-thirds of the arable land is located here. Irrigation is restricted to the relatively fertile areas around the Shabelle River, where the main crops are maize, rice, sesame, cowpeas, bananas, papayas, lemons, grapefruit, and mangoes. Figure 20 shows the distribution of livelihood zones in Somalia.

Figure 20. Livelihood map of Somalia



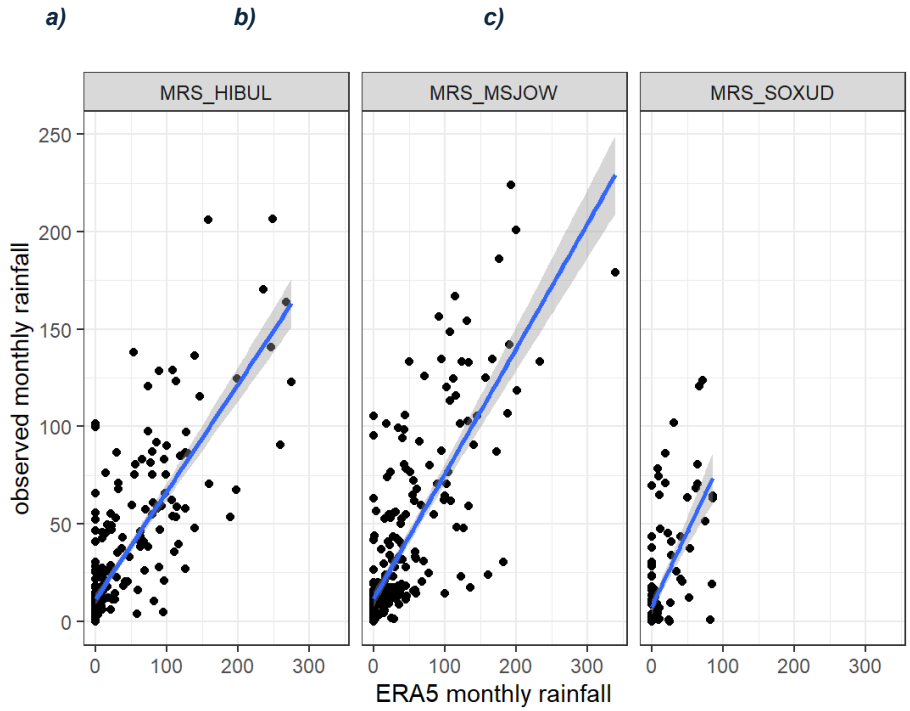
2.2 Hazards: past climate

2.2.1 Historical datasets

85. For the analysis of past climate, this study uses the W5E5 dataset for the 1981-2010 baseline period (30-year dataset for daily precipitation, daily maximum, and minimum temperatures at around 50km resolution) (Cucchi et al. 2020). W5E5 is currently used in many impact assessment studies, and it has been adopted by the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP) as the official product for the bias-correction of atmospheric models. The W5E5 merges two datasets, the ERA5 reanalysis dataset (at 0.25º spatial resolution) over the ocean with the WFDE5 over the land (at 0.50º spatial resolution). To support the analysis of historical climatic trends, this study's results are supported by a scientific literature review. The analyses performed in this document are prepared using the Climate and Agriculture Risk Visualization and Assessment (CAVA) tool, developed by the FAO Risks Team at the Office of Climate Change, Biodiversity and Environment (OCB). The tool allows the user to access different reanalysis products for the historical period, where trends can be calculated by applying a simple linear regression for the historical period.

86. In this work, we validated W5E5 dataset against observed datasets retrieved from the Somalia Water and Land Information Management (SWALIM) project stations. Our analyses reveal that the gridded climate products used in these documents (ERA5 and its derivation like W5E5) correlate well (80%) with observed precipitation data (**Figure 21**).

Figure 21. *Correlation between ERA5 monthly precipitation data and observed precipitation (from SWALIM) for three stations* ***(a)*** *Bulo Burti,* ***(b)*** *Jowhar, and* ***(c)*** *Xudun).*

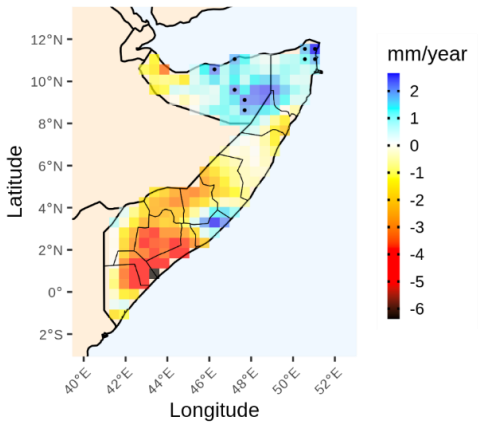


2.2.2 Precipitation

87. The total annual rainfall trends vary across the country, as displayed in **Figure 22**. The results of our analysis indicate that Somalia's total annual precipitation did not experience a statistically significant increase or decrease (absence of black dot in **Figure 22**) across most of the regions over the 1981-2010 period. Despite the lack of statistical significance, there has been a reduction in Middle and Lower Juba and Lower Shabelle (3 to 6 mm/year), as well as in Galgaduud, Mudug and Nugaal regions (1 to 2 mm/year). Middle Shabelle has experienced a slight increase in total annual precipitation (1 to 2 mm/year) while the total amount of annual rainfall in Togdheer has remained constant over the 1981-2010 period. The only significant increase ($p<0.05$) in total annual precipitation is observed in Bari, Sool and Sanaag (1 to 2 mm/year).

88. While statistically significant differences could not be assigned, the estimated total annual rainfall increase or decrease deserves attention. A yearly precipitation increase of 2 mm translates into a 60 mm difference over the 1981-2010 period. The southern part of the country, which is characterized by a higher annual precipitation, has experienced a 25% decline in total annual precipitation. The absence of statistical significance suggests high inter-annual variability, which hinders the detection of a statistically significant signal. Alternatively, a non-linear trend could explain the lack of statistical significance in our linear regression analysis. The analysis conducted in this document, is partially in disagreement with previous studies. For example, UNFCCC (2018) shows that Somaliland, south and central regions have experienced a significant rainfall decline. On the other hand, it agrees with Ogallo et al. (2018) showing that rainfall trends vary both spatially and temporally across four Somali regions.

Figure 22. *Annual change in total annual precipitation in Somalia over the 1981-2010 period. For the annual change a linear regression is applied to each pixel and, thus, a statistically significant change is represented with a black dot; conversely, pixels with an absence of a black dot indicate a lack of statistical significance.*

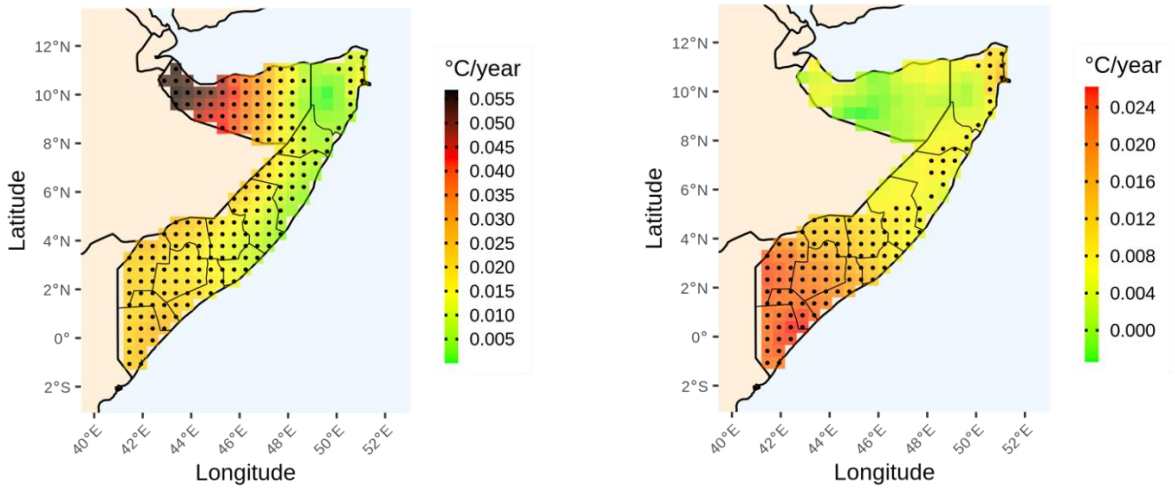


2.2.3 Temperature

89. There is a significant yearly increase in daily maximum temperature ranging from 0.005 to 0.055 °C/year, which translates into a temperature increase of 0.15-1.65 °C over the 1981-2010 period. The highest maximum temperature increase is localized in Somaliland, especially in Awdal and in Woqooyi Galseed regions and the southern part of Somalia (Figure 5a), agreeing with previous findings made by Ogallo et al. (2018). A yearly increase in daily minimum temperature was also detected, though to a minor extent to that observed for daily maximum temperature. The increase in minimum temperature is significant in most of the country, except for Somaliland (**Figure 23**b). Overall, the highest increase in minimum temperatures (0.024 °C/year) was observed in the southern part of the country (Middle and Lower Juba, Gedo, Lower Shabelle, and Bay regions). This study results agree with the scientific literature. For example, UNFCCC reported an increase of 1.0°C in 2005 compared to 1901 in Somalia (UNFCCC, 2018).

Figure 23. *Annual change in daily mean (**a**) maximum and (**b**) minimum temperature in Somalia over the 1981-2010 period. For the annual change a linear regression is applied to each pixel and, thus, a statistically significant change is represented with a black dot; conversely, pixels with an absence of a black dot indicate a lack of statistical significance.*

a) ***b)***



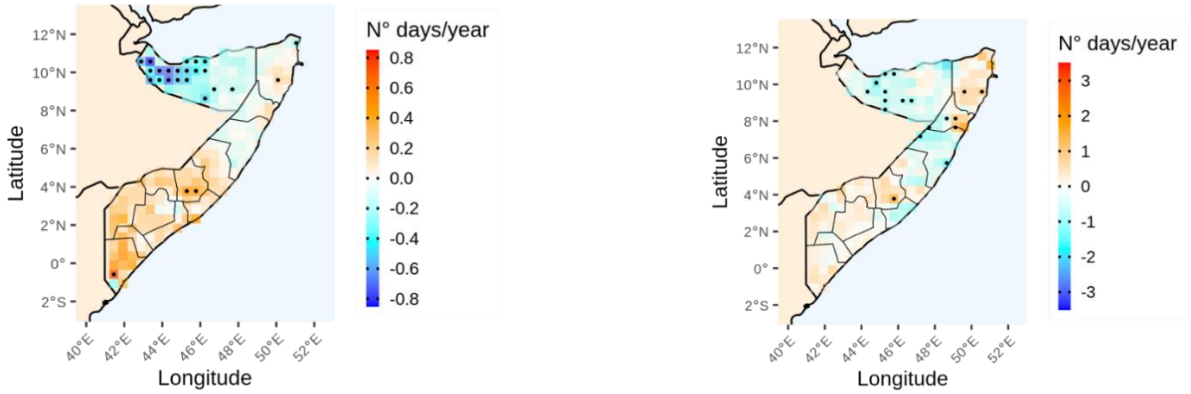
2.2.4 Extreme weather events

2.2.4.1 Dry days and length of dry-spells

90. The analysis on the number of dry days (R<1mm/day) shows an increase, ranging between 0.2 and 1 day/ year, along the southern regions (Gedo, Bay, Bakool, Galgaduud, Middle and Lower Shabelle) over the 1981-2010 period (**Figure 23**a). More specifically, this increase is statistically significant different in Hiraan and parts of lower Juba regions. In Somaliland, the number of dry days has significantly decreased at the rate of 0.2 to 0.8 days/year. Similarly, the maximum length of consecutive dry days (CDD) has increased at the rate of 1 day/year in the south and north-eastern regions (**Figure 23**b). In Hiraan, Nugaal and Bari regions this increase is statistically significant different. On the other hand, large parts of Somaliland have experienced a statistically significant decrease (1 day/year) in the length of CDD over the 1981-2010 period.

Figure 24. *Annual change in the number of (**a**) dry days (R≤1 mm/day) and (**b**) maximum length of consecutive number of dry days (CDD) in Somalia over the 1981-2010 period. For the annual change a linear regression is applied to each pixel and, thus, a statistically significant change is represented with a black dot; conversely, pixels with an absence of a black dot indicate a lack of statistical significance.*

a) b)

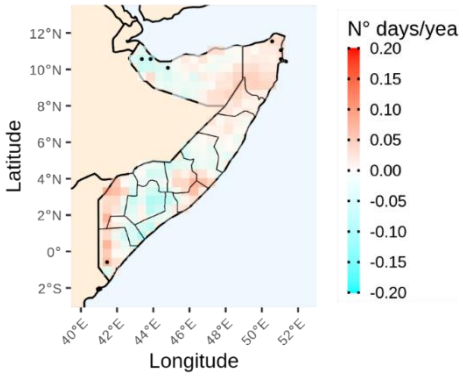


2.2.4.2 Extreme rainfall

91. The frequency of days with heavy rainfall conditions is spatially variable in Somalia. Our analysis shows the highest increase (0.05 to 0.10 days/year) in the number of days with heavy rainfall (R≥20mm/day) in the tip of the Horn of Somalia, and in some isolated areas bordering Kenya (Lower Juba and Gedo regions). This increase is significant different over the Lower Juba region.

Meanwhile, in southern inland areas and the Somaliland bordering Djibouti, such as Awdal, there is a statistically significant reduction (0.05 to 0.10 days/year) in the frequency of R≥20mm/day, as highlighted by the cyan colour in Figure 25. Nonetheless, most of the observed trends lack statistical significance, which could indicate high inter-annual variability.

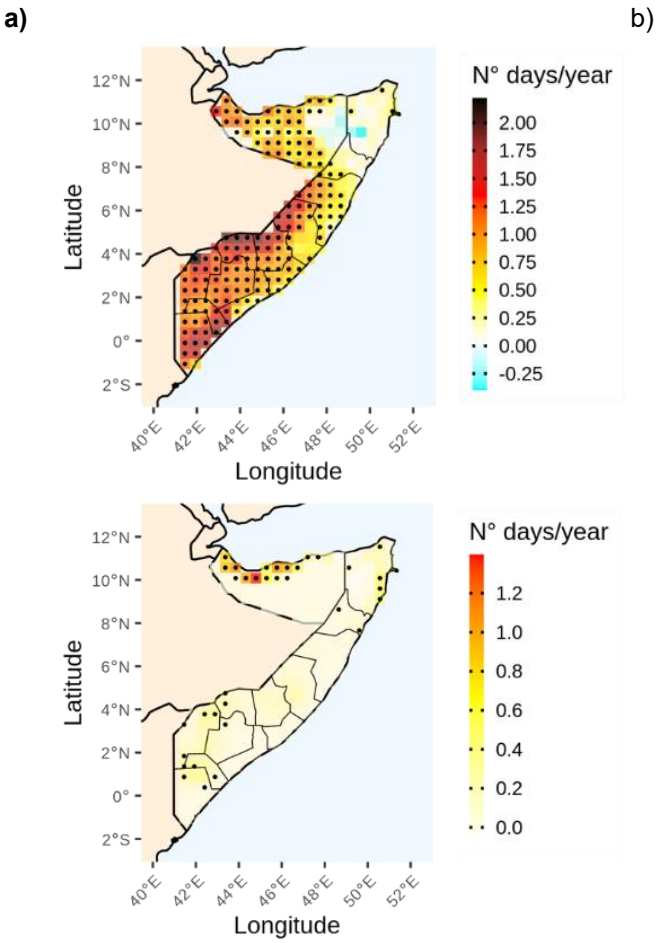
Figure 25. *Annual change in the number of heavy rainfall days (R≥20mm/day) over the 1981-2010 period. For the annual change a linear regression is applied to each pixel and, thus, a statistically significant change is represented with a black dot; conversely, pixels with an absence of a black dot indicate a lack of statistical significance.*



2.2.4.3 Extreme temperatures

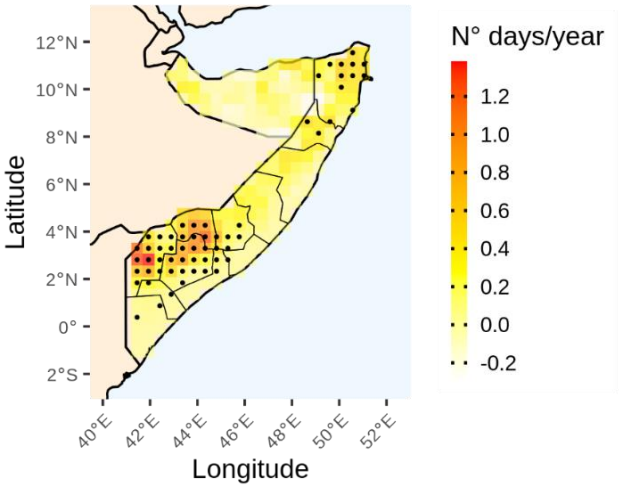
92. The analysis of temperature extremes shows a significant increase (0.25 to 2 days/year) in maximum temperature above 35ºC in most parts of the country, especially the southern parts of the country, the inland areas bordering Ethiopia and Kenya and in Somaliland (Figure 26a). On the other hand, this increase is not statistically significant different in Bari, Sool and Sanaag regions. An increase (0.8 to 1.2 days/year) in the number of very hot days (Tmax >40°C) is reported in coastal areas of Somaliland, Lower Juba, Gedo, Bakool, and Bari regions (Figure 26b).

Figure 26. *Annual change in the number of days with maximum temperature above (**a**) 35°C and (**b**) 40°C in Somalia over the 1981-2010 period. For the annual change a linear regression is applied to each pixel and, thus, a statistically significant change is represented with a black dot; conversely, pixels with an absence of a black dot indicate a lack of statistical significance.*



93. Somalia has experienced a general increase in the number of tropical nights (Tmin>20°C). This increase is significant in Gedo, Bakool, and Bay, Nugaal, and Bari regions (**Figure 27**). In these locations, observed data suggests an increase between 0.2 and 1.2 days/year over the 1981-2010 period. For the rest of the country, increases are observed but are not significantly different over time.

Figure 27. *Annual change in the number of tropical nights (Tmin>20°C) over the 1981-2010 period. For the annual change a linear regression is applied to each pixel and, thus, a statistically significant change is represented with a black dot; conversely, pixels with an absence of a black dot indicate a lack of statistical significance.*



2.3 Hazards: future climate

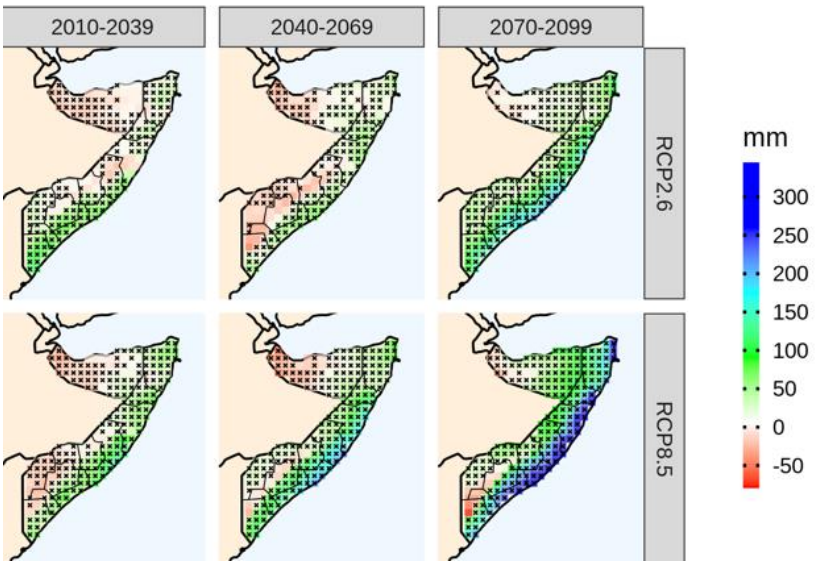
2.3.1 Future datasets

94. The FAOs CAVA analytics tool allows the user to access regionally dynamically downscaled (CORDEX CORE) CMIP-5 global climate models (GCMs), namely MOHC-HadGEM2-ES, MPI-M-MPI-ESM-LR, NCC-NorESM1-M downscaled with regional climate models (RCMs), namely REMO2015 at around 25km resolution (interpolated at 50km) for two representative concentration pathways (RCPs), namely RCP 2.6 (low emission scenario) and RCP 8.5 (high emission scenario). For future climate projections, CAVA analytics uses the W5E5 merged dataset over the 1976-2005 period for bias-correcting the outputs of atmospheric models. The calculation of the agreement of the climate change signal (as defined by the IPCC) is among the several statistical indices that CAVA analytics can perform. Additionally, CAVA analytics can calculate climatic thresholds (seasonality and extremes) and agroclimatic indices that are of interest for climate impact potential assessments in agriculture. In addition, when a linear regression is applied to future projections in CAVA analytics, design-based inference is used for the calculation of *p-values*. The scientific problem is that there are multiple models, all equally plausible. Therefore, calculating the significance of trends is much more challenging. While a linear regression on the ensemble member could mask statistical signals, a multivariate version of linear regression through resampling of model residuals via PIT-strap resampling helps us elucidate statistical signals over time (Wang et al. 2012).

2.3.2 Precipitation

95. The analysis below shows a higher total annual precipitation increase under RCP 8.5 compared to RCP 2.6, with a high model agreement both spatially and temporally (Figure 28). The increase in total annual rainfall is remarkable along the coastal areas of the country (middle and Lower Juba, Bay, and Middle and Lower Shabelle regions), leading to up to 300 mm increase in total annual rainfall compared to the historical period (1976-2005), especially in RCP 8.5 by the end-century. A small annual precipitation decrease (0 to 50mm) is projected along the inland areas (Gedo, Bakool, and in Somaliland) under the low emission scenario (RCP 2.6) and in the mid-century.

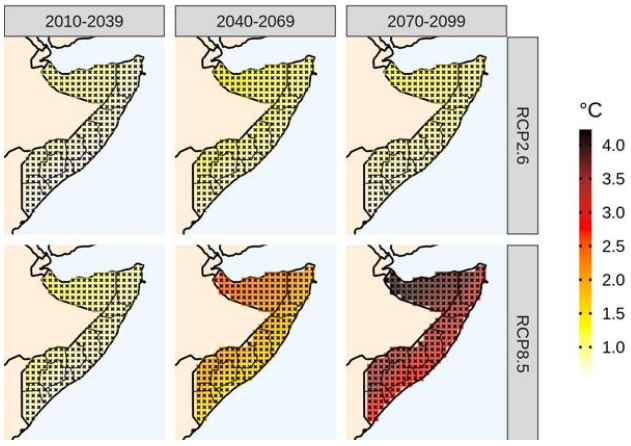
Figure 28. *Climate change signal in total annual precipitation over the 21st century from historical period (1976-2005) for two RCP's (2.6 and 8.5). The black cross indicates whether at least 60% of the models agree on the sign of the climate change signal (positive or negative). A multi-model ensemble mean of 3 GCM's and 2 RCM's is used.*



2.3.3 Temperature

96. The projections show an increase in mean annual maximum temperature in both RCP 2.6 and RCP 8.5. The highest mean annual maximum temperature increase (4ºC) compared to the baseline period (1976-2005) is reached in the far future in RCP 8.5 (Figure 11). These areas are mostly arid and currently have a low agricultural activity. Under RCP 2.6, the coastal areas of Somalia are expected to experience a lower annual maximum temperature change compared to the historical period. This is particularly important as the southern parts of Somalia concentrate most of the agricultural activities.

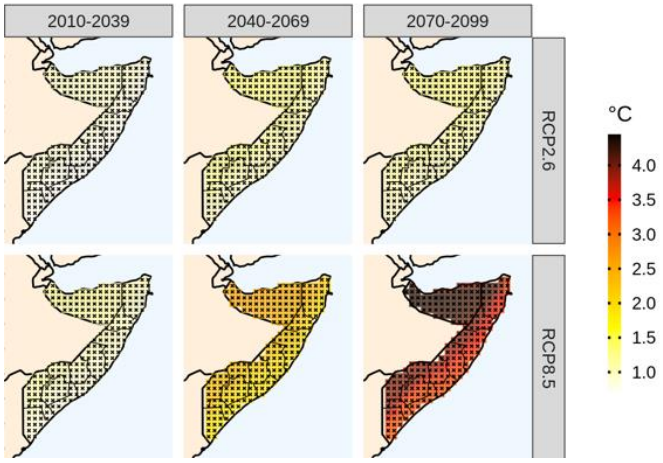
Figure 29. *Climate change signal in mean annual maximum temperature over the 21st century from historical period (1976-2005). The black cross indicates whether at least 60% of the models agree on the sign of the climate change signal (positive or negative). A multi-model ensemble mean of 3 GCM's and 2 RCM's is used.*



97. In addition, our analysis shows a general increase in mean annual minimum temperatures in Somalia in both RCP 2.6 and RCP 8.5. However, under RCP 8.5 and in the mid-future (2049-2069) and far-future (2070-2099), this increase will be greater (3 to 4ºC) in the northern parts of the country (Somaliland, Bari region and the border areas to Ethiopia) compared to the coastal areas due to

the thermic-regulatory effect of the sea (Figure 30). This poses particular challenges to the ecological stability of ecosystems in Somaliland and the northern provinces of Somalia.

Figure 30. *Climate change signal in mean annual minimum temperature over the 21st century from historical period (1976-2005). The black cross indicates whether at least 60% of the models agree on the sign of the climate change signal (positive or negative). A multi-model ensemble mean of 3 GCM's and 2 RCM's is used.*



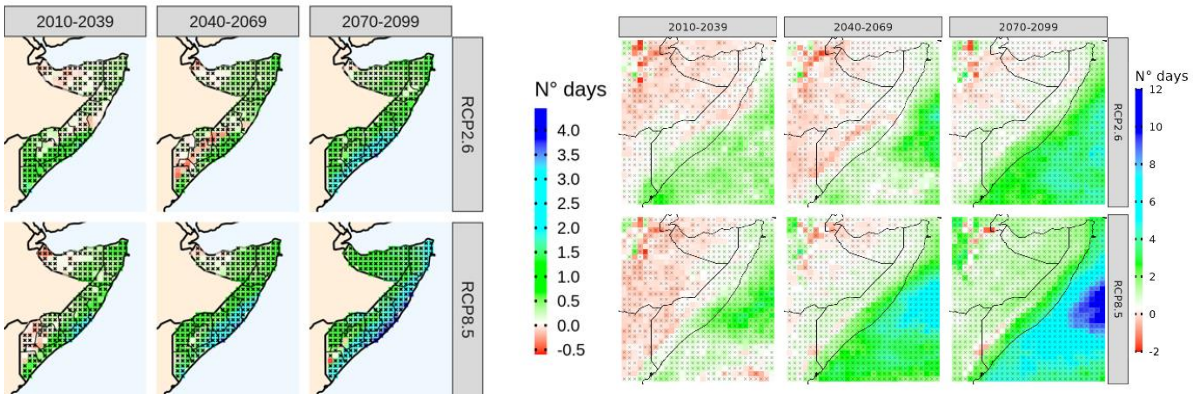
2.3.4 Extreme weather events

2.3.4.1 Dry-spells and extreme precipitation

98. Somalia is expected to experience an increasing number of heavy rainfall events (R≥20mm/day), ranging from 1 to 4 days compared to the baseline period (1976-2005) (Figure 31a). Under RCP 8.5, the increase is more pronounced (2 to 4 additional heavy rainfall events on annual average) along the coastal areas, and in the far future. The coastal areas are predicted to become wetter (12% to 70% increase in precipitation under scenarios RCP 2.6 and 8.5, respectively) and receive more rain over shorter periods of time. The former will result in a higher number of heavy rainfall events as displayed in Figure 13a. In addition, although statistically significant different, future climate projections do not show major increases (1 to 2 additional events on annual average under RCP 8.5) in heavy rainfall events along the Ethiopian Highlands, which are the source of the Shebelle River. Lastly, the number of dry days (R≤1 mm/day) is projected to decrease (2 to 15 days) along the Somalia coastline and, on the other hand, increase (5 to 15 days) in Gedo, Bakool, and Bay regions, particularly under RCP 8.5 and in the far-future (Figure 31b).

Figure 31. *Climate change signal in the (**a**) number of heavy rainfall days (R≥20mm/day) and (**b**) number of dry days (R≤1 mm/day) over the 21st century from historical period (1976-2005). The black cross indicates whether at least 60% of the models agree on the sign of the climate change signal (positive or negative). A multi-model ensemble mean of 3 GCM's and 2 RCM's is used.*

a) *b)*



99. To further validate the findings of this document, we apply recent development in climate science and calculate the time of emergence of the climate change signal (Rojas et al. 2019). Briefly, the climate change signal (delta from the historical period, 1976-2005) emerges from the noise (inter-model variation), when the mean climate change signal stays consistently (for at least 5 consecutive years) above or below the inter-model variation (mean/SD > or < 1). In other words, it tells us when change in climate will become stronger than the differences between climate models. In this document, this analysis is applied to the total annual precipitation (Figure 32) as well as to extreme events (Figure 33 Figure 34).

100. The results of this analysis further corroborate previous results. In particular, an increase in precipitation is expected along the coastline under both RCP 2.6 and RCP 8.5 by 2060. The importance of mitigation is highlighted and evident in the differences in the time of emergence between RCP's 2.6 and 8.5. While under RCP 2.6 only the southern coastal areas will experience a consistent increase in precipitation from 2040-2050, under RCP 8.5, most coastal areas will be affected by higher annual precipitation in 2060 (**Figure 33**). The Shabelle region is predicted to experience an increase in precipitation under both RCP's. Similarly, our analysis suggests that the frequency of heavy rainfall events (R≥20 mm/day) will increase, more remarkably under RCP 8.5, and will affect most of the coastline. The time of emergence for heavy rainfall events is predicted by 2060 under RCP 8.5 (**Figure 33**). Lastly, we calculated the time of emergence for dry days (R≤1 mm/day) (**Figure 34**). This analysis indicates an increase in the number of dry days for inland areas that will emerge in Somaliland by 2040 and a decrease in the Shabelle province, emerging by 2090 and 2060 under scenarios RCP 2.6 and RCP 8.5 respectively.

Figure 32. *Time of emergence of the climate change signal for total annual precipitation. Pixels coloured in red indicate in which year the frequency of dry days is expected to consistently emerge (increase) from the noise (inter-model differences). Blue pixels indicate the opposite, the moment when there will be a decrease in the frequency of dry days.*

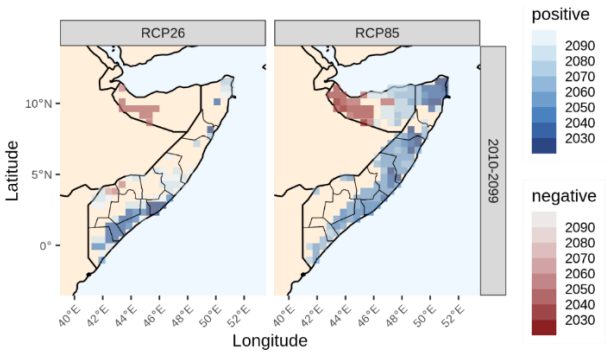


Figure 33. *Time of emergence of the climate change signal for heavy rainfall days (R≥20 mm/day). Pixels coloured in red indicate in which year the frequency of dry days is expected to consistently emerge (increase) from the noise*

(inter-model differences). Blue pixels indicate the opposite, the moment when there will be a decrease in the frequency of dry days.

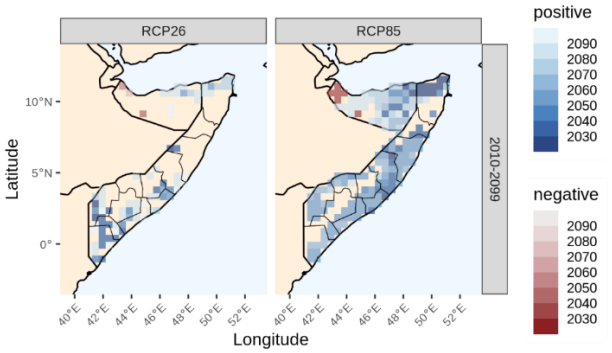
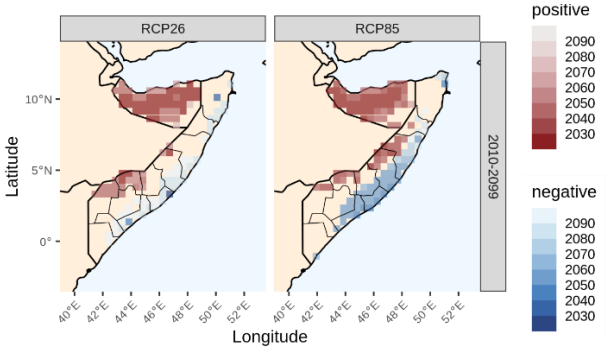


Figure 34. *Time of emergence of the climate change signal for dry days (R≤1 mm/day). Pixels coloured in red indicate in which year the frequency of dry days is expected to consistently emerge (increase) from the noise (inter-model differences). Blue pixels indicate the opposite, the moment when there will be a decrease in the frequency of dry days.*



2.3.4.2 Extreme temperatures

101. The number of days with Tmax >35°C is predicted to increase by up to 200 days on annual average in the far future and in RCP 8.5, particularly along inland areas (**Figure 35**a). This means that, most of the year, large areas of Somalia are likely to experience constant Tmax >35°C. Coastal areas show a low model agreement (absence of black cross), indicating a high inter-model variability. A similar pattern, increased frequency of extreme events in inland areas compared to coastal areas, is predicted for very hot days (Tmax > 40°C) (**Figure 35**b). This implies that, while inland areas will experience a higher mean annual maximum and minimum temperatures and extreme events, coastal areas are predicted to experience a milder increase in both maximum and minimum temperatures and extreme events (hot and very hot days). This is partially due to the thermic-regulatory effect of the sea as well as to a higher variability between climate models' outputs along the coastal zones. For example, the Shabelle province is predicted to experience a moderate increase in the frequency of hot days (Tmax >35ºC), ranging from 15 to 50 days on annual average by the end of the century compared to the baseline period under RCP's 2.6 and 8.5, respectively.

Figure 35. *Mean of the climate change signal for the number of days with (**a**) Tmax >35°C and (**b**) Tmax >40°C over the 21st century from historical period (1976-2005). The black cross indicates whether at least 60% of the models agree on the sign of the climate change signal (positive or negative). A multi-model ensemble mean of 3 GCM's and 2 RCM's is used.*

a) *b)*

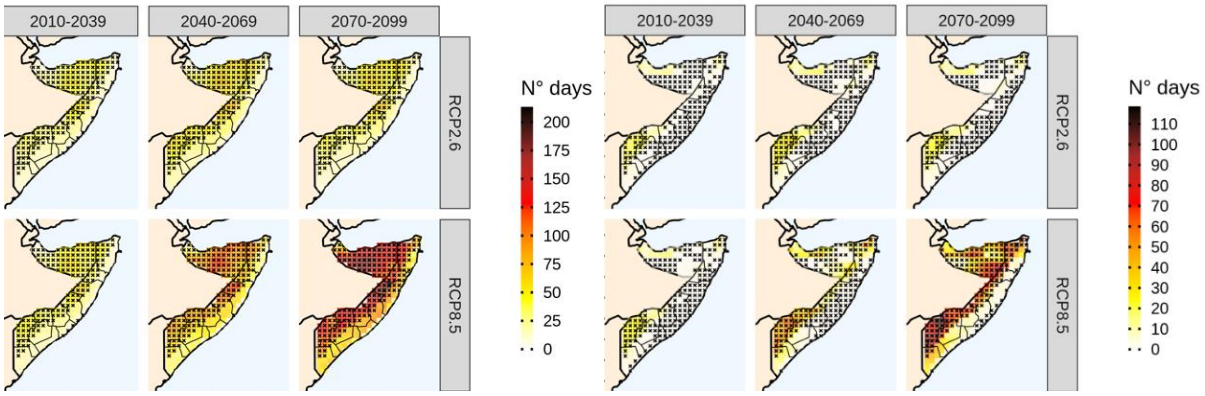


Table 6. *Summary of the changes in the probability of climate extremes and climate indicators over the 21st century compared to the baseline period (1970-2005).*

Variable	Climate scenario	Extreme/indicator	2010-2039	2049-2069	2070-2099
pr	RCP 2.6	Nº of dry days (R≤1mm/day)	0.99	1	0.98
pr	RCP 2.6	99th percentile	1.48	1.39	1.68
pr	RCP 2.6	Nº of heavy rainfall days (R≥20mm/day)	1.23	1.21	1.39
pr	RCP 8.5	Nº of dry days (R≤1mm/day)	1	0.99	0.98
pr	RCP 8.5	99th percentile	1.39	1.6	2.31
pr	RCP 8.5	Nº of heavy rainfall days (R≥20mm/day)	1.18	1.33	1.69
Tmax	RCP 2.6	1st percentile	0.05	0.02	0.02
Tmax	RCP 2.6	99th percentile	2.71	4.01	3.61
Tmax	RCP 8.5	1st percentile	0.04	0	0
Tmax	RCP 8.5	99th percentile	3.4	9.22	18.42
Tmin	RCP 2.6	1st percentile	0.51	0.41	0.43
Tmin	RCP 2.6	99th percentile	1.37	1.56	1.51
Tmin	RCP 8.5	1st percentile	0.47	0.18	0.03
Tmin	RCP 8.5	99th percentile	1.46	2.88	12.68

Note: if the probability of the 1st percentile for the historical period is 0.3% and the probability of the same event is 1%, then the increase in probability is 1/0.3= 3.3 times. Hence, the values for the near (2010-2039), mid (2049-2069) and far (2070-2099) future reflect the increase or decrease in probabilities compared to the reference period in number of times. Data has been bias-corrected before the calculation of extremes and indicators with the empirical quantile method for every month to preserve seasonality. The probability of an event for the future period has been calculated considering the probability density function of all six CORDEX-CORE models.

2.4 Exposure

102. To better understand the geographical exposure of human and natural systems, assets, and infrastructure to floods and droughts, this section of the climate impact potential assessment describes the exposure of targeted livelihoods to these hazards both for the baseline and future periods (see chapter VII for additional information on the socioeconomic impacts of drought and flood on agriculture and livestock).

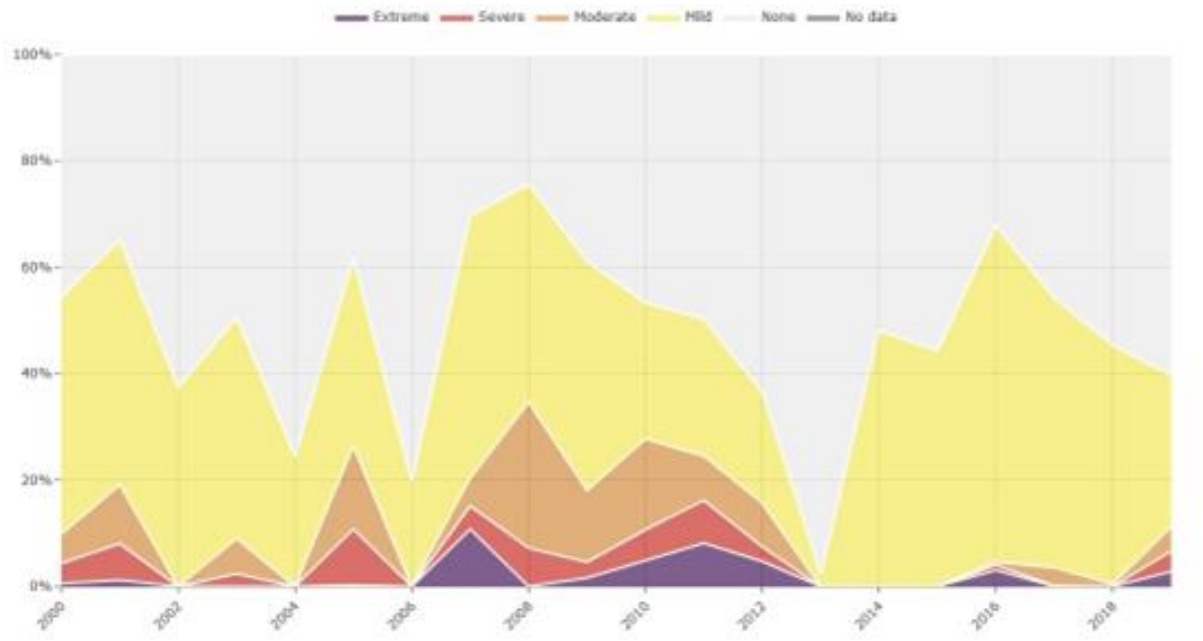
103. Somalia is characterized by rainfed agriculture along the southern and central regions mainly, except for some irrigated areas along the Shabelle River. Agriculture and livelihoods suffer from frequent droughts and floods (Ekolu et al. 2022). These two hazards alone cause severe damages and losses. Somalia has experienced at least one major extreme event per decade between 1960

and 2011 (UNDP, 2013). However, it experiences some level of drought conditions and flooding every year since 2000 (UNCCD, 2020; EMDAT, 2023). Floods are the most frequent events experienced in Somalia. According to the EMDAT database, 71% of disasters between 2000 and 2023 were caused by floods, while drought constituted 18% and storms the remaining 11%. Most of the flooding is due to overflow of the Shabelle and Juba rivers because of heavy rainfall in their catchments in the Ethiopian Highlands, combined with the siltation of canals.

2.4.1 Drought

104. Somalia has experienced some level of drought conditions every year since 2000 as shown in Figure 18 (UNCCD, 2020). Between 2016 and 2019, 39.8% of all the land in Somalia was affected by drought. Although the proportion of land under moderate to extreme drought stress was greatest between 2006 and 2013.

Figure 36. *Annual proportion of land under different drought intensities from 2000 to 2019 (UNCCD 2020)*



Agricultural drought affected Somalia between 1984 and 2022 with high frequency (>50%) as shown in ***Figure 36****Figure 37:Historical drought frequency (%) over the 1984-2020 period.*

105. . The two hotspot regions for agricultural drought are identified as the Lower Shabelle and Middle Shabelle. Hotspots of drought in rangelands (frequency of drought affecting at least 30% of grassland) as identified using data from FAOs Agricultural Stress Index System (ASIS) can be observed in the central and southern regions of Somalia for the *Gu* and *Deyr* seasons (Figure 37). Paradoxically, the regions where rainfall is the highest and where the 2 major rivers are located, Juba and Shabelle, are more subject to droughts. That said, field investigations undertaken during the feasibility study clearly illustrate that even in the North, temperatures are increasing and water more and more scarce.

Figure 37:Historical drought frequency (%) over the 1984-2020 period.
The map shows the frequency of severe drought in areas where 30% of the cropland has been affected by agricultural drought between 1984 and 2022 in the ***(a)*** *first season (March-June) and in the* ***(b)*** *second season (September-December).*

a) *b)*

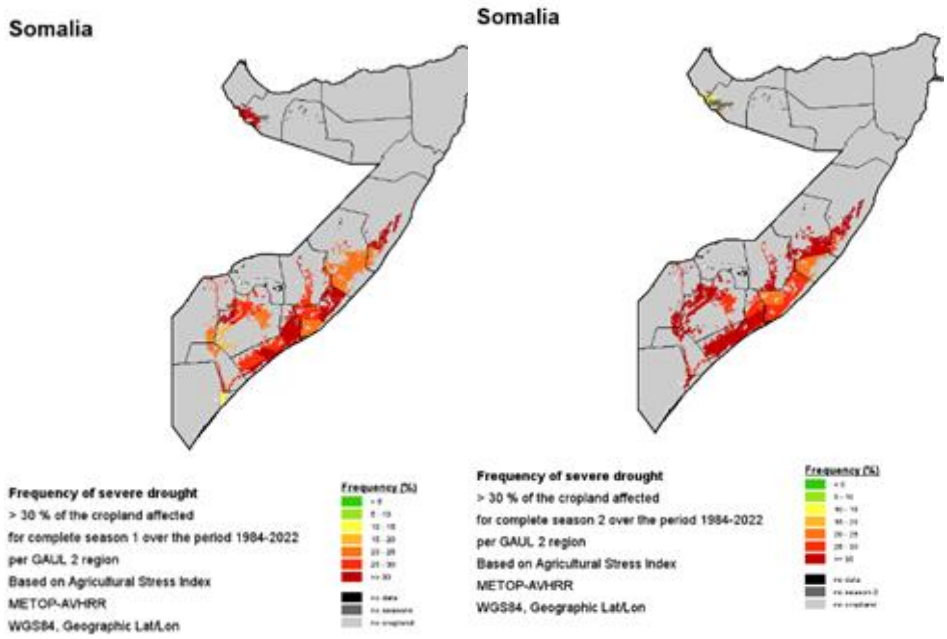
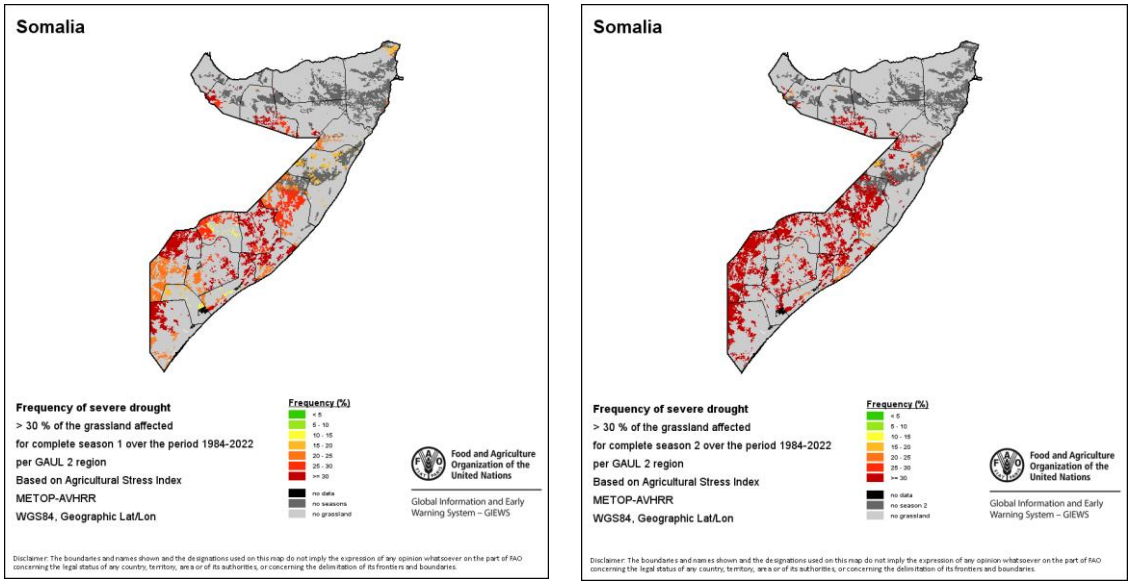


Figure 38: Historical drought frequency (%) over the 1984-2020 period
*The map shows the frequency of severe drought in areas where 30% of the pastureland has been affected by drought in **(a)** season 1 and **(b)** season 2. The maps have been prepared using data from FAOs ASIS.*

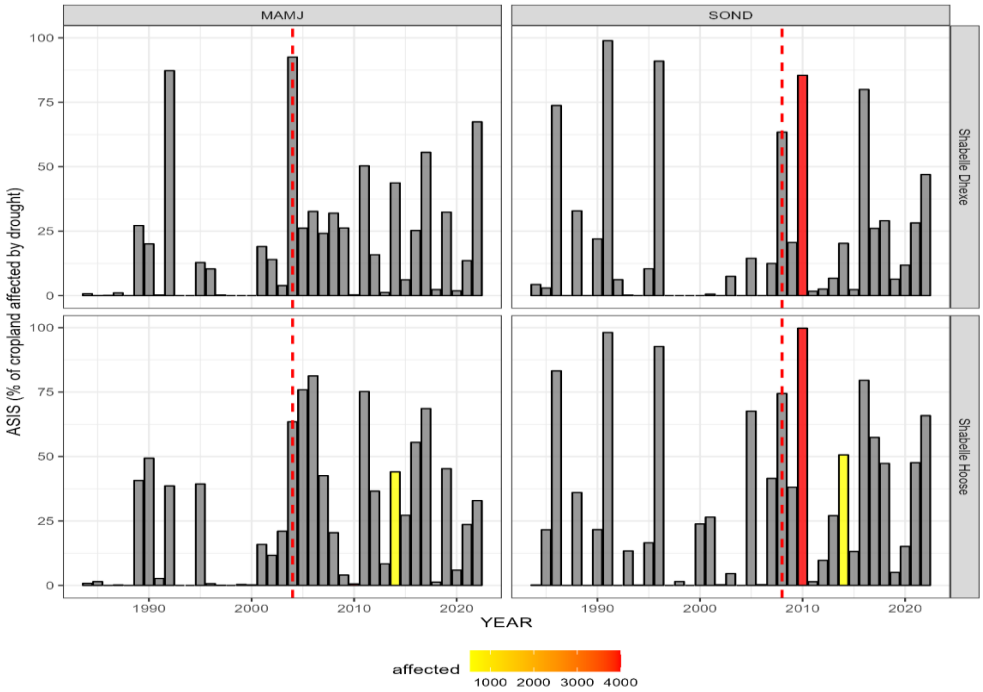
a) *b)*



106. A more detailed and tailored analysis on drought is provided below to better understand whether drought frequency increased since 1984 (Figure 38). The drought frequency (determined by the percentage of cropland from ASIS and the number of people affected from EMDAT database) has increased over the years. The frequency during the March-June season has increased since mid-2000s, while between September to December this shift in frequency happened around 2009. Following a few intense episodes of drought in the early 1990s, there was a decrease in drought frequency followed by an increase in recent years. This increase in the frequency of drought is statistically significant in most provinces (the red line is located after the year 2000), statistically

proving that drought frequency has increased in the last decades. Cross-checking the detected drought episodes with the EMDAT database (2023) shows that ASIS values are correlated with the number of people affected by agricultural drought.

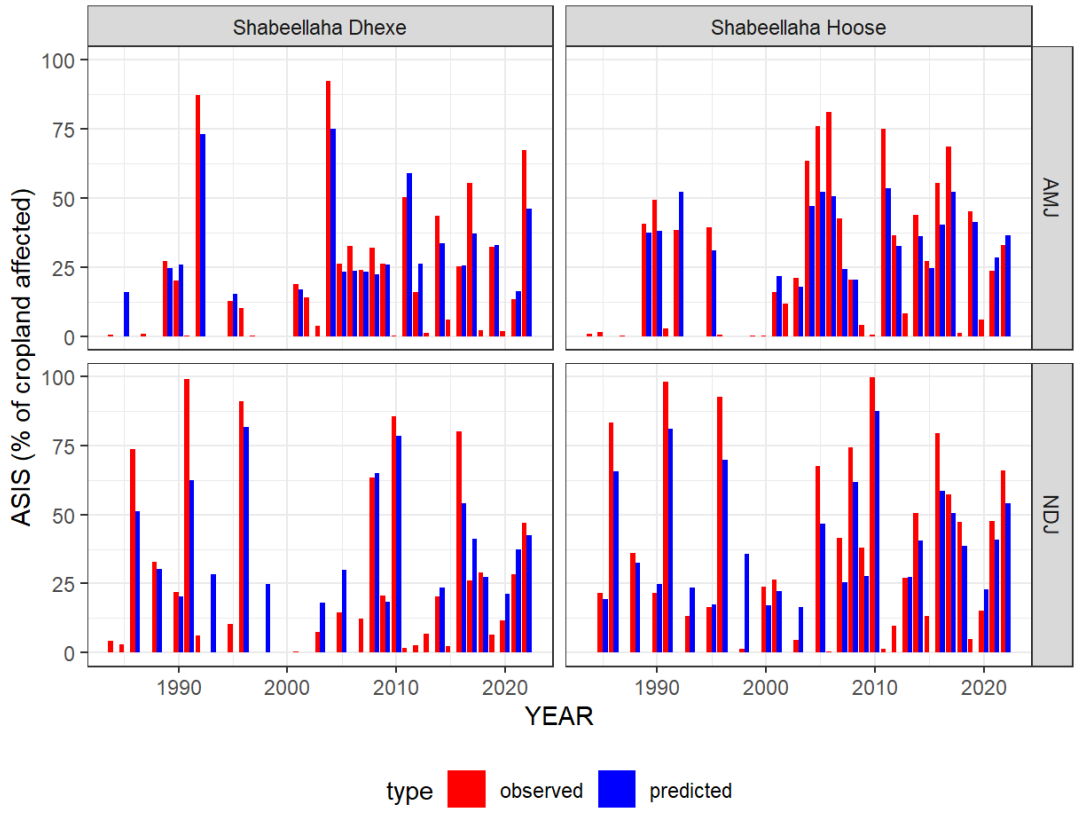
Figure 39: Drought frequency according to ASIS methodology per province and crop season.
The red line indicates a change-point, which is a point in time where the frequency of drought has changed statistically. This change-point was detected using Bayesian change-point methods. The colored bar highlights the total number of affected people (in thousands) by drought (recorded and reported in the EMDAT database).



107. In addition, we projected the frequency of agricultural drought by training a machine-learning model (random forest regression) on ASIS data using climate indicators derived from the ERA5 datasets as predictors. These indicators included, for example, the duration of dry spells and the number of dry days (R≤1mm/day). Then, after evaluating the performance of the model, we applied this approach to the same climatic indicators but calculated from bias-corrected future CORDEX-CORE climate projections (two climate scenarios and six climate models). Our framework appears to capture well the occurrence of agricultural drought (ASIS > 15%). Our evaluation procedure included repeated k-fold cross-validation, obtaining an average normalised root mean square error of 24%. Nonetheless, this value is considerably lower if only ASIS values higher than 15% are considered (Figure 39).

Figure 40: Overall performance of the ML model trained to predict ASIS data using climate indicators derived from the ERA5 reanalyses datasets.

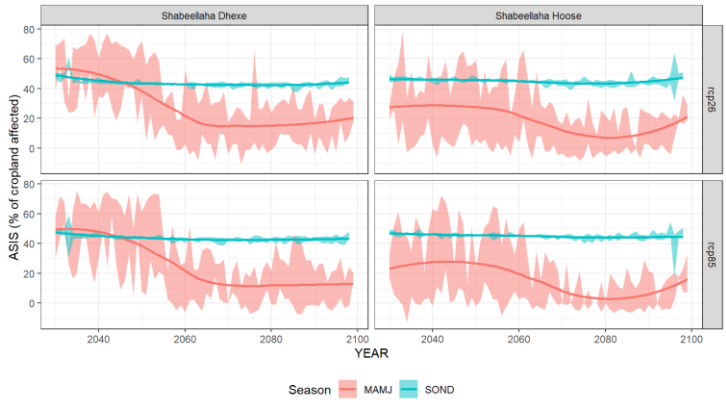
The model under-evaluated the intensity of agricultural drought in terms of the percentage of cropland affected but captured well the drought frequencies and occurrences.



108. This machine-learning model was then applied to future climate data and the predicted occurrence and intensity of agricultural drought by season, climate scenarios and region (**Error! Reference source not found.**). Under current land utilization type, the region with most of the cropland area is the Shabelle. Climate change will continue to pose significant challenges and agricultural drought is projected to strongly affect crops grown during the crop season starting in September (Figure 41). However, crops grown during the first crop season will likely experience less drought intensity. This is potentially due to an increase in precipitation projected to occur during the coastline of Somalia. Under an agricultural expansion scenario, we identified regions that are likely to be more affected by agricultural drought. Lower Juba, for example, shows a strong intensity of drought in the second season only while the first season displaying fewer drought risks.

109. Under climate change, the area of cropland affected by drought during the September-December season is projected to remain relatively similar under both RCP's 2.6 and 8.5 (Figure 41). During the March-May season the area of cropland affected by drought is projected to decrease in the Middle and the Lower Shabelle and, on the other hand, increase in Mudug, Galgaduud, Lower Juba and Togdheer. The high intermodal variability points to high uncertainty in the projections.

Figure 41 Predicted frequency and intensity of drought
***(a)** Predicted frequency and intensity of drought in the two agricultural regions of Somalia and **(b)** predicted frequency and intensity of drought in other regions of Somalia targeted by the province assuming agricultural expansion. Results are based on climate indicators computed from six CORDEX-CORE models bias-corrected with ERA5. The shaded area indicates intermodal variability.*
a)



b)

2.4.2 Heat stress

110. Sheep, goats, and camels are the dominant livestock species in Somalia, with populations primarily located in the northwestern, northeastern, and central zones. Cattle production is highest in the southern zone and Juba Valley. The country has 34.5 million head of animals, including 11.5 million goats, 11 million sheep, 7.2 million camels, and 4.8 million cattle.

111. Exposure to high ambient temperature causes impairment of reproductive functions in sheep (Marai et al 2007). The effect of heat is aggravated when heat stress is accompanied with high ambient humidity. Exposure of sheep and goats to elevated temperatures results in a decrease of body weight, average daily gain, growth rate and body total solids, which is reflected by impaired reproduction. A higher heat stress threshold is expected for goats, as they tend to tolerate hot conditions better than sheep, due to specific adaptation mechanisms. Although the most studied and quickly visible detrimental consequence of heat stress is decreased milk production in cattle, goats and sheep, reproductive disorders due to heat stress are also of great concern. Fertility is influenced by heat stress; however, problems with fertility only become apparent over time. Heat stress makes it difficult to identify oestrus in cows, increases calving difficulties, postpartum paralysis, more stillbirths, and uterine mucous membrane irritation (St-Pierre et al. 2003). Heat stressed ruminants have reduced breeding capacities. Even though camels have a high heat stress threshold, heat stress can have an adverse impact on both milk production and milk quality in camels. This yield decline was aggravated if there is severe water deprivation during the heat stress (Al Jassim & Veerasamy 2015). In processing, storage, and marketing stages, the changes in climate will affect the quality of products and their shelf lives causing changes in market availability and preferences (Feliciano et al. 2020).

2.4.3 Floods

112. According to the EMDAT database (2023), floods are recurring hydrological hazards affecting Somalia's livelihoods, particularly in the Jubbada Hoose (Lower Juba) and the Middle and Lower

Shabelle regions (Figure 42) Floods in Somalia are annual events triggered by the *Gu* rains, a monsoon-like season that commences in March. These floods bring destruction, causing significant casualties, displacement, and property damage mostly in high density population areas. The recurrence and intensity of floods in Somalia can be seen in Figure 43a,b.

Figure 42: Impacts of recorded floods in the targeted regions since the year 2000. Data retrieved from the EMDAT database (2023).

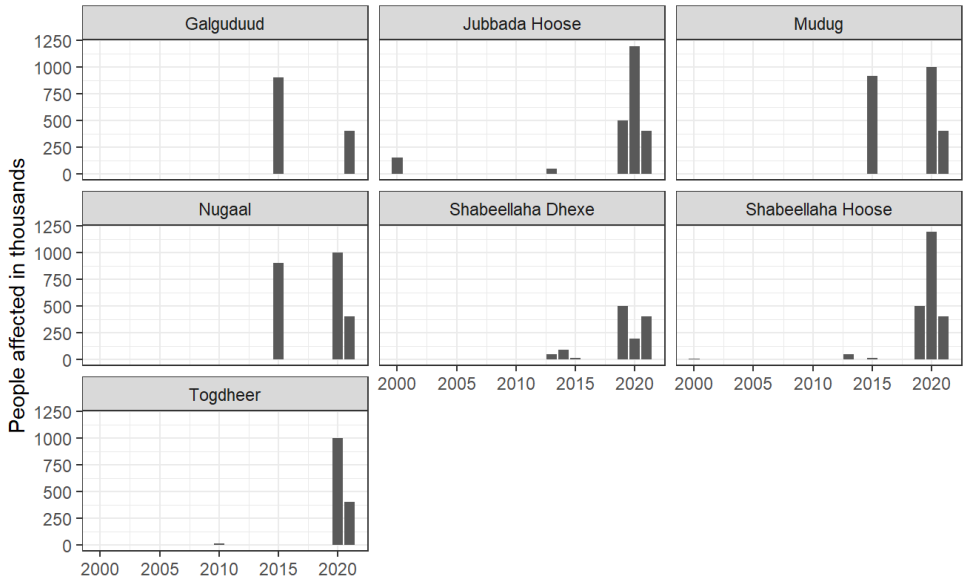
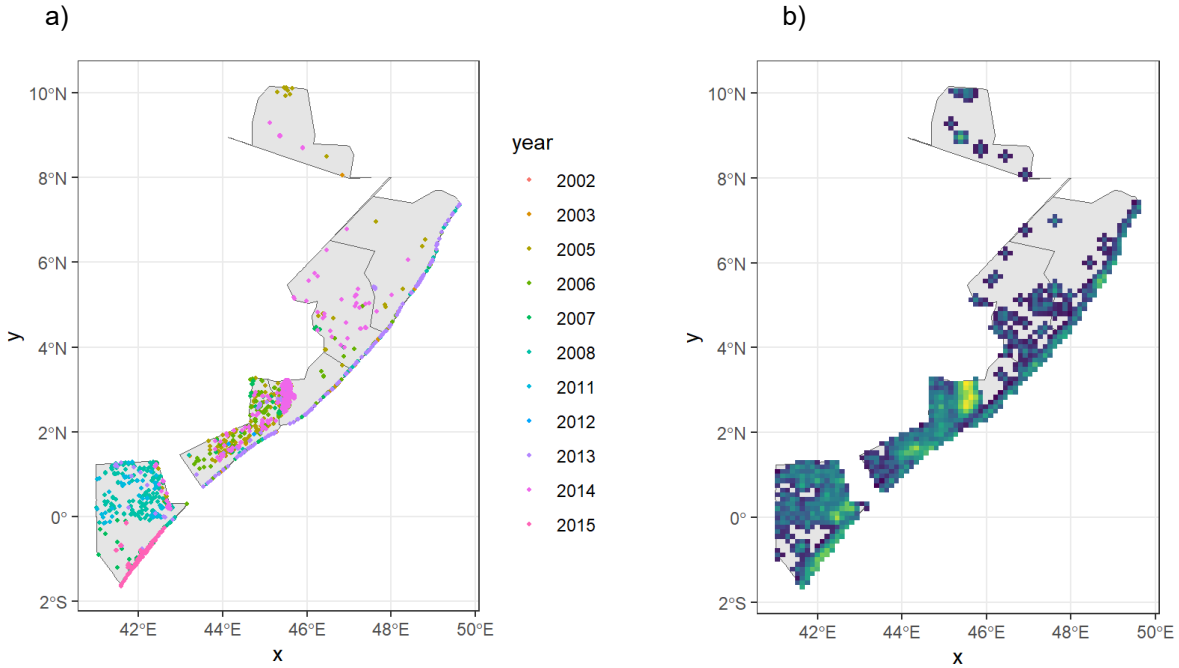


Figure 43: Frequency and intensity of floods since 2000

(a) frequency and **(b)** intensity of recorded floods in the targeted regions since the year 2000. Data retrieved from the EMDAT database.

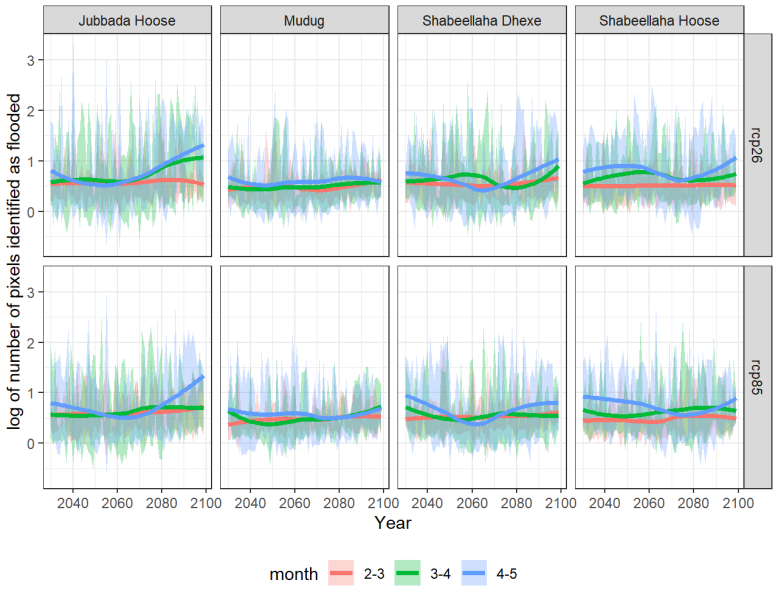


Note: the yellow bright colors in Figure 25b reflect the intensity of floods based on the number of people affected.

113. In addition, we projected the frequency and intensity of floods based on a Machine Learning (ML) pipeline, conceptually similar to the one applied to predict agricultural drought. Briefly, our model aimed at predicting the intensity of floods that is the number of pixels categorized as “floods” in the flood database per targeted region. This was done through a random forest regressor applied to the total number of pixels categorized as floods per year and region. We used as predictors the cumulative precipitation and standard deviation of the month in which the flood occurred. Our model predicted flood intensity with a 14% Normalized Mean Square Error suggesting a good performance (Figure 44). The results show that floods will continue to affect Somalia’s targeted regions and that floods will continue to intensify, particularly by the end of the century and in Jubbada Hoose (Lower Juba) during the *Gu* season due to increasing precipitation. Floods during the March-May *Gu* season are projected to generally increase in Lower Juba, Mudug, Middle and Lower Shabelle under both RCP’s 2.6 and 8.5. There is, however, a high uncertainty in these projections due to the high inter-model variability Figure 45).

Figure 44: Overall performance of the random forest regressor trained to predict floods using climate indicators derived from the ERA5 reanalyses datasets.
The ML model attempts to predict the number of pixels identified as flooded using the cumulative precipitation and standard deviation of the month in which the flooding was recorded.

Figure 45: Predicted frequency and magnitude of floods based on climate indicators computed from six CORDEX-CORE models bias-corrected with ERA5. The shaded area indicates inter-model variability.



2.5 Vulnerability

114. Vulnerability to climate change is a function of the physical exposure, the demography, the social, and the political conditions that enhance communities' sensitivity and coping capacity. By reducing these vulnerabilities, communities can become more resilient and better equipped to cope with the challenges and threats posed by climate change.

115. More frequent and intense droughts and floods undermine food security and worsen livelihood conditions in Somalia, adversely affecting marginalized groups, fuelling grievances, increasing competition over scarce resources, and exacerbating existing community tensions and vulnerabilities. This has complex and interlinked implications for the peace and security situation in Somalia, including:

- Climate-related displacement and migration are likely to increase, particularly for those whose livelihoods are influenced by droughts and floods; that can fuel tensions at the community and national levels and disrupt ongoing conflict resolution initiatives.
- Internally displaced persons are particularly vulnerable to identity-related conflicts and armed group recruitment.
- Armed groups can take advantage of climate impacts by positioning themselves as service and relief providers following droughts and floods.
- Droughts and floods can link local resource conflicts to broader insecurity, as elites may exploit the impacts to advance their influence over communities and resources.

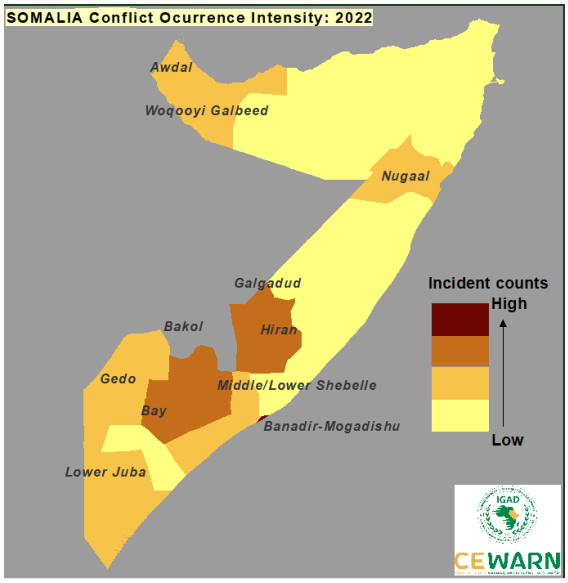
116. As a result, Somalia is ranked 172 out of 182 countries by the ND-GAIN Country Index. It is one of the most climate vulnerable countries in the world and one of the least ready to face the climate crisis, according to the Global Climate Index ND-GAIN. According to the FRS (2023) report, 54.4% of Somali population lives below the poverty line, earning less than USD 2.06 per day. Poverty incidence is highest among nomadic population at 78.4%, followed by rural and urban at 65.5% and 46.1%, respectively. These compounded vulnerabilities exacerbate systemic risks of food security in Somalia (Thalheimer et al. 2021). Approximately 6.6 million people are estimated to be food insecure in Somalia. The major reasons for the high vulnerability in Somalia include conflict, land degradation, poverty and inequality, and weak governance.

2.5.1 Conflict

117. Conflict exacerbates existing vulnerabilities within communities and introduces new obstacles that impede their ability to manage and rebound from crises. The political crisis in Somalia has caused the displacement of individuals and livelihood disruptions, causing financial loss, food insecurity, and restricted access to vital services. Additionally, critical infrastructure is often destroyed, further limiting access to essential resources. The prolonged conflict in Somalia has undermined governance and the rule of law, fostering insecurity, human rights violations, and reduced access to resources. Somalia is identified as one of the countries in Africa with a high concentration of security vulnerability hotspots associated with climate change (Busby et al. 2014).

118. The IGAD Conflict Atlas indicates a high number of conflict incidents in 2022, primarily concentrated in areas like Banadir-Mogadishu, Galgmudud, Baol, Bay, Middle and Lower Juba, and Middle and Lower Shabelle regions. These conflicts are driven by factors such as armed groups activities and inter-clan clashes, with some incidents also linked to extreme climatic conditions (CEWARN, 2022). Data from the Armed Conflict Location and Event Data project (ACLED) reveals over 634 instances of political violence and 2,207 reported fatalities in Somalia between January 1 and March 17, 2023 (ACLED, 2024). The bulk of these incidents occurred in southern and central Somalia, coinciding with government military operations against armed groups. Figure 46 shows the conflict occurrence intensity in Somalia in 2022.

Figure 46: Somalia conflict occurrence intensity in 2022



2.5.2 Environmental degradation

119. Soil, water, and biological degradation are the prevalent forms of land deterioration and are driven by factors such as overgrazing, unsustainable agriculture, and urbanization. Environmental degradation in Somalia is both a cause and a consequence of disasters, impairing the environment's capacity to meet societal and ecological needs. According to the Somalia Land Degradation Report, over 85% of the land in Somalia is, to some extent, degraded and 22% is strongly degraded (Table 7). Biological degradation is the highest type of land degradation (37.9%) followed by soil erosion caused by water (34.1%), and, to a minor extent, by water degradation (10.8%) (Table 8).

Table 7: Extent of land degradation in Somalia

Land degradation status	Area coverage (km^2)	Area Coverage (%)
None	85,086.4	13.4
Light	212,761.8	33.6
Moderate	195,070.8	30.8
Strong	140,328.1	22.2
Total	633,608.5	99.5

Source: FRS (2020)

Table 8: Extent of prevalent land degradation types in Somalia.

Land degradation type	Area coverage (km^2)	Area Coverage (%)
Soil erosion by water	217,054.7	34.1
Biological degradation	241,043.7	37.9
Water degradation	68,865.7	10.8
Soil erosion by wind	15,766.5	2.5
Chemical soil deterioration	5,430.0	0.85
Urban	175.1	0.03
Temporal water bodies	186.3	0.03
None	87,717.9	13.8
Total	636,240	100

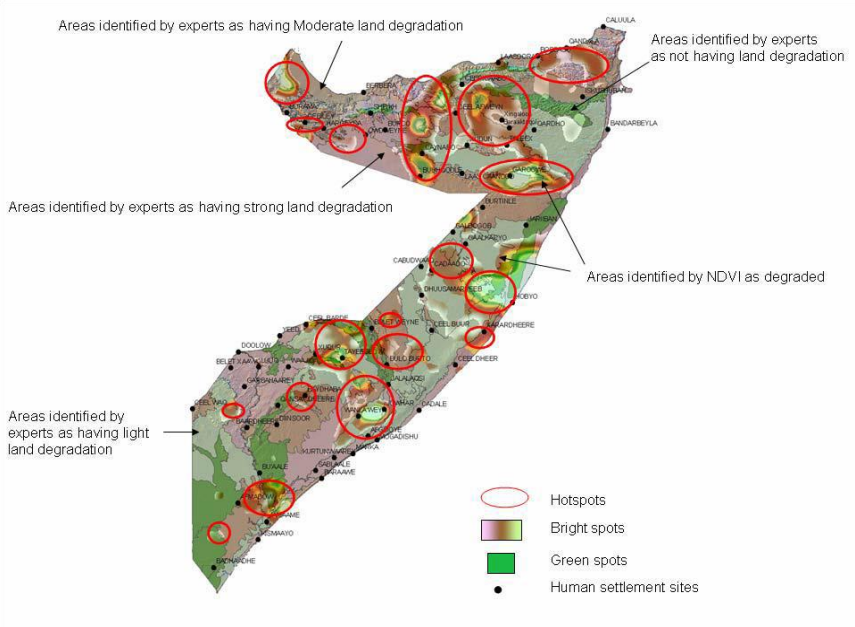
Source: FRS (2020)

120. Land degradation heightens vulnerability to climate change by compromising the resilience of ecosystems and communities. Degraded lands typically lack adequate vegetation cover, leading to soil erosion. Soil erosion reduces soil fertility and water retention capacity, undermining agricultural productivity and exacerbating food insecurity. Biodiversity loss further weakens ecosystem resilience, making it harder for ecosystems to modulate climate impacts. Degraded lands are more susceptible to flooding and drought, as they have reduced water retention capacity and increased surface runoff. Additionally, land degradation disrupts carbon sequestration processes, contributing to greenhouse gas emissions and climate change. Consequently, communities reliant on agriculture and natural resources suffer economic hardship, exacerbating their vulnerability to climate-related shocks.

121. The Shabelle and Juba basins, vital areas for productivity, face heightened degradation risks due to deforestation, overgrazing, and poor agricultural methods such as improper irrigation, monoculture, and excessive tillage. These drivers are encouraged by the prevailing communal land tenure practices, poor governance, and civil war (Omuto et al. 2014). Population growth also intensifies resource pressure, and consumption, exacerbating deforestation rates due to charcoal and wood fuel demands. Approximately 23% forest cover loss in Somalia occurred between 2000 and 2019 (Musei et al. 2021).

Hot spots of declining land productivity are scattered across various regions, highlighting the widespread nature of the issue. Figure 47: NDVI and expert assessment map of land degradation hotspots in Somalia shows the degradation hotspots in Somalia (FRS, 2020).

Figure 47: NDVI and expert assessment map of land degradation hotspots in Somalia



2.5.3 Weak governance

122. In weak governance zones, public sector entities fail to fulfil their obligations in safeguarding rights, delivering basic services, and ensuring efficient management. Weak governance exacerbates disaster risk and is interconnected with factors like poverty, inequality, and unplanned urbanization. Governance encompasses the organization of governments, private sector entities, and societal institutions in managing collective affairs, while risk governance involves navigating uncertainty, complexity, and ambiguity in addressing risks.

123. Somalia's governance has long grappled with conflict, instability, and institutional deficiencies. State collapse and fragmentation have allowed competing factions to emerge, creating governance vacuums where local power dynamics overshadow national coherence. Moreover, non-state actors like Al-Shabaab further complicate Somalia's governance landscape, challenging state authority and controlling significant territories. These groups exploit governance deficiencies, perpetuating fragmentation.

2.5.4 Poverty and inequality

124. Poverty is both a driver and consequence of disasters, and the processes that further disaster risk related poverty are permeated with inequality. Environmental shocks are identified as a key contributor to poverty, alongside other significant factors according to the World Bank's (2020) report. Among the top four drivers of poverty, natural disasters stand out prominently. Additionally, shifting migration trends, inadequate urban planning and infrastructure, and escalating inequality all play crucial roles. These factors collectively exacerbate vulnerabilities, particularly for marginalized communities by disrupting livelihoods, displacing populations, and straining already limited resources. Consequently, communities experiencing poverty are disproportionately impacted, facing heightened risks and challenges in their efforts to achieve sustainable development and economic prosperity.

2.5.5 Heavy dependency on rain-fed agriculture and pastoralism

125. The mainstay of the Somali economy has traditionally been dominated by pastorals and crop production, followed by fisheries and forestry, and these four sectors are supporting over 80% of the population. These communities face significant risks due to the country's semi-arid climate and erratic rainfall patterns. The dependence on a narrow range of livelihood activities leaves

communities highly susceptible to climate variability and extreme weather events such as droughts and floods and exacerbated by climate change. Limited livelihood diversification reduces adaptive capacity, as communities lack alternative sources of income or food security during environmental shocks. During droughts, pastoralists may lose their livestock, their primary source of sustenance and income, leading to food insecurity and economic hardship. Similarly, crop failures, due to erratic rainfall, devastate farming communities, exacerbating poverty, food insecurity and malnutrition. This dependence to single livelihoods contributes to environmental degradation, as communities may engage in unsustainable land management practices out of necessity or desperation. Overgrazing, deforestation, and soil erosion further degrade ecosystems, exacerbating the impacts of climate change and creating feedback loops of vulnerability. This situation is made worse by the poor access to extension and veterinary services.

2.5.6 Disruption of livelihoods and displacement

126. In areas heavily dependent on agriculture, climate change-related impacts can disrupt livelihoods. Climate-related shocks and stresses can diminish income-generating opportunities, increase debt burdens, and displace people from their traditional livestock activities, thereby intensifying food insecurity. Climate change can be a driver of human displacement, as people are forced to leave their homes in search of better job opportunities. Displaced populations often face increased vulnerability to food insecurity, as they lose their livelihoods, assets, and social support networks. Moreover, competition over scarce resources, including land and water, has led to conflicts between pastoralists and farmers and, consequently, exacerbate food insecurity.

2.5.7 Gender vulnerabilities exacerbated by climate change

127. Women are vulnerable because of the gender division of labor, their unequal access to material and nonmaterial resources, and their low participation in decision-making. Women play a vital role in the management of natural resources and are often the most affected when negative impacts of climate variability and associated conflicts strikes. Conflicts disrupt social, economic, and natural systems, with devastating impacts on women's livelihoods, household poverty, and agricultural productivity. Gender inequality and disempowerment among women further exposes women to vulnerability given their lack equal rights of ownership and control over land, property and other productive assets compared to their male counterparts. Their lack of participation in decision-making on the above matters undermines their capacities to cope, recover and adapt to climate change shocks, the situation is further compounded when gender roles and household structures are altered, for example when men die in conflict, or migrate with livestock in search of pasture and water, women assume the role of heads of households - forced to provide for their homes despite the customary disempowerment.

128. During a drought, while men migrate in search of employment, women are forced to become heads of households and primary breadwinners with limited assets and resources at their disposal. In crises, women must find solutions to feed their families. They must walk long distances, 5-8 km at times, to get water. They have challenges accessing fuelwood for household use and face security risks as they travel in search of fuelwood. When community elders meet to resolve issues around natural resources and disasters, women are not represented.

129. FAO's recent publication has revealed that extreme weather events would reduce the incomes of female-headed households significantly more than those of male-headed households[48]. Due to women's limited participation in economic sectors including non-farm employment, female-headed households have less opportunities to compensate on-farm income loss by off-farm earnings, compared to men.

130. Women play a key role for food security in Somalia. Women are forced to adopt negative coping strategies when food is limited during droughts due to limited resources. They cope by limiting food consumption and prioritizing other members of the household, which exposes them to malnutrition.

131. Climate change would increase the vulnerability and exposure of women and girls to GBV and SEAH. Young girls are forced to go into commercial sex work for survival in the event of droughts. Women are also exposed to an increased risk of sexual and gender-based violence in IDP camps during migration.[49]

132. Increased frequency and intensity of extreme weather events could increase the risk of families undertaking early marriage for their female children. As families are anxious to secure economic security in case of extreme weather events, there has been an increased trend in cases of FGM to ensure marriageability of their female children[50].

133. Further details, as well as a locally specific gender profile, can be found in Annex 8.

2.6 Impact assessment

2.6.1 Socioeconomic impacts of drought

134. Droughts are slow-onset, spatially diffuse and difficult to tackle, and their impacts can emerge gradually. Prolonged droughts in pastoral regions increase the frequency and distance of animal migrations, leading to increased interaction between different groups. Moving to new regions may increase exposure to disease pathogens (Bett and Delia, 2019).

135. Major drought events in Somalia were experienced in 1969, 1976, 1984, 1987, 1999, 2001, 2004, 2011, 2016-17 and 2022-23. The drought frequency (determined by the percentage of cropland and number of people affected) has increased over the years. The frequency during the *Gu* season (March-June) has increased since mid-2000s, while in the *Deyr* season (October to December) this shift happened around 2009.

136. The economic cost of droughts in Somalia has always been high. For example, according to the EMDAT database, the drought event of 2010 alone affected 2,000,000 people, triggered a famine in 2011, and resulted in the loss of 258,000 human lives. This drought affected nearly 100% of the total cropland across the country.

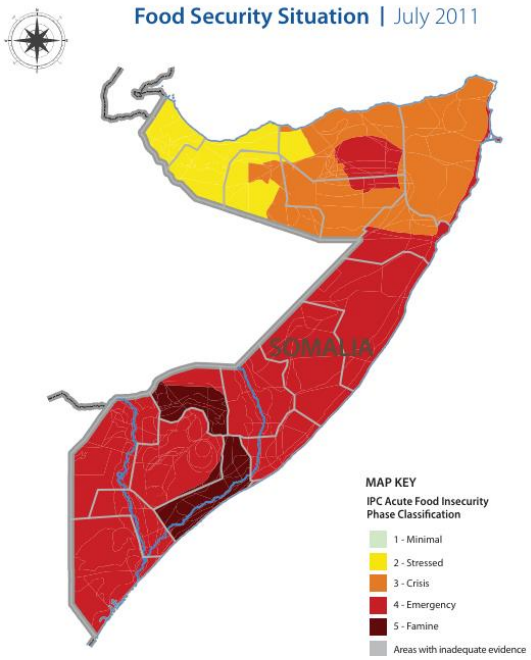


Figure 48 Food security situation in July 2011 (IPC)

137. Furthermore, the 2016-17 drought event resulted in damages amounting to USD 1.02 billion, and losses estimated at USD 2.23 billion. As a result, the total effect of the 2016-17 drought event was estimated to exceed USD 3.25, whilst the total recovery needs were estimated at USD 1.77 billion. Approximately 4 million animals died causing USD 875 million in lost income for pastoralists and agro-pastoralists. Agriculture, environment, and natural resources sectors were the two most impacted sectors. The agricultural sector suffered 46% of the damages and 67% of the losses during this drought. The former was costed at over 1.5 billion USD (UNDP, 2018). The economic losses of animals were 52% in sheep and goats, 42% in camels and 6% in cattle (World Bank, 2018). Furthermore, pastoralists were increasingly unable to support their families. Poor households suffered the heaviest brunt during the droughts (FAO, 2017). Over the subsequent five years, additional losses of USD 640 million occurred due to a decline in the livestock population. At the household level, the drought forced 2.2 million people into internal displacement, with 1 million individuals transitioning away from their traditional pastoral lifestyle by selling their breeding stock for food. This transition intensified food insecurity as these households became destitute (Otte et al. 2023).

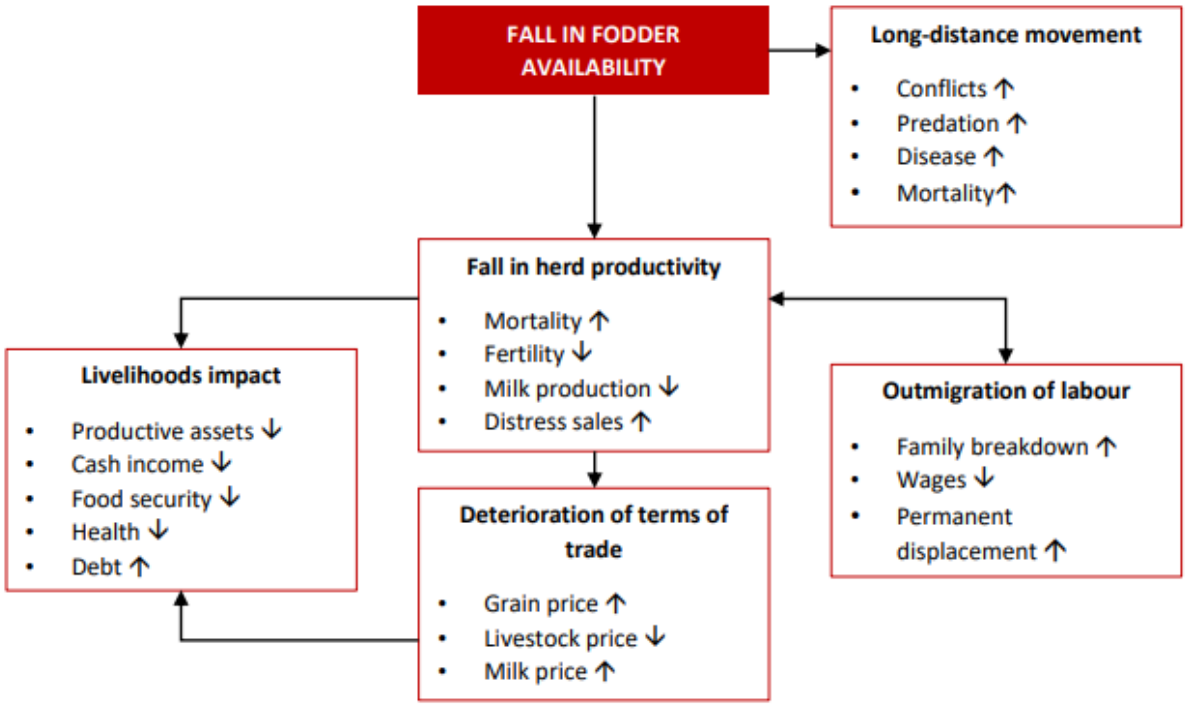
138. The latest 2022-2023 drought caused massive losses in Somalia. It was a result of multiple failed rain seasons. By December 2021, UNDP and OCHA estimated that about 2.3 million people were already suffering with serious water, food and pasture shortages in Somalia. Nearly 100,000 people in central and southern Somalia had abandoned their homes in search of food water and pasture for their livestock. This figure was projected to rise to 3.8 million people by January 2022, with a further projection of 7.7 million people affected by the end of 2022. A government of Somalia report estimates that there were 43,000 excess deaths in 2022 in Somalia due to the deepening drought compared with similar droughts in 2017 and 2018 (Ministry of Health 2023). The dramatic food insecurity situation in drought-affected areas persisted, driving high humanitarian needs well through 2023, with forecasts predicting a sixth failed rainy season in March-May 2023. According to the Somalia Humanitarian Fund 2023 Annual report, by the end of 2023 1.3 million people had been displaced due to the drought (OCHA 2024).

139. The 2021–2023 drought is leading to greater recognition that early warning should be complimented by early action and that humanitarian assistance is insufficient in the face of climate change. Efforts to transitioning to climate-resilient development is needed.

140. Drought affects the quantity, quality and availability of feed and water resources available for livestock, affecting communities in multiple ways as shown in Figure 49. During droughts, the productivity of herds drops due to high mortality, decrease in production of milk and loss of animal body conditions, which leads to distress sales. The reduction of productivity and distress sales lead to the deterioration of terms of trade by increasing prices of grain and milk and reducing livestock prices. Poor herd productivity and deterioration in terms of trade in turn affect livelihoods by eroding community's productive assets, reducing their income, food security, health status and increasing their debts and liabilities.

141. One of the popular adaptability measures during such crisis is to sell off animals, or move to a new place where there are good pasture and enough water resources. However, this mobility creates interaction between livestock, which ultimately leads to transmission of diseases. Livelihood losses usually lead to pastoral dropouts who in turn move to urban areas in search of other livelihood options.

Figure 49: Impacts of feed shortage on communities and livelihoods (Otte et al. 2023)

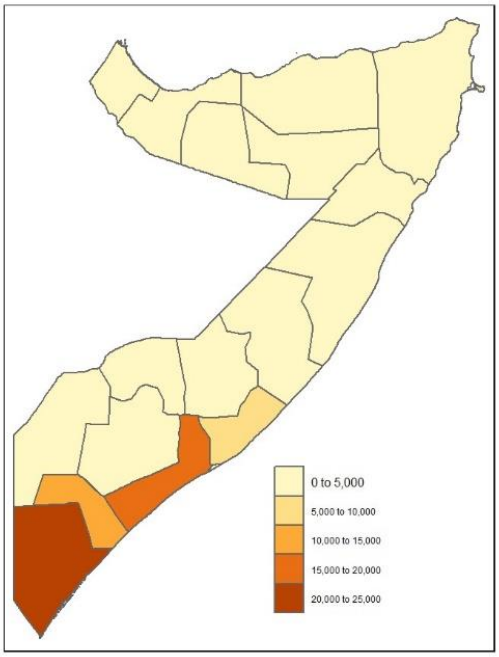


2.6.2 Socioeconomic impacts of floods

142. Floods are quick onset, high-impact events that destroy infrastructure, damage homes, and disrupt livelihoods. Stored food reserves (usually stored underground) are either inundated or washed away during floods leading to food losses. Along the riverbanks, destruction of irrigation infrastructure such as water pumps and canals can happen.

143. Major floods in Somalia occurred in 1961, 1977, 1981, 1997-98, 2005, 2006, and 2009. For example, in the recent flood event during the *Deyr* (October- December) 2023 season at least 1.5 million ha of farmland was swamped causing 20% harvest loss in south/central Somalia. As a result of these floods and loss of crops, 1.5 million children are projected to face acute malnutrition between August 2023 and July 2024 (UNOCHA, 2023). In addition, UNOCHA report suggests that since October 2023 floods have affected more than 706,100 people in Somalia, mostly in Southwest, Hirshabelle, Jubaland and Galmudug Banadir, and Jubaland states. Thousands of people were cut off from markets and supplies or marooned in isolated villages. Stored food was either inundated or washed away leading to food losses and contamination. There was massive destruction of irrigation infrastructure and death of livestock by drowning. An additional flooding event occurred in July 2020, that resulted in the displacement of nearly 342,000 people, inundating 294 villages and destroying between 15,000 and 20,000 ha of cropland, mainly along the Juba and Shabelle River valleys.

Figure 50:Number of livestock units affected by floods under the current climate. Source: ICPAC



According to this study, Somalia will continue to experience recurrent flooding. It is projected that these damages will amount to USD (million) 2,700, 10,000, and 38,000 by 2030, 2050 and 2080, respectively. These figures exclude damage to crops and livestock (World Bank, 2023).

144. Flooding, along with rising temperatures, will have a direct and indirect impact on livestock productivity through changing pest and disease dynamics. Direct impacts occur when an increase in temperature, precipitation intensity, floods, and humidity increases pathogens and vectors metabolic processes, reproductive rates, and or population densities, resulting in higher vector-pathogen-host interaction and, therefore, the risk of illness. Indirect consequences of climate change include changes in disease transmission patterns due to ecological, socio-cultural, and behaviour.al disturbances.

145. Of notable concern is the Rift Valley Fever (RVF), a zoonotic disease transmitted by mosquitoes. In East Africa, major outbreaks are often associated with the warm phase of the ENSO phenomenon, although there have been a few incidences (e.g. in mid-1989) when an elevated RVF activity was not ENSO-driven but due to local seasonal rainfall and flooding (Bett et al. 2019). The projected increase in rainfall totals and flooding may lead to increased RVF incidences in Somalia. RVF incidences are the reason why Somalia's livestock exports have been banned several times by the importing countries, especially in Middle Eastern countries which is Somalia's main livestock export market. These bans lead to a drop in the price of livestock locally. In addition, tick borne diseases such as the East Coast Fever can cause up to 100% mortality in susceptible breeds and may also increase due the increase in the vector suitability zones (Bett et al. 2019). There are also links between climate change and on the occurrence of camel diseases such as Theileriosis (Olwoch et al. 2007).

2.6.3 Direct impacts on agriculture and livestock

2.6.3.1 Projected impacts on maize and sorghum

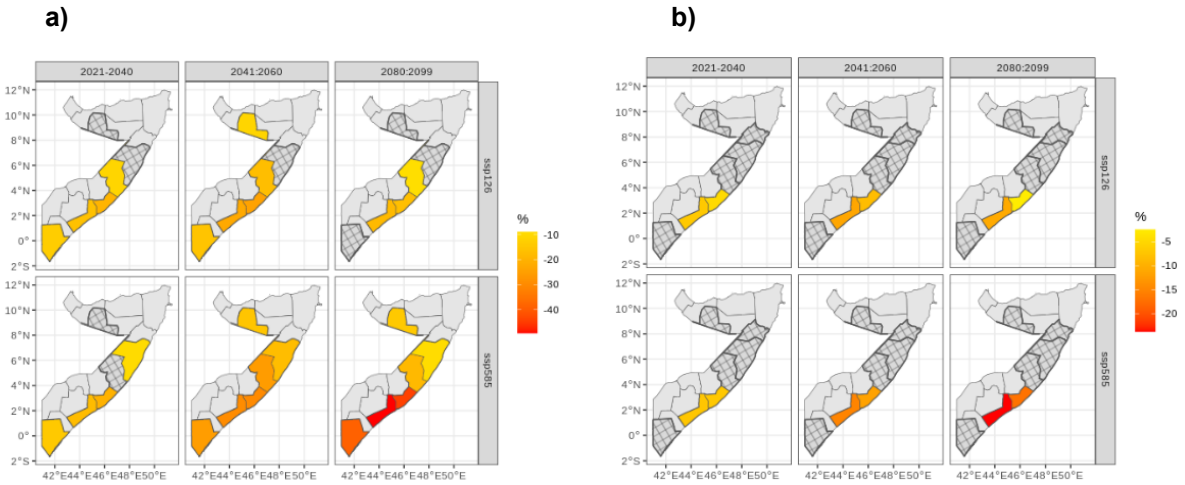
146. Projected sorghum yields under rainfed conditions under RCP 2.6 are uncertain in all the project sites except for the Middle and Lower Shabelle regions that show a decline of up to 10% in the near, mid, and far future (Figure 51). Under RCP 8.5, the yields in Middle Shabelle and Lower

Shabelle regions are projected to decline by 5%, 15% and 20% in the near, mid, and far future, respectively. This could be because of the projected increase in rainfall in these areas that are already experiencing flooding under current climate.

147. Furthermore, maize yields under rainfed conditions are projected to decline by 10-20% in Middle Juba, Lower Juba, Middle Shabelle and lower Shabelle in the near, mid, and far future under RCP 2.6 (Figure 51). Maize yields in Togdheer are projected to decline in the mid future (2041-2060) but remain uncertain in the near and far future. Togdheer is projected to experience a decline in rainfall under RCP 2.6 and RCP 8.5 across the century. Projected maize yields in Nugaal are uncertain in all scenarios. Under RCP 8.5, maize yields under rainfed conditions are projected to decline by 20-40% with the greatest decline in Lower Juba, Middle Shabelle, and Lower Shabelle regions.

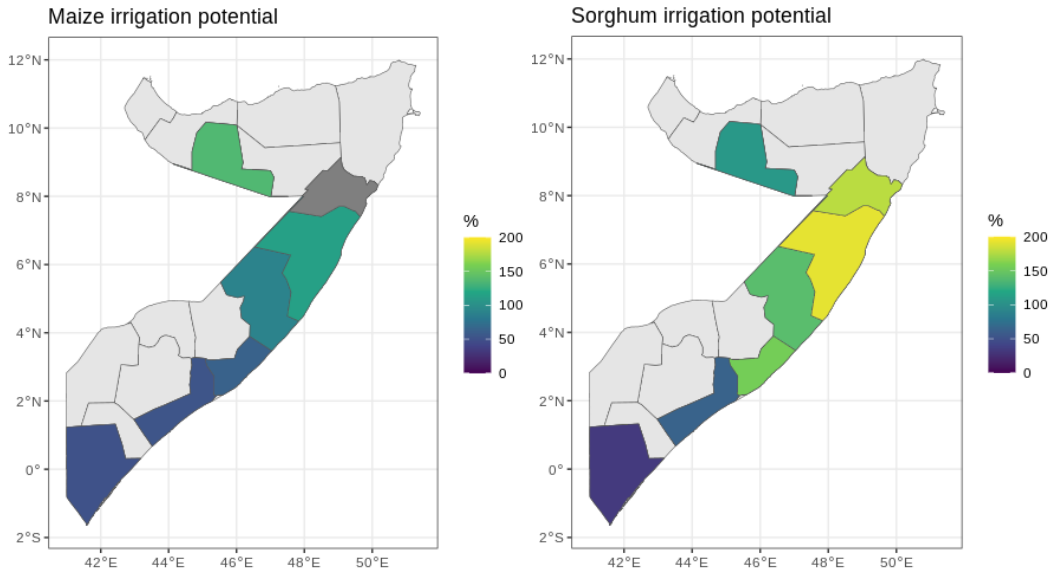
Figure 51: Anomalies for projected (a) maize and (b) sorghum crop yields under rainfed conditions for two climate scenarios with respect to the reference period 1983-2013.

Crosshatches indicate provinces in which results are uncertain.



148. To complement the above analysis, we looked at the advantages of irrigation to mitigate climate change impacts (Figure 52). The results highlight that northern regions are under green water scarcity, that is when the amount and or distribution of rainfall is not enough to fully meet crop evapotranspiration demand. Irrigation can boost maize production by up to 100% in Togdheer compared to rainfed agriculture. Yields can also be improved by 50 to 100% on Galmudug and Mudug, respectively. Similarly, sorghum cultivation can benefit from optimal irrigation up to 200%, with large increases in Togdheer, Nugaal, Mudug, Galmudug and Upper Shabelle regions.

Figure 52: Yield increase (%) under irrigation compared to rainfed conditions (1983-2013 average).
a) b)



Note: crop model simulation results were taken from ISIMIP. Crop models for maize included CROVER, CYGMA1p74, DSSAT-PYTHIA, LPJML, pDSSAT and for sorghum CYGMA1p74 and LPJML. The selected crop models have been described in the literature to capture well water and heat stresses. Regions coloured in grey show “no data”.

Table 7. Climate change impacts on some crops cultivated in Somalia

Crops	Main climatic drivers					Projected impacts
	High temperatures	Water stresses (drought)	Water stresses (heavy precipitation)	Pests and diseases	CO_2 effect	
Maize	▪Warmer temperatures accelerate maize's development rate resulting in shorter vegetative and reproductive phases. ▪Heat stress is a main threat to current and future global maize production. ▪Heat stress (Tmax ≥36ºC) may cause a reduction in yields via pollen viability that in turn determines the kernel number.	▪Water deficit stresses at flowering and grain-filling stage leads to significant yield penalty, especially among non-drought tolerant lines.	▪Waterlogging significantly reduces maize yield, with longer durations of waterlogging leading to greater yield losses ▪Waterlogging also affects the rhizosphere soil microorganism, with an increase in bacteria that could lead to bacterial wilt.	▪Maize streak virus (virus transmitted by leafhoppers, mainly *Cicadulina mbila)*, *Aspergillus flavus, A. fungus* (aflatoxin producer), *Fusarium verticillioides* (fumonisin producer) may increase under rising temperatures.	▪As a C_4 crop, leaf photosynthesis can decline in a CO_2 enriched environment and, thus, result in yield decline.	▪Crop models show that Africa is likely to suffer up to 10% yield losses in maize by 2055 due to climate change. ▪Pests such as Fall Army Worm may become more prevalent. ▪Maize yields in Somalia could decline by between 20% and 50% due to hotter temperatures
Sorghum	▪Simulation studies have shown that temperature is a dominant driver of the global climate change influencing future sorghum productivity. ▪Heat stress conditions (Tmax ≥32ºC) during flowering stage may result in a yield decline.	▪Water stresses during the vegetative stage can reduce sorghum yields. ▪Drought during pre- and post-flowering stages results in substantial yield loss in sorghum. ▪Water stress at the reproductive	▪Early growth is more susceptible compared to the early and late reproductive stages. ▪Flooding at the early growth stage severely impaired the primary root and shoot growths in sorghum.	▪Rising temperatures may accelerate life cycle of pests and diseases (e.g., *Sporisorium holci-sorghi* also known as sorghum head smut) affecting sorghum.	▪Increase in water demand for sorghum production is likely in a CO_2 enriched environment. ▪Elevated CO_2 reduces the water use under drought stress, resulting in the availability of soil water for a long time during dehydrated periods.	▪Sorghum is a more climate resilient crop than other crops grown in the region. ▪A slight/moderate yield decrease is expected under climate change.

	▪Temperatures above 33/28 °C during panicle development results in floret and embryo abortion. ▪Short periods of heat stress in sorghum significantly affect seed set and seed number, whereas season long heat stress has a negative impact on individual seed weight due to reduced grain-filling period. ▪Few studies exist but it is speculated, like other cereals, accumulation of starch decreases under heat stress in sorghum	stage is more impactful than at the vegetative stage. ▪Drought stress at post-flowering stage affects the seed size and number per plant by 55% and 36%, respectively, ultimately reducing the grain yield. ▪Water stress for 35 to 42 days from the beginning of boot stage resulted in yield loss of 43 and 54%, respectively. Likewise, 16 and 28 days of water stress during the vegetative stage resulted in 16 and 36% of yield reduction.				

Lucerne	▪Increased temperatures may reduce photosynthetic capacity and increased leaf dark respiration.	▪Drought may limit water availability for irrigation and negatively impact biomass production, morphology, and nutritional quality of herbage.		▪Impact is variety specific. The impacts could either reduce or enhance resistance to aphids due to the quantitative and qualitative changes in foliar amino acids.	▪ For aphids, there is a variety of specific changes in response to elevated CO_2	▪Drought may be the major driver of nutritional and morphological changes under climate change.
Sesame		▪Moderately tolerant to drought. ▪drought stress adversely affected plant growth of sesame including plant height, fresh weight, dry weight, number of leaves and leaf area, ▪severe drought stress significantly reduced leaf area, number of leaves, number of capsules, number of seeds, 1000-seed weight, seed yield	▪It is sensitive to excessive rainfall and waterlogged soils, and does best on deep, free-draining sandy soils at pH 5.5 to 8.	▪During *Gu* season sesame is susceptible to several pest and diseases ▪Practically all crops are attacked by webworm (*Antigastra sp.*), with the most serious damage occurring during early growth. ▪During wetter weather, isolated incidences of damping off and brown leaf spot.		

Cowpeas	▪Extreme temperatures (Tmax>35°C): early flowering and flower abscission in cowpeas ▪Despite its ability to thrive in high-temperature environments, cowpea productivity can be hampered by heat stress, particularly when night air temperatures exceed 17 °C. ▪High day temperatures (33–36 ◦C) and soil temperature have been implicated to some extent in reducing pod set in cowpea. ▪	▪Reduction of yields and toughening of the leaves (reduced quality) and moderated to high incidences of pests like spider mite and white flies, and diseases such as bacterial wilt and powdery mildew.	▪Heavy rainfall and unpredictable downpours: promoted rapid growth of weeds necessitating frequent weeding; reduced yield and quality of cowpeas by causing yellowing and falling of leaves	▪Heavy rainfall moderately increases incidence of pests, highly increased incidences of black spot and blight in cowpeas.		

2.6.3.2 *Projected impacts on animal health*

149. Drought years are often characterized with high temperatures that causes heat stress and adds a burden to the already hungry and weak animals. It is anticipated that all livestock species will be impacted by climate change, particularly by heatwaves, droughts, and floods. However, certain species will suffer more than others. Direct impacts of temperature changes on the animals will be mainly through heat stress. Dairy and meat cattle, sheep, goats, camels, and chickens each have different heat stress tolerances. Heat stress on animals is considered when the body temperature rises above their normal range due to their exposure to excessive heat and humidity. It occurs when the animal's ability to dissipate heat is compromised, leading to various physiological and behavioural changes. This normal range is known as the Thermo-Neutral Zone (TNZ). Within this temperature range, dairy cows require no additional energy above maintenance to cool or heat their body. The TNZ depends on the age, breed, feed intake, diet composition, previous state of temperature acclimatization, production, and housing and stall conditions, tissue insulation (fat and skin), external insulation (coat), and animal's behaviour. Heat stress in animals can be calculated using the Temperature Humidity Index (THI).

150. The THI for ruminants, which comprise the biggest fraction of livestock kept in Somalia, has been calculated using the following equation by Hahn et. al. (2009):

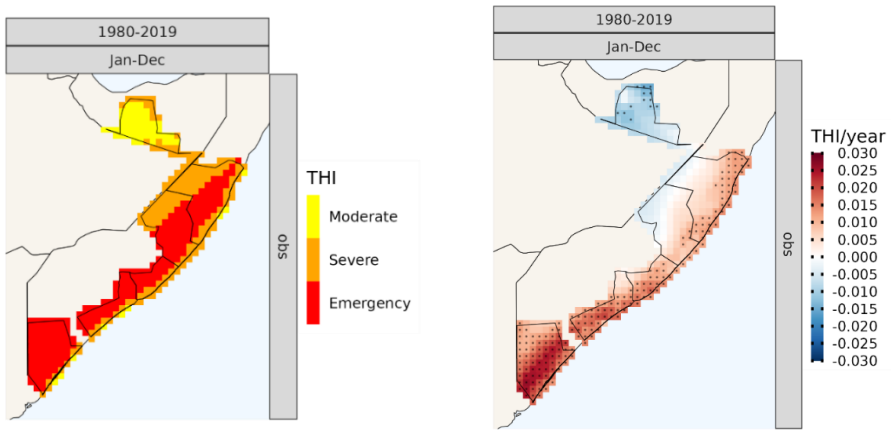
THI ruminant= (1.8 Tmax+32)-((0.55-0.0055 RH) (1.8 Tmax-26.8))

151. Figure 53 shows the THI of ruminants in Somalia during the 1980-2019 period. THI significantly increased at the rate of 0.010-0.030 units/year along the coastline throughout this period. In Togdheer, THI showed a significant decreasing trend at the rate of 0.020 units/year during the same period.

Figure 53: THI classes for ruminants and annual THI change

(Normal: THI <74; Moderate: THI >74 and <78; Severe: THI >78 and <83; Emergency: THI >83) over the 1980-2019 period using the ERA5 dataset. **(b)** Annual change in THI calculated through linear regression. Pixels with a black dot indicate areas in which a statistically significant increase or decrease in THI could be detected. A linear regression was applied to bootstrapped residuals to improve estimations of coefficients under non-normality assumptions.

a) b)



152. Our analysis shows that, in the present, the project sites are already experiencing severe to emergency heat stress conditions. This means that livestock production is already limited by high temperatures. The THI is expected to increase across the project sites under both RCP's 2.6 and 8.5, with the greatest increase projected along the coastal areas (Figure 35). These results are

consistent with Rahimi et al. (2021), which showed an increasing trend in heat stress for sheep, goats, and beef cattle in Somalia. Most models agree with the direction in the change of THI in Somalia (Figure 53).

Figure 54. *THI classes for ruminants (Normal: THI <74; Moderate: THI >74 and <78; Severe: THI >78 and <83; Emergency: THI >83) over the 21st century for two climate change scenarios. The results provided are an ensemble mean of the six CORDEX-CORE models bias-corrected with ERA5. Briefly, climate projections were bias-corrected with the empirical quantile method using the ERA5 dataset and consequently THI was calculated for each CORDEX-CORE model before calculating the ensemble mean.*

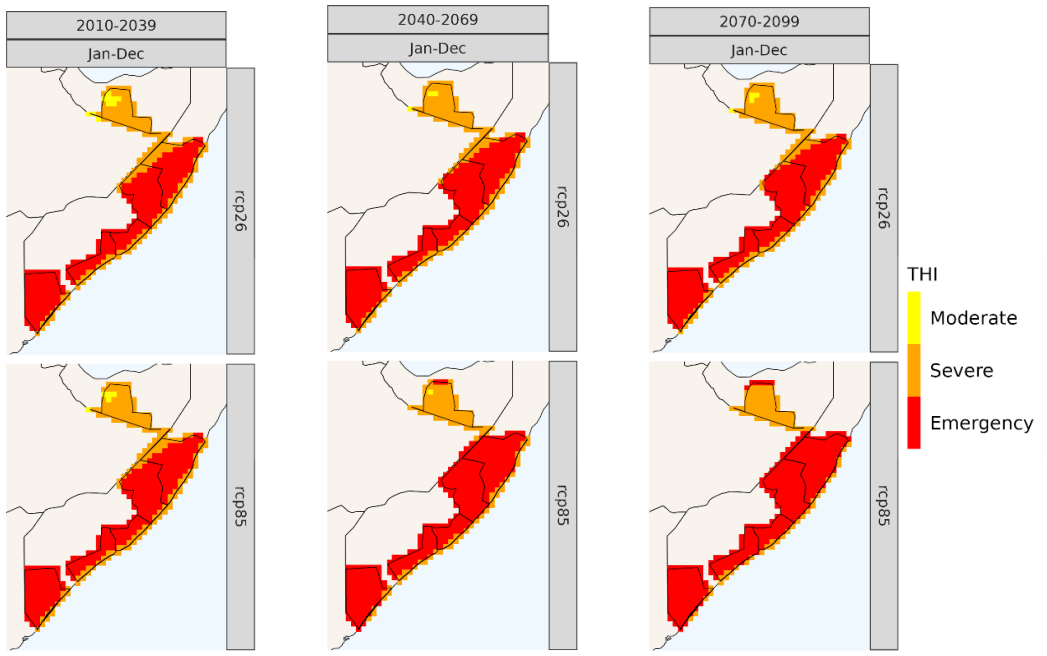
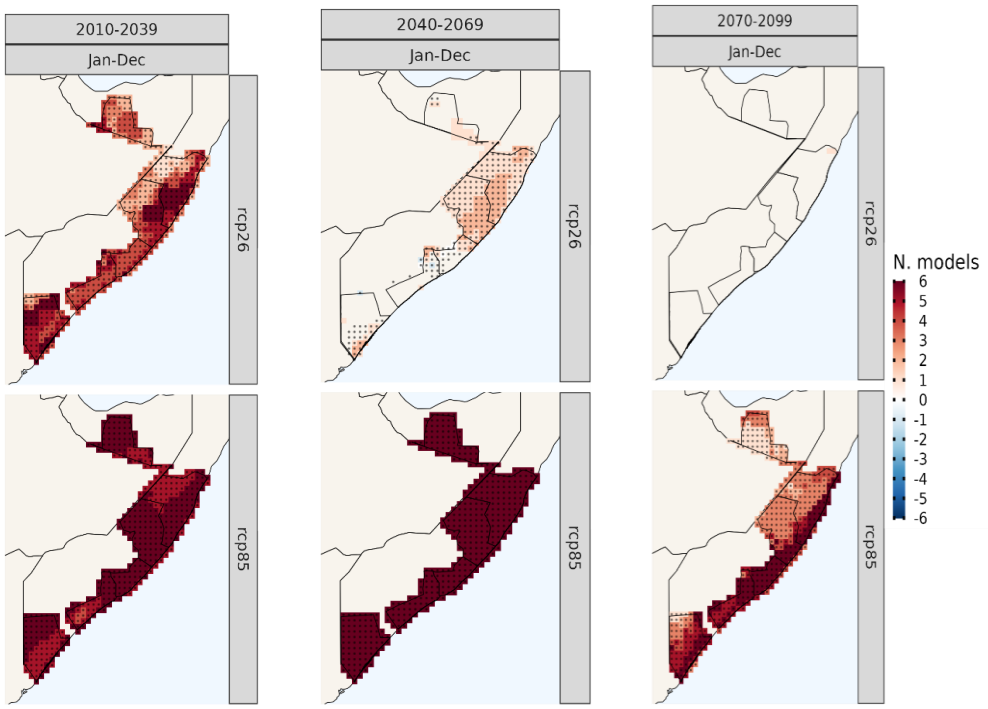


Figure 55. *Number of climate models agreeing in the direction of change for THI values. For example, red pixels indicate areas where THI values are projected to increase, while blue pixels show the areas where THI values are projected to decrease. The black dots indicates whether that values is statistically significant.*



2.6.3.3 Impacts on storage, markets, and trade

153. Climate changes affects elements of the agriculture and food system beyond the farm, including economic risks to elements of the value chain such as storage facilities, processing plants, and transportation, as well as trade. (Ruane & Rosenzweig 2019). Postharvest systems will be affected by changes in temperature, rainfall, humidity and extreme events. Higher temperatures may favour reproduction and hence proliferation of certain storage pests such as grain borers and beetles leading to higher grain losses. Similarly high rainfall during harvest or post-harvest seasons may favour fungal growth and lead to mycotoxin production. Extreme rainfall events may cause damages to both storage and transport infrastructures (Stathers et al.2013). Water infiltration into underground storage pits (commonly used in Somalia) during extreme rainfall events and flooding leads to total loss or contamination of stored grains (Abdurahman 2023)

154. These impacts will also be evident in the milk value chain. As a perishable product, raw milk collection and trade linking dairy farms and processing plants critically depend on cold chain and logistics services. As for the milk collection and trade activities, cold chain services are also crucial to post-processing distribution and marketing of dairy products in consumer markets. Post-production losses in the milk value chain mainly occur at han/dling and storage, and distribution. Milk losses are expected to increase with increasing temperatures mainly due to poor handling and sanitation. High temperatures will create a conducive environment for rapid multiplication and growth of bacteria and moulds. This is particularly important in warm environments and where unsuitable containers such as plastics (which cannot be properly sterilized) and uninsulated containers are used during transportation and storage stages. This calls for the installation of more cooling systems that will lead to higher energy demands. Losses are expected to be higher during the wet season due to the proliferation of mould and fungi. Extreme rainfall events and flooding may damage road infrastructure and reduce access to milk storage, processing, and marketing facilities, leading to milk spoilage, thus reducing sales and dairy farmers' income. Drought may lead to inadequate supply of water to be used for sanitation along the value chain. Increased variability in production will likely make trade patterns less regular. Costs along the supply chain, commodity price, and price volatility are likely to increase due to the adverse effects of climate change on feed availability.

2.7 Summary of findings

155. This climate impact potential assessment has supported the identification of the "Climate Resilient Agriculture in Somalia" project sites based on observed and projected hazards and its impacts on the agricultural and livestock sectors.

156. The targeted areas of the project were pre-identified based on the climate risk analysis, which considered climate hazard, exposure and vulnerability, and the agro-ecological zones in Somalia. The following components of risks have been taken into consideration to prioritize project target areas: (i) Hazard that refers to the occurrence of meteorological (e.g., extreme temperature), climatological (e.g., drought), or hydrological (e.g., flood) events or trends, (ii) human and natural exposure to climate hazards which is determined by the climate zone, the geographical characteristics of targeted areas, the population density, the agricultural and other socio-economic activities undertaken, (iii) vulnerability determined by the social and economic conditions of the targeted population, and (iv) adaptive capacity assessed by the access to climate information, electricity and internet, infrastructure development, as well as national institutional support through policy and financial mechanisms for climate-resilient agriculture currently available at national level.

157. The results of the climate impact potential assessment are supported by Figure 56. Although types of climate risks would differ especially between the coastal area and the inland area, as indicated in previous sections, most of Somalia's regions fall under high climate risk, except for Bakool.

158. The project will target seven regions in Somalia which include the top three high climate risk regions: (i) Southwest: Lower Shabelle region; (ii) Hirshabelle: Middle Shabelle region; (iii) Jubaland: Lower Juba region, and other four regions where the agro-pastoral system prevails; (iv) Puntland: Nugal region; (v) Somaliland: Todgheer region; (vi) Galmudug: Mudug region. These regions have been selected in close consultation with the government considering the government's priority areas that have been newly liberated from Al-Shabaab in Hirshabelle, Galmudug, Jubaland and Southwest states where no major investment project has been implemented and there are huge needs of rural communities to cope with climate change.

Figure 56. *Somalia climate risk for the baseline period*

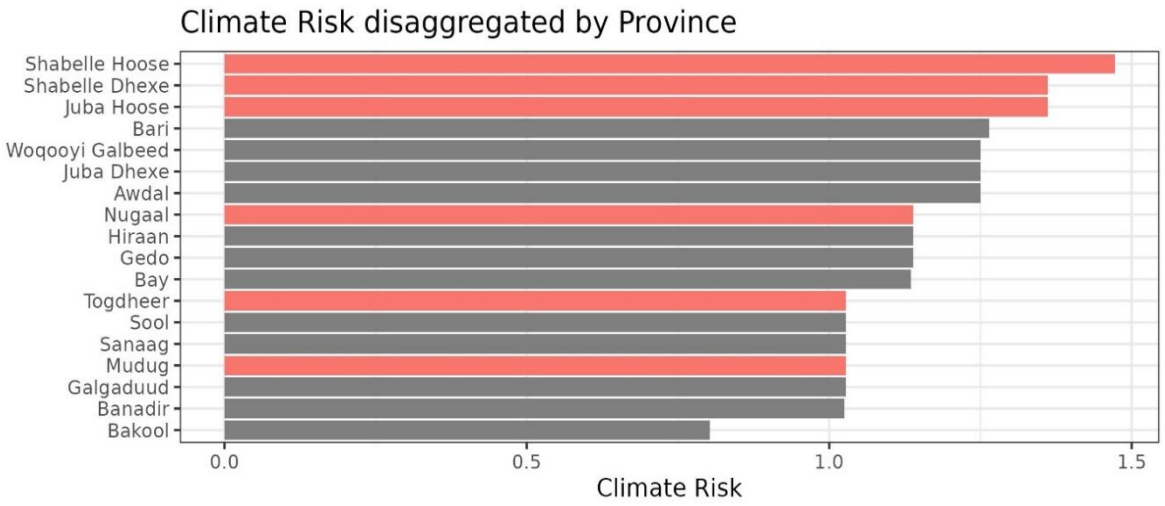


Table 8. Key characteristics and climate hazards and challenges across Somalia

Region	Key characteristics	Climate hazards and challenges
Lower Shabelle	▪Comprised of livelihood zones SO11, SO14 and SO17.	▪Droughts, flooding, and climate variability.

	▪Agro-pastoral zone, irrigated crops (maize and sesame). ▪Total population: 1.3 million and 9% of the population in food crisis, emergency, or catastrophe.	▪Increase in evapotranspiration demand. ▪Animal and crop pests and diseases. ▪Environmental degradation.
Middle Shabelle	▪Comprised of livelihood zones SO10, SO14 and SO15. ▪Agro-pastoral zone, irrigated crops (maize and sesame). ▪Total population: 0.86 million and 29% of the population in food crisis, emergency, or catastrophe	▪Flooding and drought. ▪Erratic rainfall and dry spells. ▪Increase in evapotranspiration demand. ▪Livestock and crop pests and diseases. ▪Market disruptions.
Lower Juba	▪Comprised of livelihood zones SO17 and SO18 ▪Agro-pastoral zone, irrigated crops (maize and sesame). ▪Total population: 0.98 million and 13% of the population in food crisis, emergency, or catastrophe	▪Drought. ▪Flooding in coastal areas. ▪Climate variability. ▪Livestock and crop pests and diseases. ▪Market disruptions.
Nugaal	▪Comprised of livelihood zones SO05 and SO06 ▪Pastoral zone and potential agro-pastoral areas ▪Total population: 0.53 million and 7% of the population in food crisis, emergency, or catastrophe	▪Drought. ▪Flooding (coastal areas). ▪Water shortages. ▪Significant environmental destruction. ▪Livestock diseases. ▪Conflict.
Togdheer	▪Comprised of livelihood zones SO02, SO04 and SO05. ▪Agro-pastoral zone, rainfed crops (+ flood irrigation from highlands). ▪Total population: 0.73 million and 32% of the population in food crisis, emergency, or catastrophe	▪Drought. ▪Lack of pastures and water. ▪Environmental degradation. ▪Animal diseases. ▪Conflict.
Mudug	▪Comprised of livelihood zones SO05, SO08, SO09 and SO10. ▪Pastoral and agro-pastoral areas, some irrigation with underground water. ▪Total population: 1.2 million and 47% of the population in food crisis, emergency, or catastrophe	▪Drought. ▪Low erratic rainfall and dry spells. ▪Tropical storms and flooding (coastal areas). ▪Livestock diseases. ▪Environmental degradation. ▪Market disruptions.

Table 9: Summary of main climatic drivers and its impacts including proposed climate actions by project components.

Main climatic drivers	Observed and projected impacts	Climate resilient practices
Heat stress in livestock presents a significant climate risk to Somalia's livestock sector over the short to long term. THI is already high and will continue to rise in the near, mid, and distant future. Extreme heat events and overall warmer days and nights, and/or precipitation variability, during key calving, kidding and lambing periods can lead to higher mortality among livestock young and birthing livestock, as well as decreases in milk production Heat stress risks further generate cascading gendered nutrition and economic risks amongst pastoralists and agro-pastoralists, as women often supplement children's nutrition with milk products and augment their incomes from the sale of milk products. There is potential reduction in dryland forage yields due to the potential increase in extreme precipitation events, more dry spells and shifts in the onset and duration of the *Gu* and *Deyr* rainy seasons, and higher temperatures in all seasons. Rangelands are already degraded due to overstocking and grazing, charcoal production, and recurrent droughts. Rainfall variability will likely continue to be high over the short term, and evapotranspiration will increase due to hotter temperatures in all seasons. These climate shifts, coupled with current unsustainable use patterns, can potentially exacerbate local desertification and land degradation.	Livestock ▪ Heat stress in livestock results in greater nutritional requirements, reduced milk production and milk quality. ▪ Calving difficulty, postpartum paralysis, increasing the number of stillbirths. ▪ Increased frequency of health-related issues such as mastitis. ▪ Changes in the ranges of vectors such as ticks, tsetse flies and mosquitoes. ▪ The safety of milk and milk products may be compromised by the growth of fungi and mycotoxins. Crop ▪ Establishment of new exotic pests, weeds, and diseases. ▪ High evaporative demand for crops. Heat stress during flowering stage and panicle development ▪ Increase in pest development rates	Outcome 2: Local livelihoods are resilient to climate change - Improved herd management - Use of improved breeds - Increased use of water and fodder - Improved post-harvest and milk storage - Increased access to markets - Use of resilient breeds and varieties - Improved land and water management Outcome 3 An improved institutional enabling environment for sustainable landscape management and climate resilient agriculture is in place at State and Federal Levels - Increased access to locally specific agro-climate information
Crop yields in Somalia could decline due to hotter temperatures as well as increased frequency/intensity of extreme weather events. Pastoral, agro-pastoral and agricultural livelihoods in Somalia follow the distribution of surface and groundwater supplies and rainfall seasonality. The Jubba and Shabelle rivers – both originating in the southeastern Ethiopian Highlands – are the primary sources of irrigation, livestock, and domestic water supply for rural and urban areas in the south during the rainy seasons. Upstream abstractions for livestock, crop farming and household use often exceed river flows during dry months leading to the drying of rivers.	Crop ▪ Poor crop yields or total loss of crops. Livestock ▪ Poor pasture regeneration. ▪ Long dry seasons may decrease forage quality and growth, and biodiversity. ▪ Migrations in search of pastures. ▪ Overgrazing and land degradation.	Outcome 1: Restored landscapes are resilient and sustainably managed - Landscape rehabilitation and management. - Rangeland management - Removal and management of prosopis Outcome 2: Local livelihoods are resilient to climate change - Increased access to irrigation - Increased use and access to fodder - Use of resilient seeds and varieties

Food (crops) loss in the events of floods due to lack of climate-proofed storage systems	▪ Pastoral dropouts increase, leading to displacements, poverty, and destitution. Other ▪ Enhanced conflicts over scarce resources can affect food security, particularly of pastoral communities. ▪ Loss of livelihoods.	- Improved land and water management Outcome 3 An improved institutional enabling environment for sustainable landscape management and climate resilient agriculture is in place at State and Federal Levels - Increased access to locally specific agro-climate information
Water risks for Somalia over the short to long term will be heavily mediated by changes in demand related to urbanisation and economic diversification; land-use planning and change; conservation plans and measures; and the planning, construction, and maintenance of infrastructure for irrigation, livestock watering points and urban use, both within Somalia and along shared basins with Ethiopia and Kenya. Climate-driven shifts in temperature and precipitation means and extremes will compound changes in water demand and use. Variability in precipitation will also remain quite high, with the potential for multiple consecutive deficient rainy seasons. The increases in maximum and minimum temperatures will lead to higher evaporation and evapotranspiration.	Crop ▪ Flooding of cropland and pastures. ▪ Increase in crop pests and diseases. ▪ Loss of soil due to erosion by water. Livestock ▪ Increased incidences of vector borne diseases. ▪ Death of livestock due to floods. Other ▪ Human displacements ▪ Water-borne diseases	Outcome 1: Restored landscapes are resilient and sustainably managed - Landscape rehabilitation and management. - Rangeland management - Removal and management of prosopis Outcome 2: Local livelihoods are resilient to climate change - Increased use and access to fodder - Use of resilient seeds and varieties - Improved land and water management Outcome 3 An improved institutional enabling environment for sustainable landscape management and climate resilient agriculture is in place at State and Federal Levels - Increased access to locally specific agro-climate information

Table 10: summary of climate events, proposed solutions and adaptation benefits

Climate events as experienced by ecosystems and agriculture/livestock sectors	Proposed climate solutions/ technologies		Adaptation benefits
	Ecosystem level intervention	**Farm level intervention**	
Elevated plant/animal stress *Contributing climatic factors:* *Extreme heat* *Droughts* *Floods* *Increased precipitation variability*	Landscape rehabilitation and management (output 1.2) including; - Reforestation and afforestation - Agroforestry	Promotion of CRA technologies (output 2.2) including: - Heat-Tolerant Crop Varieties - Irrigation Management - Soil Health Management, such as cover cropping and mulching - Shading and cooling structures - Conservation Agriculture (CA) Output 2.3: Climate-proof storage and milk storage	- Improved ecosystem services such as pollination. - Enhanced carbon sequestration thanks to CA and agroforestry - Increased and stabilised yields - Reduced heat stress for livestock - Enhanced crop resilience - Better soil health
Inconsistent water supply *Contributing Climatic Events:* *Extreme heat* *Droughts* *Floods* *Increased precipitation variability*	Soil and water conservation (output 1.2) including; - Watershed management - Aquifer recharge eg. through check dams - Large scale rainwater harvesting in reservoirs and pond to be used during dry seasons - Riparian buffer zones Rehabilitation of irrigation infrastructure (output 2.1)	Promotion of water saving technologies (output 2.1) including - Efficient and effective irrigation systems - On-farm rainwater harvesting Promotion of CRA technologies (output 2.2) including: - Soil moisture conservation through practices like mulching, cover cropping and minimum tillage - Crop selection and diversification - Use of drought-tolerant variety	- Improved water use efficiency - Long term water resource conservation - Sustained household incomes due to diversification.
Increased soil erosion *Contributing Climatic Events:* *Extreme heat* *Droughts*	Implementation of landscape management plans (output 1.2) including - Reforestation and afforestation - Maintaining riparian buffer zones - Grassland conservation	Promotion of CRA technologies (output 2.2) including: - Cover cropping - Mulching - Contour farming and terracing - Conservation Agriculture	- Preservation of topsoil, maintaining soil fertility ensures sustainable agricultural productivity - Improved water infiltration and retention hence enhanced water availability for crops,

Floods *Increased precipitation variability*	- Ecosystem based watershed management	- Agroforestry	- Stabilized agricultural productivity and reduced soil degradation lead to more consistent incomes for farmers and reduced costs associated with soil erosion damage. - increased carbon storage in soils and vegetation
Decline in soil fertility *Contributing Climatic Events:* *Extreme heat* *Droughts* *Floods* *Increased precipitation variability*	Implementation of landscape management plans (output 1.2) including - Reforestation and afforestation - Biodiversity enhancement by promoting diverse plant species in the natural and agricultural landscape - Agroforestry	Promotion of CRA technologies (output 2.2) including: - Crop rotation and diversification - Cover cropping and mulching - Soil testing and precision agriculture - Organic soil amendments by adding organic matter and planting nitrogen fixing crops. - Conservation agriculture - integrated nutrient management using both organic and inorganic fertilizers. - Biochar application	- Enhanced soil health through improved soil structure, biology and chemistry - Stabilised and improved yields - Improved soil water retention - Sustainable nutrient management - Carbon sequestration - Environmental protection through preventing nutrient runoff into water bodies
Further deforestation and degradation *Contributing Climatic Events:* *Extreme heat* *Droughts/Aridity* *Floods* *Increased precipitation variability*	Climate-resilient landscape management planning, establishment of LMCs (output 1.1) Implementation of landscape management plans (output 1.2) including - Reforestation - Half-Moon structures - Contour bunds - Sand dams or Subsurface dams - Berkad - Hafirs/ Water Pans - Management/ Control of Prosopis	Promotion of CRA technologies (output 2.2) including: Restorative agriculture such as compositing cover cropping and mulching	- Sustainable livelihoods from community-based management and alternative livelihood - Enhanced ecosystem services
Intensified incidence of pests and diseases *Contributing Climatic Events:*	Implementation of landscape management plans (output 1.2) including	Promotion of CRA technologies (output 2.2) including:	- Reduced pest and disease pressure

Extreme heat *Droughts* *Floods* *Increased precipitation variability*	- Habitat Diversification; hedgerows, cover crops, and maintaining natural vegetation - Conservation of natural enemies; Protecting and enhancing populations of natural pest predators through habitat management and reduced pesticide use. - Coordinating pest management efforts across multiple farms and landscapes. - Monitoring and early warning systems	- Coordinating pest management efforts across multiple farms and landscapes; - Combining biological, cultural, physical, and chemical tools to manage pests in an environmentally and economically sustainable manner - Crop rotation and diversification - Use of resistant and tolerant varieties	- Reduces environmental degradation, and supports sustainable food production.

3 Institutional Context

3.1 Laws, policies

159. Environmental policy and legislation across Somali territories are currently in a phase of development, focusing on evaluating the impact of such policies on environmental preservation and the enhancement of sustainable livelihoods.

3.1.1 Frameworks

160. **The Constitution of the Republic of Somalia** serves as the primary legal framework for environmental management, highlighting key articles such as Article 25 (Environment), Article 43 (Land), Article 44 (Natural Resources), and Article 45 (Environment). Article 25 guarantees every Somali the right to a safe environment, free from pollution and harmful substances, and emphasizes the equitable distribution of the country's natural resources, safeguarding against their excessive and detrimental exploitation.

161. Article 45 advocates for the collective involvement of Somali people in the sustainable management and protection of natural resources and the environment. Meanwhile, Article 43 offers guidelines for implementing environmental and social safeguards, despite the absence of specific legislated regulations. It also mandates the federal government to prioritize the conservation of biodiversity and ecosystems, urging both the Federal Government of Somalia (FGS) and Federal Member States (FMS) to combat environmental challenges such as desertification, deforestation, and degradation. To operationalize these principles, the FGS, in consultation with the FMS, is tasked with formulating overarching environmental policies for Somalia.

162. **National Development Plan:** The Ninth National Development Plan (NDP-9) for the period 2020-2024 serves as a holistic framework for addressing the myriad challenges impeding Somalia's path to stability and progress. Central to the plan's analysis are the intertwined issues of resource use conflicts, environmental degradation, and climate-related disasters such as droughts and floods, which collectively pose significant barriers to national development. In response, NDP-9 strategically focuses on interventions designed to yield multifaceted benefits. These targeted initiatives aim not only to stimulate economic growth but also to enhance environmental sustainability, reduce conflicts, strengthen governance, and mitigate social exclusion, thereby laying the groundwork for a more resilient and inclusive society.

163. Climate resilience emerges as a critical pillar within NDP-9, underpinning the plan's comprehensive approach to sustainable development. Acknowledging the profound threats that climate change poses to achieving its development objectives, the plan integrates climate change adaptation and mitigation strategies across its priorities. This forward-looking stance recognizes the importance of safeguarding the country against the adverse effects of climate variability and extreme weather events. By embedding climate resilience into its development strategy, NDP-9 aspires to secure a sustainable future for Somalia, ensuring that its developmental gains are robust, durable, and capable of withstanding the challenges presented by a changing climate**.**[62]

164. **National Environmental Management Act (NEMA), 2024:** NEMA is designed to ensure a clean and healthy environment for all Somali citizens. It sets forth measures to prevent pollution, safeguard natural resources, and champion the principles of sustainable development across the country. By establishing a comprehensive framework for environmental protection, this act underscores the government's commitment to balancing ecological preservation with the nation's developmental needs. Furthermore, it provides a legal basis for the implementation of practices and policies aimed at maintaining environmental integrity and promoting the well-being of current and future generations. This act represents a significant stride towards

[62] The Ministry of Planning, Investment and Economic Development, Somalia National Plan 2020-2024, the Path to a just, stable and prosperous Somalia, 2020.

achieving environmental sustainability and resilience in Somalia. An Implementation Plan needs to be designed.

165. **The Environmental and Social Impact Assessment Regulations (ESIAR), 2024:** Establishes a comprehensive set of procedures for managing the entire lifecycle of applications for environmental authorization. This includes the preparation, evaluation, submission, and processing of applications, as well as the final decision-making process for activities that require an environmental and social impact assessment. The primary goal of these regulations is to prevent or minimize harmful effects on the environment and society while enhancing positive outcomes, including those related to climate change adaptation and mitigation. By ensuring thorough assessment and oversight, the regulations aim to promote sustainable development practices that respect both ecological balance and social well-being. Ultimately, these regulations serve as a critical tool for integrating environmental and social considerations into the planning and execution of development projects in Somalia. Resources are needed to implement the regulations. Main components will be : (i) Training, (ii) Implementation monitoring and, (iii) Coordination.

3.1.2 Climate Change policies and plans

166. **Somalia National Climate Change Policy:** The policy incorporates concrete recommendations for the agriculture and livestock sectors to enhance resilience and sustainability:

- Climate-Resilient Practices: Develop cropping and livestock management systems that can withstand climate-related stresses. This includes promoting improved seed and crop varieties, as well as developing new breeds of livestock that are more resistant to drought and heat.
- Diversified Land and Resource Use: Encourage diversified farming practices such as agro-forestry, dry-land farming, and urban gardening, alongside beekeeping and poultry production. Implement practices to provide shade and water in livestock farming to reduce heat stress.
- Water Management and Efficiency: Improve the efficiency of water use in both crop and livestock production. This involves better irrigation practices and ensuring a stable water supply for livestock through the protection of water catchments and the development of resilient water infrastructure.
- Organic and Sustainable Inputs: Promote the use of organic fertilizers in crop production and sustainable feed sources for livestock to enhance soil and animal health while minimizing environmental impacts.
- Risk Management and Insurance: Establish risk transfer schemes such as insurance for both crops and livestock to protect against losses due to adverse weather conditions, disease outbreaks, or supply disruptions.
- Infrastructure and Post-Harvest Improvements: Enhance storage, processing facilities, and overall infrastructure to reduce post-harvest losses in crops and maintain the quality and health of livestock products.
- Early Warning Systems and Disease Control: Develop and strengthen early warning systems and veterinary services to enhance preparedness and response to climate-induced risks and diseases affecting both crops and livestock.

167. The **Disaster Preparedness and Response Policy:** foresees the Establishment of a National Meteorological Authority to provide standardized weather information and accurate early warning on adverse weather conditions in order to lessen climate-related hazards such as floods, drought. It also advocates for the improvement of hydro-meteorological observation networks to provide better climate data and information, and communicate early warning of natural hazards. It recognizes that work is needed enhancing the institutional capacity of agencies engaged in disaster risk response and management. Among the key physical recommendations, the policy advocates for the construction of proper drainage systems, floodways, dikes, dams, riverbank protection, buffer zones, and for afforestation along embankments and other measures to reduce flooding. In response to drought the key measures are to construct channels, water collecting reservoirs and dams to contain floods and store water for the dry

season. The policy also encourages relocation of settlements and economic activities from climate-related disaster- prone areas (Federal Directorate of Environment and Climate Change, 2020)[63].

168. **Somalia's updated Nationally Determined Contribution (NDC)** and the NDC implementation Plan were launched at COP 28 in December 2023. It identifies key vulnerable sectors such as agriculture (including livestock) and food security, forest and environmental, transport, energy, water, human settlement, marine, fisheries, blue economy, health, and disaster preparedness for adaptation. It also notes the key drivers of vulnerability for agriculture as drought, heat stress, invasive alien species, pests and flooding. Priority actions recommended in the NDC for the agriculture include the following, many of which are addressed by this project:

1. Provision of climate resilient water resources and infrastructure for agro-pastoral productivity and resilience in the rangelands of Somalia.
2. Implement and up-scale development of new irrigation schemes and modernizing existing schemes
3. Development of soil maps for Somalia, delineating areas with denuded or bare land and recommending mineral fertilizer blends for enhanced crop production.
4. Promotion of integrated pest control and disease control for crops and livestock
5. Establish and restock national strategic grain reserves to enhance food security and avert recurrent famine
6. Establish national plant and livestock breeding systems that can, in the long-term, possess technical capacity to develop fast maturing cultivars and climate smart livestock breeds.
7. Replace water intensive and flood based paddy rice production with an upland rice production.
8. Implement comprehensive crop and livestock insurance
    a. Collaborating with insurance companies, agricultural experts, and local governments to design insurance products that cover a wide range of climate risks (e.g., droughts, floods, pests).
    b. Ensuring accessibility and awareness of these insurance programs among rural and vulnerable groups (women, youth, and IDPs) through education and outreach campaigns.
9. Promote the cultivation of legumes and other crops that offer multiple benefits, such as soil fertility enhancement and dietary improvement.
10. Facilitate increased access to both local and international markets for agricultural produce by establishing and empowering agricultural cooperatives.
11. Promote the adoption of effective manure management and efficient fertilizer use techniques among farmers to enhance soil fertility and reduce environmental impact
12. Promote feed preservation techniques and establish fodder banks to ensure a consistent and nutritious feed supply for livestock.
13. Promote agricultural value addition through the establishment of export processing zones that specialize in the efficient transformation of raw agricultural outputs into higher-value goods suitable for internal consumption and export.
14. Institute and upscale proper post-harvest practices. Establish metallic silos and distribute PICS bags to small scale growers for effective grain storage.
15. Institute a holistic strategy for planning and overseeing sustainable land use that takes into account traditional gender roles and other important social structures.
16. Develop and implement national strategy for the control of invasive alien species (Prosopis plant).
17. Develop, coordinate, and implement training and educational programs to share knowledge or climate smart agricultural practices with farmers and pastoralists, ensuring access for smallholder farmers, women, and youth.

169. With regard to water, the NDC also recommends:

- the construction of new water storage facilities to improve water availability and manage supply more effectively.

[63] Federal Directorate of Environment and Climate Change, Federal Republic of Somalia, Somalia National Climate Change Policy, August 2020.

- Restoration of degraded wetlands and upscale water harvesting techniques to enhance groundwater recharge and reduce dependency on unpredictable rainfall.
- Upscaling of flood forecasting and early warning systems.
- Development and construction of flood protection infrastructure like dikes and storm drains to mitigate flood risks.
- Implementation of nationwide initiatives to improve water hygiene and sanitation, aiming to increase access to clean water and adequate sanitation facilities.

3.1.3 Regional, national, and local climate change adaptation strategies

170. In the last decade, Somalia has made great strides to establish political, social, environmental, and economic systems to tackle climate change. Somalia has also enacted critical natural resource management and climate change relevant policies and legislative frameworks (Table 11). For example, Somalia's federal system has established six federal member states (FMS) and one special status region. The FMSs have mandates and responsibilities over natural resources and local environmental issues and oversee policy development and implementation in their respective regions. The Climate Change Policy recognizes that climate change mitigation and adaptation is a multi-sectoral issue, and that success depends on the cooperation of Government agencies/ministries responsible for various aspects of environment. The private sector and civil society organizations also play an important role in Somalia's climate change response.

Table 11:Relevant plans, policies, and strategies on adaptation and mitigation adopted in Somalia

Plans, policies, & strategies	Year	Priority areas of action
National Adaptation Plan (NAP)	2022	The NAP is a strategic approach by which the Federal Government of Somalia can address climate change impacts in a more integrated and coordinated way. It guides the development, coordination and implementation of policies, plans and strategies that will help the country address its medium- and long-term adaptation needs, while aligning these actions with the country's development and its continued progress toward peace and stability.
Intended Nationally Determined Contributions	2021	Outlines Somalia's main needs to cope with climate change effects as (i) an effective disaster management; (ii) a well warned and informed population; and (iii) a coordinated joint government inter-ministerial plan.
National Water Resources Strategy (2021-2025)	2021	Provides a suite of strategies, objectives, and actions for the water sector for the 2021-2025 period. It identifies key challenges in driving water resource management from a climate resilience lens, limited by the low availability of meteorological and hydrological information.
Roadmap to implement the National Water Resource Strategy (2021-2025)	2021	It intends to respond to climate change and its impacts on water resources management through developing flood and drought risk management strategies and plans, and mainstreaming water priorities into the national climate planning. The roadmap recommends prioritization of research on climate change impacts on the water sector and to develop capacity building and training plans to strengthen water sector climate change and disaster risk reduction competencies.
National Climate Change Policy	2020	It is a vehicle to move the country's efforts in a climate resilient and sustainable path. Similarly, this policy is instrumental to the implementation and achievement of the Sustainable Development Goals (SDGs, 2015) and the National Development Plan (2020 -2024). The goal of this policy framework is to enhance resilience and improve the adaptive capacity of vulnerable Somali communities, the ecosystems on which they depend, to the adverse impacts of climate change in Somalia. This policy instrument enabled the creation, in 2022, of the Ministry of Environment and Climate Change (MoECC), which has the mandate of formulating federal level climate policies and coordination of activities. It also serves as UNFCCC National Focal point and the National Designated Authority (NDA) to the Green Climate Fund. In addition, the National Climate Change Committee (NCCC)

Plans, policies, & strategies	Year	Priority areas of action
		has the mandate to coordinate and supervise the implementation of the National Climate Change Policy.
National Voluntary Land Degradation Neutrality (LDN) Targets	2020	Targets set have been endorsed by Directorate of Environment and Climate change, Office of the Prime Minister of Somalia. LDN implementation provides an opportunity to prioritize land-based sustainable management practices, foster policy coherence and address climate change.
National Food Security and Nutrition Policy	2020	Has the overarching vision to make the Somali people more resilient to climate change, recognizing their high vulnerability in an economy that is dominated by a high dependence on natural resources.
Ninth National Development (NDP) Plan (2020-2024)	2020	Recognizes the threats that climate change poses to the country's development objectives and mainstreams climate change into the strategic interventions planned for all vulnerable sectors of the economy to enhance resilience. It acts as the country's Interim Poverty Reduction Strategy Paper (IPRSP). The government adopted the 2030 Agenda for Sustainable Development and has aligned and mainstreamed the NDP-9 with the SDGs to provide a national framework for institutional renovation. Further, the NDP-9's aims to reduce poverty and inequality through four pillars: i) inclusive and accountable politics; ii) security and rule of law; iii) economic growth; and iv) social development.
National Drought Plan	2020	The goal is to design drought monitoring, early warning, and information where the government and relevant stakeholders can operate on for better early action and response to droughts. It is also an implementing mechanism for drought response, mitigation, and preparedness at multi-sectoral level to reduce vulnerability to drought and promote drought adaptation for effective drought risk management with paradigm shift from reactive emergency relief to pro-active approach.
National Environment Policy	2019	The overall goal of the policy is to improve and enhance the health and quality of life of the Somali people and to promote sustainable development through sound management of the natural resources of the country. It recognizes climate change as a key environmental challenge in Somalia and outlines how the government will support key sectors to combat the impact of climate change.
Resilience and Recovery Framework (RRF)	2018	Over a 3 to 5-year time frame, the RRF aimed to support Somalia's progress from early drought recovery to longer term resilience and disaster preparedness. It established a collective vision and strategy for enabling recovery and resilience building and breaking out of the cycle of vulnerability and humanitarian crises.
National Biodiversity Strategy and Action Plan	2015	Recognizes climate change as an indirect driver of biodiversity loss and recognizes the role biodiversity plays to help mitigate and adapt to climate change. It also identifies the gap in effective biodiversity conservation in 3 zones. The financial gap is placed at USD 240 million
The National Adaptation Programme of Actions	2013	Provides the starting point from which climate change adaptation can be mainstreamed into development plans as a key strategy for attaining sustainable development and poverty reduction. It recognizes droughts and floods as the main hazards in Somalia and it identifies key adaptation needs for key sectors as well the need for sustainable land management, watershed management and disaster management as priority programmatic areas.

3.1.4 Agriculture

171. **The Agriculture Strategy Plan (ASP), 2016-2020:** ASP guides and prioritizes the efforts of the Ministry of Agriculture by assigning ministerial responsibilities and outlining activities pertinent to the Ministry's mandate. Action plans and indicators are provided, designed to be achieved from 2016 to 2020.

172. The primary goal of this strategic plan is to enhance the agricultural sector's contribution to the livelihoods of the farming community and the economic revival of Somalia. This objective is to be realized through the reconstruction of the Ministry of Agriculture and other relevant bodies, the improvement and rehabilitation of agricultural infrastructure, the increase of local agricultural production, and the bolstering of the ministry's capacity for resource mobilization.

173. The **Livestock Sector Development Strategy (2019)** underscores the critical importance of livestock to Somalia's economy, accounting for 43 percent of the nation's GDP and providing essential employment and livelihoods for a significant portion of the population. Yet, this vital sector is increasingly vulnerable to the adverse effects of climate change and recurrent droughts, which jeopardize the long-term sustainability of livestock production. In response to these challenges, a range of strategies and policies have been formulated, aiming to mitigate the impacts of drought, address water scarcity, and alleviate social unrest. Despite these proactive measures, the capacity of public services to adequately support livestock owners remains constrained, further compounding the poverty experienced within this community. The sector's resilience is further tested by issues related to natural resource management and the need for skill development in value-added programming to bolster sector robustness and community livelihoods.

3.1.5 National Framework on Climate Services

174. Somalia does not have a National Hydrological and Meteorological Service (NMHS) in place. These activities are being performed by the Hydrometeorological Department, within the Ministry of Energy and Water Resources (MoEWR), which plays a critical role on providing weather, water resources, and disaster risk management services to the population and relevant sectors. Its responsibilities include monitoring weather conditions and collecting hydromet data, providing forecasts and early warnings for extreme weather events, archiving, and disseminating climate and weather data and analysing hydrological data and forecasting floods, droughts, and cyclones. However, the National Meteorological Agency bill has recently been passed to enable the creation of the NMHS.

175. Climate data collection is not very strong in Somalia, but efforts are in place to strengthen and expand existing data collection, monitoring, and forecasting systems. For example, the Ministry of Agriculture, Department of Meteorology, has been monitoring the rainfall and producing weekly forecasts. Roughly 100 Automatic Weather Stations (AWS) are installed across the country despite some of them not properly functioning. There is limited data collection from other indicators relevant in determining drought situation such as pasture/vegetation, livestock body condition, yields production, and other ecological and climatic related indicators. The data collection and monitoring gaps have been partially fulfilled by the FAO Somalia Water and Land Information Management (SWALIM) project, which has installed 26 AWS, 110 manual rainfall stations, 5 synoptic stations, and 7 ground water stations. In addition, the IGAD Climate Prediction and Applications Centre (ICPAC), in collaboration with MOECC, has installed an additional 19 AWS across the country. The network coverage is however still below the recommended WMO requirements.

176. At the regional level, information on weather patterns, such as rainfall, temperature, and drought indices that support the determination of forage availability and the status of rangelands as well as long- and short-range weather forecasting and weather advisories are issued by ICPAC. In addition, the Greater Horn of Africa Climate Outlook Forum (GHACOF) reflects the performance and impacts of the following season, present the consolidated objective of regional climate outlooks for the next season, and provide regional interaction platforms for decision makers, climate scientists, users of climate information, among others. Satellite images and remote sensing technologies are used to keep track on vegetation characteristics, such as biomass cover, which influence cattle grazing supplies. Some examples monitoring the vegetation and water availability in the Horn of Africa include the East Africa Hazards Watch, which supports the tracking of extreme weather events such as drought, cyclones, pests (desert locust), heavy rainfall, floods, and crop failures. It also includes a rangeland monitoring system that shows warning about low or delated vegetation performance at a given region. Forage availability forecasts are also available at seasonal basis. The ICPAC Warning Explorer also provides near-real-time earth observations and weather information and 10-day drought conditions warnings for crops and rangelands at the provincial level.

177. Currently, last mile users, producing households and extension services do not have sufficient access to climate information services. Forecasts are not yet being shared from national to State or local level, and their reliability is inadequate. Seasonal forecasts are currently available, but only distributed to government services. Early warnings for climate extremes are not being disseminated at local level, leading to missed opportunities for early adaptive action of local communities. If producer households do not have access to adequate agro-meteorological advice, the transition to climate-resilient livelihoods will be incomplete and unsustainable. Some examples of market information advisory services include:

- **The Joint Market Monitoring Initiative (JMMI)** from the Somalia Water, Sanitation and Hygiene, Shelter, and Education clusters. JMMI aims to address an information gap in Somalia in terms of regular monitoring of market functionality and a broad range of non-food items, while contributing to the existing supply chain and price monitoring of the main minimum expenditure basket items.
- **The Food Security and Nutrition Analysis Unit (FSNAU) Market Price Monitoring System**, in partnership with the Famine Early Warning Systems Network (FEWSNET), has put in place a market price monitoring system to collect and analyse weekly price data for 24 commodities (cereals, other foods, livestock, energy, and labour) and two exchange rates (Somaliland and Somali Shilling) in 36 markets throughout Somalia. The FSNAU regularly collects and analyses secondary import and export data from the Berbera and Bossaso ports.

178. The following early warning structures have been put in place across the country:

- **The National Multi Hazard Early Warning Centre in Mogadishu** established in 2020 tasked with the coordination of disaster risk management activities in the country. One of the main tasks of the centre is to produce regular information products on climate such as rainfall and temperature forecasts, early warning on floods and droughts, cyclones, as well as projections on desert locust movement and diseases.

- **The SWALIM project** is an information management program, technically managed by the FAO in Somalia. SWALIM serves Somali government institutions, NGOs, development agencies and UN bodies engaged in assisting Somali communities whose lives and livelihoods depend directly on water and land resources. The program aims to provide high quality water and land information, crucial to relief, rehabilitation, and development initiatives in Somalia, in order to support sustainable water and land resources development and management. On this regard, SWALIM has developed the Flood Risk and Response Management Information System (FRRMIS) to assist flood management in Somalia. FRRMIS is a web-based approach mainly, designed to provide information on a sharing platform and to assist in guiding lead agencies and cluster responses to plan and embark on interventions. Real-time flood information provided during a flood event includes daily flood observations (water level) compared to moderate and high-risk flood levels for major locations. SWALIM has also developed a drought-monitoring tool, which was used effectively during the 2010-2011 famine in Somalia to show the magnitude and duration of the drought event. In addition, SWALIM has developed a unique mobile phone-based alert and early warning system called DIGNIIN. It facilitates early detection of flood situations in the Juba and Shabelle Rivers and enables timely warnings that are communicated to vulnerable communities, allowing rapid evacuation and response. During the flood period, SWALIM issues the “Flood Preparedness and Safety” materials that contain key messages for local communities on what to do before, during and after a flood. SWALIMS also provides advice on riverbank protection and placement of sandbags.

- **FEWSNET** has the lead in monitoring and provision of early warning and analysis on food insecurity in the region through the Food Security and Nutrition Analysis Unit (FSNAU). FSNAU is a project managed by FAO and is the primary source for early warning information on food security, nutrition, and livelihoods in Somalia. It provides a broad range of information with timely and relevant information and analysis for better decision-making relating to short-term food insecurity and malnutrition, as well as informing development planning to address underlying causes of food and livelihood insecurity and malnutrition.

179. The challenges and set of recommendations for investment provided below are based on an extensive search of literature that includes research papers, technical reports, UN reports and regional workshops conducted by WMO as part of the GFCS (Table 12). These actions and recommendations aim to enhance the effective production and delivery of climate services.

Table 12: Main barriers faced by the Somalia Department of Meteorology at each stage of the climate services value chain and investment opportunities.

Barriers	Priority areas of action
Data collection, monitoring, and forecasting	
▪Poor weather and agromet observation network. ▪Lack of quality control of databases and information coming from weather stations. ▪Limited resources for maintaining and expanding the observation network, purchasing advanced equipment, and enhancing NMHSs forecasting and warning capabilities. ▪Inadequate funding for procuring, maintaining, and renovating instruments and equipment. ▪Poor technical capacity of staff and succession management problems. ▪The NMHS staff is not thoroughly trained on agromet related aspects.	▪A growing network of stations and interest by both public and private entities. ▪Interoperability of the information so that all stakeholders easily retrieve the data. ▪Information should be efficiently collected, analysed, disseminated, and updated. ▪Ensure that the procurement of equipment is in line with investment plans of national institutions. ▪Support data collection of variables relevant for drought, flood, and cyclones. ▪Invest in open access platforms and remove barriers to using climate and agriculture data as a public good. ▪Invest in forecasts and early warnings with longer lead times to ensure that users have sufficient time to act before the disaster occurs.
Cooperation and collaboration	
▪Institutional obstacles and inadequate coordination mechanisms amongst various stakeholders and line ministries. ▪Limited institutional arrangements and agreements with other governmental institutions to freely share weather data and livestock information. ▪Several institutions monitoring weather and climate variables without engaging NMHSs. ▪For most climate scientists, the concepts of participation, user engagement, or co-production remain unfamiliar.	▪ Develop a working environment that includes a multidisciplinary working group for government, private sector, NGOs, CBOs to participate in the co-production and co-design of advisory services. ▪ Recognize the distinct roles and responsibilities of the public and private sector, academic institutions, research organizations, and technological agencies in the provision of climate services. ▪ Strengthen institutional arrangements and develop formalized agreements between NMHSs, Ministries of Agriculture, Livestock and Environment, and other stakeholders (e.g., research institutions, private institutions, including phone operators, and NGOs) involved in the production of climate services. ▪ Establish national plans that identify priorities and needs to enable the effective development and application of climate services. The plans should: (i) inform investments along the whole climate services value chain, (ii) clearly identify needs in terms of the observing networks and capacity development, and (iii) should have clear monitoring and evaluations indicators to enable assessment of progress over time.
Advisory services	

▪Lack of public knowledge on how to interpret disaster indicators and thresholds. ▪Low accuracy and lag-time to deliver the information. ▪Ineffective communication of complex meteorological and hydrological concepts to diverse audiences, including rural communities and marginalized groups. ▪Private and public institutions may use different sources of information to produce and disseminate weather forecasts and agronomic advisories and, thus, may send misleading messages to the population.	▪ Translate technical language into user friendly advisories. ▪ Produce relevant agromet advisory services, including mapping of potential flooding zones, mapping of potential conflict zones between pastoralists and farmers, marketplace information, among other advisory services.
Communication channels	
▪ Limited access to technologies such as internet connectivity, mobile phones, radio, and television can hinder the dissemination of climate services and prevent effective communication. ▪ Communication network is not fully developed. ▪ Limited funding, technical expertise, and infrastructure can hinder the establishment and maintenance of robust communication channels for climate services.	▪ Develop user friendly interfaces for illiterate farmers. ▪ Increase the number of trainings with farmers and develop a training curriculum describing the pros/cons of each information communication technology (ICT). ▪ Strengthen the cooperation with mobile phone operators and enhance access to ICTs in rural areas. ▪ Leverage existing digital technologies and ensure equitable access by women and youth. ▪ Mapping of effective communication channels for delivering information to the livestock sector (e.g., television, radio, SMS etc.).
Participatory engagement	
▪ Feedback mechanisms are not fully rolled out. ▪ Language barriers, especially among illiterate groups. ▪ Low level of education and poor digital literacy among farmers, making it slow for farmers to understand the potential applications and benefits of advisory services in agriculture. ▪ Low inclusiveness and sensitivity of the information being used and delivered. ▪ Lack of trust in the information being delivered. ▪ Scarce visibility of the Department of Meteorology within the community. ▪ Gender participation and knowledge gap.	▪ Promote participatory approaches, such as Farmer Field Schools, Participatory Scenario Planning, and PICSA to ensure a higher information uptake and ownership over the information. ▪ Invest in tailoring products into languages, figures, animations, cartoons, and other media that are easily understood and actionable by livestock communities. ▪ Promote user-centred feedback mechanisms, including: (i) user-focused workshops where the benefits of using climate-informed actions are highlighted, (ii) digital learning and knowledge exchange between farmers and other stakeholders, (iii) processes that allow last mile users to co-design and co-produce services and provide feedback (e.g., call services). ▪ Ensure meaningful participation of underrepresented groups, including women and youth. This can be achieved by investing in outreach campaigns to ensure that women and men, youth and other vulnerable groups have equitable access to information.

3.1.6 Gender

180. The 9th National Development Plan of Somalia (2020-2024) had adopted strengthening gender, human rights and social equity as one of its cross-cutting policy objectives. Under the economic development pillar,

investment in livestock and agriculture sectors to create employment opportunities for rural women and youth is prioritized. In order to diversify the economy, investment in in skills training in TVETs targeting sectors where women are overrepresented is encouraged. Under the social protection and human development pilar national policies and strategies are developed to protect vulnerable groups. Among these are the development of the Somali Women's Charter, the FGM Act and the National Gender Policy.[3]

181. The **National Gender Policy of Somalia** (2016) establishes a comprehensive framework designed to steer the development of legislation, policy formulation, implementation, and various initiatives aimed at promoting gender equality and ensuring equal rights and opportunities for both men and women in every sphere of life. This policy serves as a cornerstone for integrating gender considerations into Somalia's legislative and policy-making processes, emphasizing the importance of creating an equitable society where all individuals can thrive regardless of gender.

182. Somalia's National Gender Policy focuses on addressing the disparities faced by women in various spheres of life, aiming to promote equal rights and opportunities. Key areas of intervention include economic empowerment, health, education, and political participation. The policy emphasizes developing legislation and programs to address gender-based violence, enhance women's access to education and healthcare, and increase their participation in politics and decision-making processes[64]. At the Federal level, the Ministry of Women and Human Rights Development (MWHRD) of the Federal Government of Somalia is mandated to advance the promotion and protection of gender equality and human rights, including the rights of women, children and other vulnerable groups. Some states have a similar ministry of women's affairs.

183. States such as Puntland and Somaliland also drafted their state gender policies. For example, the Somaliland National Gender Policy was developed in 2009 by the Ministry of employment and social affairs and family. The overall goal of the policy is to facilitate the mainstreaming of the needs and concerns of women, men, girls and boys in all areas of sustainable development and poverty eradication.

184. In terms of climate change, the National Climate Change Policy (2020) states the need to generate data on gender to understand gender specific needs and impacts of climate change. **The National Adaptation Programme of Action on Climate Change** developed in 2013 recognized women, youth, and pastoralist communities as the most vulnerable to climate change. **The Nationally Determined Contributions (NDC)** of 2021 recognizes that women are at a disadvantage compared to men in all socio-economic and human development indicators and that the impact of climate change disproportionately affects women because of their lack of access and control to critical resources to adapt to changing climate conditions.

185. The assessment of the national policy framework and institutions indicates that there is a strong political will to promote gender equality in climate change. However, there are gaps in the institutional capacity of the government to turn this commitment into action. Additional details on gender policy framework can be found in Annex 8.

3.2 Key Institutions

186. The Federal Government of Somalia includes 9 Ministries with mandates in relation to adaptation to climate change : (i) Ministry of Environment and Climate Change, (ii) Ministry of Planning and International Cooperation, (iii) Ministry of Livestock, Forestry and Rangeland, (iv) Ministry of Commerce and Industry, (v) Ministry of Women and Human Rights Development, (vi) Ministry of Agriculture and Irrigation (vii) Ministry of Fisheries and Marine resources, (viii) Ministry of Youth and sports, (ix) Ministry of Labor and Social Affairs, (x) Ministry of Energy and Water.

187. The provisional constitution of the Federal Republic of Somalia, (2012) enshrines matters that relate to the environment, natural resource management, land and property, at both federal and state levels. In conclusion, despite the slow progress and enormous challenges of peace building and recovery of the nation and as part of strengthening global environmental governance; the Federal Government of Somalia

[64] https://www.undp.org/somalia/genderequality

took important steps to bring the country in line with global efforts to address environmental issues by ratifying multiple multilateral environmental agreements. The new Ministry of Environment has the mandate of formulation of federal level climate policies, coordination of activities by federal institutions, Federal Member States, local governments, international partners, and other stakeholders in the climate change. The Ministry also serves as UNFCCC National Focal point and the National Designated Authority (NDA) for Green Climate Fund.

188. The Ministry of Environment includes 9 departments namely: (i) Department of Environment Conservation, (ii) Department of Planning, (iii) Department of Forestry and Wildlife, (iv) Department of Climate Change, (v) Department of Administration and Finance, (vi) Department of Natural Resources, (vii) Department of ICT, (viii) Department of Legal Compliance, (ix) Department of Meteorology (Agency). Each of the department includes sub departments as follows: (i) **Environment conservation**, biodiversity, Chemicals, Desertification, Wetlands, Marine Ecosystems, (ii) **Planning**: Partnership, FMS, Science and Research, Capacity Building and M/E, (iii) **Forestry and Wildlife**, Forestry Protection and Management and Wildlife Protection and Management, (iv) **Climate Change**: Climate adaptation, Climate mitigation, Ozon Layer protection, (v) **Administration and Finance**, Finance, Human Resources, Procurement, Logistics and Archive, (vi) **Natural Resources**, Land resources, Water resources, Waste Management, GIS, Urban Landscape, (vii) **ICT**, Network solutions, communication, technical support, production, (viii) **Legal compliance**, legal service, ESIA, Environment audit, (ix) **Meteorology department** (Agency), prediction services, production services, environment monitoring, EWS.

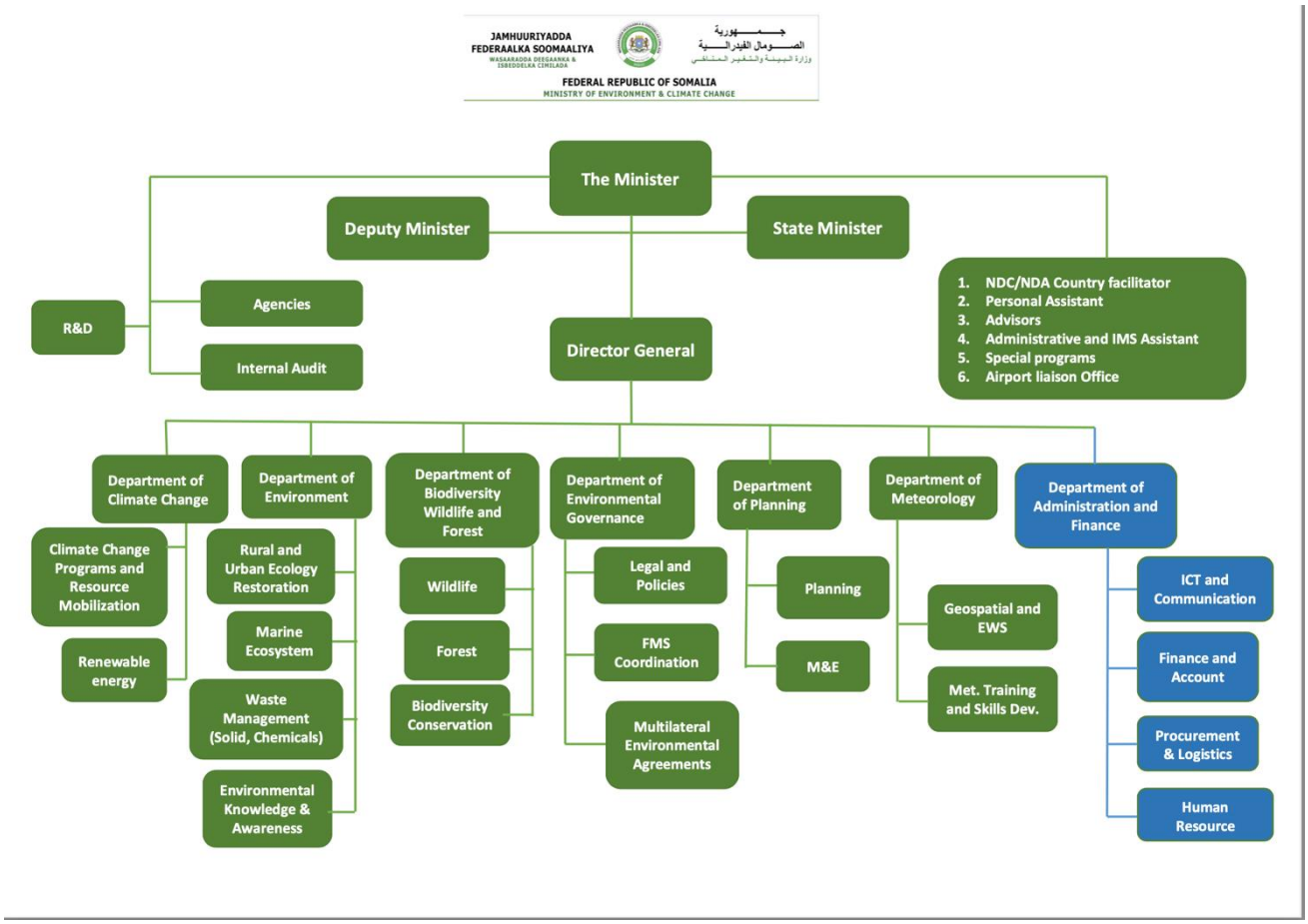


Figure 57: Ministry of Environment and Climate Change (MoECC) organigram

189. The **Federal Member State** government structure when it comes to Environment and Climate Change is uneven. There is : (i) a full fledged Ministry of Environment and Climate Change in Somaliland which is responsible for Rural development and environmental protection of the Country, (ii) In Puntland, a Ministry of Environment, Agriculture and Climate Change, (iii) the Ministry of Environment and Wildlife of South

Western State, (iv) the Ministry of Environment, Climate Change and Rural Development of Galmudug State, (v) the Ministry of Environment, Climate Change and Rural Development of Hirshabelle State and , (vi) the Ministry of Environment and Tourism of Jubaland State.

4 Baseline

4.1 Relevant projects and programmes

190. To date, donors or international organizations are more involved in Humanitarian than in Resilience and Development interventions due to the political instability prevailing over the last 30 years. Because of the protracted crises, donors' interventions are limited all over Somalia. Because of the absence of capacity of Government partners, donors partner with NGO's or even private organizations to implement projects.

191. IFAD is implementing a GEF 7 funding blending Somalia STAR allocation resources and LDC funds. The objective of the project is 'Enhancing the climate resilience of poor rural households in Somalia through sustainable natural resources management on multiple levels: improved water resources and rangelands management; eco-agriculture and climate-proof livelihoods; forest/habitat rehabilitation; improved governance and information systems for land degradation and biodiversity'.

192. Through its emergency operations, FAO has responded at local level to some of the aforementioned climate challenges. Canal repairs as well as rehabilitation of water infrastructure have been conducted all over Somalia but their sustainability was jeopardized because there was no consolidation of ditches with vegetal cover, or with forage arboreous species.

193. A non-exhaustive list of ongoing development projects and programs in Somalia is found below.

FAO Projects

194. Listed in Table 13 below are FAO projects that are relevant to the project.

Table 13 FAO Projects and Programmes in Somalia

Project / Programme title	Description	Synergy with FAO Project/Programme	Budget	Timeline
Climate adaptation for Resilient livelihoods (CadRe)	Main project outcomes include: (i) Increased capacity of inclusive government institutions in policy formulation, information and knowledge production, dissemination, and management and, (ii) Improved production, incomes and access to employment opportunities for women, men and young people	There is a geographic complementarity as well as a thematic complementarity particularly in building capacity of climate smart agriculture and access to market and provision of finance services. This project is a potential co-financing for the proposed project.	$8 million USD	2023 - 2025
Somalia Water and Land Information Management (SWALIM)[65]	Multi-phase information management program, technically managed by FAO. The program provides high quality water and land monitoring, sensing, data collection, and conservation for the purposes of sustainable development and management. Data and information are available for government, NGO, development agencies, and UN bodies engaged in assisting Somali communities.	The proposed project will complement the SWALIM project by implementing measures that utilize the data provided by the SWALIM project while complying with SWALIM guidance, procedures, and other best practice recommendations that promote water conservation and sustainable harvesting, as well as land conservation and rehabilitation.	€43.45 million	2001 – 2022 (but is ongoing as of 2024)[66]
Food Security and Nutrition Analysis Unit (FSNAU)[67]	FSNAU was a FAO multi-phase project, begun in 1994 as a World Food programme project to provide food surveillance after the Somali government fell to international donors, Somali decisionmakers, and researchers on the state of food security and livelihoods in Somalia. It was a multi-phase project until 2017, when it became a core unit of FAO Somalia.	FSNAU's data and food security, livelihood development recommendations will complement Outcome 2 and Outcome 3. Specifically, Output 2.1 and 2.2 directly interface with FNSAU's food monitoring work as Output 2.1 and 2.2 are focused on improving food security via climate-resilient seeds and growing awareness of extension services. Outcome 3 intersects with FSNAU's work with outputs 3.2 and 3.3, which		1994 - ongoing

[65] https://www.faoswalim.org/about-us/who-we-are
[66] https://www.faoswalim.org/about-us/project-phases/swalim-phase-vi
[67] https://fsnau.org/about-us

		concern climate policy coordination and information services. Lessons learned from FSNAU's work on capacity development will be incorporated in the coordination and awareness raising of resilience-promoting activities in outputs 3.2 and 3.3.		
Somalia Humanitarian Needs and Response Plan 2024	FAO direct assistance, co-led with the World Food Programme to reach an estimated 2.6 million Somalis with food and livelihood assistance after endearing the worst flood on record in Somalia after its worst drought on record.	Outputs 1.1, 1.2, 2.1, 2.2, and 2.3 intersects with FAO's direct assistance. Outputs 1.1 and 1.2 improve community climate capacity with improving irrigation and landscape management programs. Part of FAO's direct assistance is assisting community's restore livelihoods and ensure access to food, which Outputs 1.1 and 1.2 do with their supporting infrastructure that supports food production. Outputs 2.1 – 2.3 focus on the value chains – improving the facilities for storing harvest grains, feed for livestock, and assisting in developing financial assisting instruments. These activities complement the livelihood restoration and food security actions of FAO's direct assistance by increasing the number of communities reached and diversifying assistance offerings.	$120 million USD	2024 -
PHASE II - Joint Programme for Sustainable Charcoal Reduction and Alternative Livelihoods (PROSCAL)	The project aims at improving sustainable food production and contribute to the resilience of food systems in Somalia. The project includes the following outcomes: (i) Outcome 1: Increased agricultural production through improved productivity and improved community productive infrastructure such as irrigation canals, (ii) Outcome 2. Sustainable Value Chain development and strengthening of market linkages to promote income generation and, (iii) Outcome 3: Managing climatic and economic shocks to strengthen resilience.	There is a geographic complementarity as well as a thematic complementarity. This project will be implemented in Jubaland, SouthWest and Hirshabelle regions. Setting up VSLA associations or rehabilitating irrigation canals will complement the GCF project interventions.	$7.5 million USD	2023, In pipeline
Climate adaptation for Resilient livelihoods	Main project outcomes include: (i) Increased capacity of inclusive government institutions	There is a geographic complementarity as well as a thematic complementarity particularly in building	$8 million USD	2023 - 2025

(CadRe), EU funded project	in policy formulation, information and knowledge production, dissemination, and management and, (ii) Improved production, incomes and access to employment opportunities for women, men and young people	capacity of climate smart agriculture and access to market and provision of finance services.		
Reducing communities' vulnerability to Droughts and External shocks	The project includes 3 outcomes: (i) Outcome 1: Increased risk- informed climate smart production for households across agriculture, livestock and fisheries sectors, (ii) Outcome 2: Incomes increased through investment in value addition, access to markets, and access to savings and credit facilities and, (iii) Outcome 3: Improved nutrition among households	This project can support the project exit strategy/sustainability through Value Chain development activities under output 2.3.	$8.5 million USD	2022 – 2024
Food and Nutrition Security Resilience Programme	Jointly supported by FAO and the government of Netherlands the project includes activities in Somaliland, South Sudan and Sudan. In Somaliland the program focuses on the fodder value chain: FNS-REPRO proposed activities centred on the fodder value chain in Somaliland will increase the resilience of communities and their food security status by: **Increasing fodder and feed production and reducing production costs**, through capacity building, aggregation, increasing storage capacity and processing capacity, and achieving economies of scale; **Restoration of degraded rangelands and actions against desertification**, such as Prosopis management and community tree planting; **Strengthening the capacity of agro-pastoral and pastoral producer**	Lessons learned from this project integrated on board in outcomes 2 and 3 specifically for the development of the fodder value chain. The project will assess whether organizations who have benefited from assistance under REPRO can be further assisted to access finance and business development services under Outcome 3.	$28 million USD	2019-2024

	organizations to effectively participate in the feed/fodder value chain, and; ○ **Promoting good agriculture practices** to maximize crop yields and improve the nutrition quality of crop residues while diversifying food available for people.			

Somali Government Projects and Programs

Table 14: Somali government projects and programmes

Project / Programme title	Description	Implementing Agency	CN synergy with FAO Project/Programme	Budget	Timeline
Integrated Water Resources Management [68]		i) Directorate of Environment and Climate Change[69] ii) Ministry of Energy and Water Resources iii) UNDP iv) GEF		GEF: $ 8.8 million USD Cofinancing: $1.5 million USD	2019 – (Under Implementation)
National Readiness and Preparatory Support Programme (NRPSP)[70]	Developing a pipeline of projects for GCF funding and strengthening the national designated authority, in Somalia's case that is the Ministry for Environment and Climate Change	Ministry for Environment and Climate Change and GWPEA	The proposed project supports the NRPSPS primarily through Outcome 3, which focuses on strengthening Somalia's climate change adaptation policy		2021 -

GCF projects in Somalia

Table 15: Relevant GCF projects in Somalia

Project / Programme title	Description	Implementing Agency	CN synergy with Project/Programme	Budget	Timeline
FP211 Hardest-to-Reach (H2R)[71]	The H2R programme aims to provide affordable and green energy access to first-time users	Ministry of Environment	Output 2.3 of the proposed project can help develop financial instruments to assist producers access low carbon mini	GCF: $65 million USD	Approved 2023, waiting to be implemented

[68] https://moecc.gov.so/portfolio/iwrm-integrated-water-resource-management-2/; https://www.adaptation-undp.org/projects/support-integrated-water-resources-management-ensure-water-access-and-disaster-reduction

[69] Office of the Prime Minister

[70] https://moecc.gov.so/portfolio/gcf-readiness-in-somalia-2/

[71] https://www.greenclimate.fund/project/fp211

	in low-income populations in 16 countries in Africa. The programme will support off-grid solar companies to enter and grow in these underserved markets by providing flexible financing that matches the needs of the companies. The programme seeks to mobilise a blend of donor and private finance to deliver off-grid solar solutions to least developed communities via pay-as-you-go financing methods. The goal is to close a historically persistent energy gap in sub-Saharan countries, thereby contributing to a more just and inclusive energy systems transition.	and Climate Change	grids. Low carbon mini grids could be incorporated in this output or Output 1.2, which is concerned with improving water infrastructure but could incorporate deployment of mini grids supporting current activities.	Co-financing: $185 million USD	
FP204 Sustainable Renewables Risk Mitigation Initiative (SRMI) Facility (Phase 2 Resilience focus) [SRMI-Resilience][72]	SRMI-Resilience, the second phase of the SRMI Facility, aims to support the energy transition in nine developing countries by increasing access to affordable, reliable, modern, and sustainable electricity. The project will help these countries develop their energy transition programmes and uphold solid procurement processes needed to crowd-in private investments for future RE infrastructure.	Ministry of Environment and Climate Change	The project does not include any energy elements.	GCF: $160 million USD Co-financing: $959 million USD	2023 - 2035
FP177 Cooling Facility[73]	The Cooling Facility will be one of the world's first cooling-focused facilities with the aim to	Ministry of Environment	Tthe project currently does not contain any cooling components.	GCF: $157 million USD	2022 - 2032

[72] https://www.greenclimate.fund/project/fp204
[73] https://www.greenclimate.fund/project/fp177

	provide cooling solutions in nine countries, Somalia being one of them. It will focus on regulation and policy, technical assistance, and financing to address and help remove barriers to the development of sustainable cooling investments. Planned measures include financing for investments in innovative, climate-friendly cooling technologies and systems, and creating an enabling environment by strengthening institutional, policy and regulatory frameworks and building capacity of key stakeholders in technologies, business models and cooling project appraisal and implementation.	and Climate Change		Co-financing: $722.8 million USD	
GCF multi-country project: Program to Build Resilience and Food Security in the Horn of Africa, AfDB (under development)[74]	Main outputs to be funded by the GCF are : (i) under outcome **Strengthening Pastoral and Agropastoral Production Systems' Resilience to Climate Change,** (a) Supporting the Sustainable Management of Agropastoral Land, Improving and, (b) Access to Climate-smart Innovations, and Technologies, (ii) under outcome, **Supporting the**	Government of Somalia	This project will be implemented in transboundary areas in Southern, Central and Northwestern Somalia. There is no geographic duplication between the two projects. There is a thematic complementarity and particularly in relation to the access to climate information services and weather infrastructure and the support to sustainable management of agricultural land.	$150 million USD	2024 – Under implementation

[74] Djibouti, Ethiopia, Eritrea, Kenya, Somalia, Sudan, South Sudan and Uganda

	Development of Agribusiness, (a) Increasing access to digital advisory services, and markets , (b) Developing Entrepreneurship Skills and Increasing Access to Finance, (iii) under outcome **Strengthening Agropastoral Communities' Capacity to Adapt to Climate Change, (a)** Enhancing Climate Services and Weather Infrastructure, (b) Providing Climate Risk Finance and Insurance, (c) Strengthening Operational Capacity for Resilience.				

GEF Projects in Somalia

Table 16: GEF projects in Somalia

Project / Programme title	Description	Implementing Agency	CN synergy with Project/Programme	Budget	Timeline
Somalia - Kismayo-Baidoa Urban Water Supply and Sanitation Project	Improving access to safe and reliable water supply between the towns of Kismayo and Biadoa	African Development Bank	Output 1.2 directly intersects with the project, by further improving the water infrastructure in Lower Juba, where Kismayo and Baidoa are located. Since the AfDB project will be completed by the time this project's implementation starts, efforts will be made to build on their achievements and to complement works conducted in Kismayo.	7.5 million UA	2021 - 2024
Adaptive Agriculture and Rangeland	Enhancing the climate resilience of poor rural households in Somalia through sustainable natural resources	IFAD	There are direct linkages between the two projects, particularly in terms of climate-resilient agricultural value chains and the management of landscapes, water mobilization and conservation activities in	GEF: $17 million USD	2023 - 2028

Rehabilitation Project (A2R2)[75]	management on multiple levels: improved water resources and rangelands management; eco-agriculture and climate-proof livelihoods; forest/habitat rehabilitation; improved governance and information systems for land degradation and biodiversity.		Outputs 1.1 and 1.2. There is no geographical overlap, hence the two projects complement each other. Coordination between the two projects will be conducted through FAO.	Co-financing: $23.7 million USD	
National child project under the GEF Africa Mini-grids Program Somalia[76]	Supporting access to clean energy by increasing the financial viability, and promoting scaled-up commercial investment, in low carbon mini grids in Somalia, with a focus on cost reduction levers and innovative business models.	UNDP	Output 2.3 is focused on improving climate resilient value chains by increasing accessibility of producers to financial assistance for climate resilient technologies and services. Low carbon mini grids could be incorporated in this output or Output 1.2.	GEF: $3.27 million USD Co-financing: $171.45 million USD	2022 - 2027
Integrated Water Resources Management [77]	The project focuses on: • National policy reform and development of integrated water resource management (IWRM) • Capacity-building at the national,	UNDP	The proposed project builds on the outcomes of national policy reform in the water sector. Lesssons learned, particularly in terms of state and district capacity will be integrated into the project's design.	GEF: $ 8.8 million USD Cofinancing: $1.5 million USD	2019 – 2023

[75] https://www.thegef.org/projects-operations/projects/10792

[76] https://www.thegef.org/projects-operations/projects/10470

[77] https://moecc.gov.so/portfolio/iwrm-integrated-water-resource-management-2/; https://www.adaptation-undp.org/projects/support-integrated-water-resources-management-ensure-water-access-and-disaster-reduction

	state, district and local levels • Infrastructure for improved climate and water monitoring • Capture and sharing of best practices on IWRM.				

Other Projects

Table 17: Other pipelined projects with relevance

Project / Programme title	Description	Agency	Likely synergy with the proposed project	Lessons learned integrated	Budget	Timeline
	This project aims at enhancing the climate resilience of poor rural households in Somalia through sustainable natural resources management on multiple levels: improved water resources and rangelands management; eco-agriculture and climate-proof livelihoods; forest/habitat rehabilitation; improved governance and information systems for land degradation and biodiversity	IFAD	The Full proposal is being submitted to the GEF Secretariat for Approval. Geographic complementary with the proposed project	Project implementation not started.	$17 million USD	5 years
Rural Livelihoods Resilience	The Rural Livelihoods Resilience Programme supports smallholder farmers to restore their livelihoods, increase their	IFAD	The project supports the Livelihoods Programme with the community capacity building activities in Outputs 1.1, 1.2, 2.1, 2.2, and 2.3. Landscape and water	Project implementation at early stages	IFAD: $11.6 million USD	2023 – 2030 (waiting to be

Programme (RLRP)[78]	productivity and income, and become resilient to multiple shocks through climate-resilient community-led agriculture and infrastructure development.		management practices will support community capacity to overcome drought and flood impacts, while Outputs 2.1 – 2.2 support development of climate-adapted agricultural inputs while raising awareness of extension services that can support accessibility, while Output 2.3 supports financing for climate adapted inputs. These activities will increase the impact of the RLRP, increasing community capacity.		Co-financing: $5 million USD Financing Gap: $13.92 million USD	implemented)
Joint Programme for Sustainable Charcoal Reduction and Alternative Livelihoods (PROSCAL) (1st phase completed, 2nd phase under preparation)	The PROSCAL program promotes energy security and more resilient livelihoods through a gradual reduction of unsustainable charcoal production, trade and use. Its objectives are: (i) to mobilize key stakeholders in the region and build institutional capacity among government entities across Somalia for the effective monitoring and enforcement of the charcoal trade ban, the development of an enabling policy environment for energy security and natural resources management, (ii) to support the development of alternative energy resources, (iii) to facilitate – for stakeholders in the charcoal value chain – transition towards livelihood options that are sustainable, reliable and more profitable than charcoal	UNDP, FAO, UNEP	Opportunities to be leveraged by the project are: (i) Formulation and implementation of the Charcoal policy at the national, regional and local level (main result of PROSCAL), (ii) Awareness raising of the population on testing innovative action solutions and reducing the exploitation of the rangeland biomass and illicit export of charcoal	Capacity building and the establishment of nursery groups in tree nursery management combined with the construction of nursery structures under the FAO component led to the production of a variety of tree seedlings of socio-economic importance and in supporting efforts towards land reclamation through tree planting leading to the improvement of environmental security. The adoption of an environment-friendly sustainable source of energy, comprising fuel-efficient stoves, alternatives to charcoal, and solar solutions, aims to reduce the amount of	$10,5 USD Million	2016 - 2023

[78] https://www.ifad.org/en/web/operations/w/country/somalia#anchor-projects_and_programmes

	production and, (iv) to start reforestation and afforestation throughout the country for the rehabilitation of degraded lands			life tress burned for household cooking in Somalia, reduce deforestation, as well as household air pollution to protect the health of women and young children while creating employment. The environmental problems addressed through these integrated alternative energy solutions to charcoal use are very real and urgent ones.		
Water for Agro-Pastoral productivity and resilience II	The project includes 4 main components : (i) Component 1. Support the Development of Multiple Use Water Sources ((ii) Component 2. : Development of Agriculture and Livestock Services around Water Points (iii) Component 3. Development of Environmental Catchment Services in Project Areas, (iv) Project Management, Community Development and Enhancing Livelihoods Planning	World Bank	There is a geographic complementarity with this project as well as a thematic complementarity. Thematic complementarity lies with Soil and Land Management activities as well as with water management. This project is a potential co-financing for the proposed project. This project is implemented in Puntland, Galmudug, Hirshabelle, Southwest State, Jubbaland and Somaliland	Implementation has just started	$70 million USD	Under implementation
The Groundwater for resilience is a regional project funded	The development objective of the project is to increase the sustainable access and management of groundwater in the Horn of Africa's borderlands. Main components include: (i) Component 1. Delivery of inclusive groundwater services to priority areas. (US$293 million IDA equivalent), (ii) Component 2.	World Bank, Kenya, Somalia, and Ethiopia	Target regions in Somalia are : Gedo, Bay, Juba Hoose, Bakool, Hiraan, Galgaduud, Mudug, Nugaal, Bari, Sool, Sanaag, Buuhoodle, Burco, Hargeyza, Gebiley, Borama and Zeylac. The project is implemented in some of the GCF project target areas : Nugaal, Galgudud, Mudug, Gebiley. Component 1 will complement the activities planned in the GCF project as activities include : (i)	Under implementation	$455 million USD	Under implementation

	Generating groundwater information and strengthening regional and national groundwater institutions. (US$62 million IDA equivalent) , (iii) Component 3. Support for project management, knowledge, and operations (US$30 million IDA equivalent) and, (iv) Component 4. Contingent Emergency Response Component .		Small-scale irrigation infrastructure to promote CSA practices, contributing to soil conservation and aquifer recharge and, (ii) Rehabilitation or construction of new, climate resilient groundwater infrastructure for human consumption and livestock			
Acceleratin g Sustainable and Clean Energy Access Transforma tion (ASCEAT) in SOMALIA	The objective of the Accelerating Sustainable and Clean Energy Access Transformation Program using the Multiphase Programmatic Approach Project, to which participating countries and regional institutions will contribute, is to increase access to sustainable and clean energy in Eastern and Southern African countries.	World Bank	ASCEAT is implemented via five components and the fourth component, knowledge exchange and consumer engagement, is where the project can intersect. With the policy development activities in Outputs 3.2 and the community engagement in Outputs 2.1, exploration of including a clean energy awareness component to the project can be explored		$123.5 million USD	2024 - 2028
Somalia Urban Resilience Project phase II	To strengthen public service delivery capacity of local governments, increase access to climate-resilient urban infrastructure and services, and to provide immediate and effective response to an eligible crisis or emergency in selected areas.	World Bank	Activities in Outputs 3.1 – 3.3. intersect with the Urban Resilience Project, Phase II, as they are directly engaged in increasing government technical capacity, and Outputs 1.2 implement infrastructure. The project will support and increase the impact of the Urban Resilience Project by targeting rural communities as well.		$50 million USD	2023 –
Climate Risk and Early Warning Systems (CREWS)	CREWS aims to improve the capacity development for staff in priority technical areas (observation, data management and analysis, meteorological and hydrological forecasting), strengthen the development and	UNDR R, WMO and the World Bank	Linkages and synergies will be built through the MoECC and SWALIM efforts built into this project. In particular the proposed project will build on existing climate modeling and observation infrastructure.			ongoing

	delivery of services to the priority farming and pastoralist communities and support technical design of minimum basic observing, data management, forecasting and service delivery systems.					

4.2 Summary of Lessons Learned

195. Based on the experiences from various programs and projects in Somalia since the war, a number of lessons learned have been integrated into this design. In particular, lessons from past FAO projects, particularly those working in project regions and with project stakeholders, have inspired the design of specific activities. A review of the Country Programme also generated a number of management-relevant lessons that have all been take into consideration when developing the intervention strategies and management approaches for this project[79].

196. **Community Engagement and Local Ownership:** Ensuring the active participation and engagement of local communities is crucial for the success of any project. Projects should be designed with substantial input from the local population, which not only ensures that interventions are culturally appropriate and meet the actual needs of the community but also fosters a sense of ownership among the participants, enhancing sustainability. Involving local leaders and community-based organizations can help in aligning project objectives with local priorities and increase the likelihood of continued support and maintenance after the project ends. Regional consultations have shown that lack of community engagement at design stage is one of the main barrier for project implementation.

197. **Integrated Approach to Resilience Building**: Projects should adopt an integrated approach that addresses multiple aspects of resilience to climate change simultaneously. This includes combining efforts in economic development, environmental sustainability, and social inclusion. For instance, projects that focus on agricultural development should integrate water management, crop diversification, and market access to ensure comprehensive development. This approach helps in creating synergies between different sectors and enhances the overall impact on the community's resilience to shocks and stresses.

198. **Capacity Building and Skills Training**: Strengthening the capacities of individuals, institutions, and communities is fundamental. This involves not only training local people in specific skills that are directly related to the project (such as sustainable agricultural techniques or water conservation methods) but also in broader skills such as project management, leadership, and governance. Enhancing local capacities ensures that communities can sustain and scale up project benefits on their own, and better manage future challenges.

199. **Rehabilitation of infrastructure should foster a sense of ownership and future sustainability of the infrastructures rehabilitated**. The infrastructures should be planned with the communities, taking care to highlight an exit strategy in which communities can be autonomous. Consultations should State Government Ministry responsible for the concerned sector, Local Authority in the Districts where the infrastructures are located and discussions with the Village communities where the infrastructure are to be rehabilitated. Training on the use, operations and maintenance of the rehabilitated infrastructures should be inbuild as part of the rehabilitation process.

200. **Delivery mechanisms vary according to location and community engagement**: Infrastructures and activities within close reach of the settlements are easily rehabilitated by the community living within the settlement areas. Infrastructures and activities away from settlement areas are best done through contracting out. Wherever possible, local labor should be used (local enterprises should be encouraged to recruit locally), such as in cash for work programs. A balancing of the two modes of rehabilitation is necessary for the rehabilitation.

201. **Early Warning systems must be built with the following elements in mind**: active and ongoing coordination with government agencies based on agreed roles and responsibilities and clear, common

[79] Evaluation of FAO Country portfolio in Somalia, 2018-2022, Draft available in 2024.

Standard Operating Procedures. Efforts should be made to develop communication mechanisms that reach the last mile users through various channels, building on baseline assessments of connectivity and cost (e.g. mobile phone, email, print, radio). Media such as radio and television are the best channels to reach communities at risk. Observing infrastructure upstream and downstream should be upgraded to allow for early and real-time warning.

202. **Care should be taken to mitigate the inherent risk for beneficiaries to adopt the practices promoted by the project to maximize adoption rates.** The implied change in behavior and maintaining these practices is normally mitigated by conducting sensitization exercises and encouraging peer-to-peer knowledge transfer, and by showcasing visible gains to communities. Ensuring proper demonstration and communication of concrete, relevant benefits is key to promoting change and sustainability for project outputs.

203. **Cash for work and blended approaches can be useful in mitigating risks for farmers in the short term.** FAO has a longstanding experience in managing cash for work and food for work projects and programs in Somalia. The Cash+ approach, i.e. combining unconditional cash transfers with productive inputs, assets and/or technical training, can support households' dietary diversity and food security and reduce households' need to resort to negative coping strategies. Nutrition-sensitive cash+ interventions can be tailored to account for different types of livelihood zones and have a significant potential for upscale. The "plus" in FAO's cash+ programming ensures families not only have cash in their pockets, but also the inputs, assets, training and support they need to farm, herd, fish and diversify their livelihoods.

204. **Gender-based interventions should be conceived in a way that facilitates meaningful participation of women, seeking incremental yet transformational change.** Agriculture based resilience interventions have the potential to leverage deep social transformation in gender relations if gender relations are integrated into the intervention. Gender mainstreaming must evolve from the simple inclusion of women to facilitating their participation in meaningful, decision-making roles, allowing them increased control over assets. Furthermore, in areas where conflict has particularly affected women,care should be taken to avoid creating situations that could create new risk, including Sexual Exploitation, Abuse or Harassment or Gender Based Violence that could arise from the appearance of new assets, new infrastructure, settlements or long periods of work with non-local labourers.

205. These elements are derived from the analysis of past initiatives, recognizing the complex interplay of social, economic, and environmental factors that influence project success in the challenging context of Somalia. Implementing these elements can help in creating more sustainable and effective interventions moving forward.

5 Theory of change

5.1 Threats/problems (problem tree)

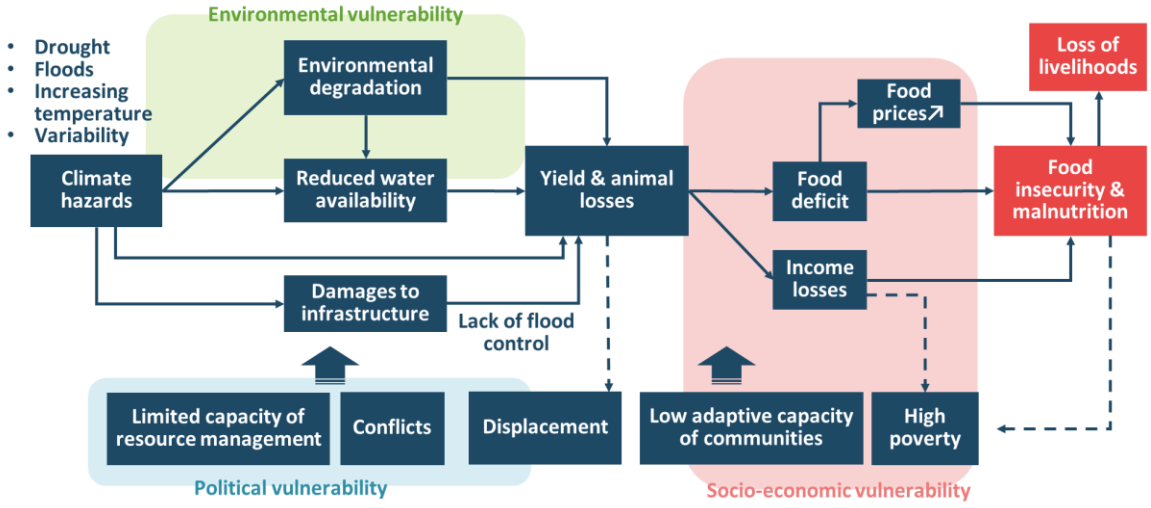
206. Somalia has witnessed significant climatic shifts and extreme weather events from 1981 to 2010, with increasing impacts on its communities and ecosystems. During this period, maximum temperatures rose annually by 0.005 to 0.055°C, accumulating to a total increase of 0.15-1.65°C. Although annual rainfall trends differ across regions, areas such as Middle and Lower Juba, Lower Shebelle, and Bay have seen reductions up to 25% alongside greater variability. Notably, the frequency of heavy rainfall days and extremely hot days has also changed, with some regions experiencing more frequent events, thereby stressing the local environment and communities.

207. Looking forward, these climatic trends are expected to persist. Projections under Representative Concentration Pathways (RCP) 2.6 and 8.5 suggest both mean maximum and minimum temperatures will continue to rise through the 21st century, with extreme temperature days becoming more common, especially near the Ethiopian border. Rainfall patterns are also expected to alter, with coastal areas seeing potential increases and inland areas experiencing decreases in annual precipitation.

208. The implications of these changes are profound for agricultural and ecological systems. The frequency of agricultural droughts has risen and is projected to continue doing so, particularly affecting the Gu (March-June) and Deyr (October-December) seasons. Additionally, increased flood risks during the Gu season threaten to exacerbate challenges, including displacement and damage to property and livelihoods.

209. The economic costs of these climatic events are staggering. For instance, the 2016-2017 drought resulted in estimated losses of approximately $2.23 billion. Similarly, frequent floods have led to significant agricultural losses and displacement of communities. Crop yields are anticipated to decline under ongoing climatic stresses, with maize and sorghum yields expected to decrease by up to 40% by 2050 in some regions.

210. Amid these challenges, Somalia faces significant barriers to effective climate adaptation. Limited literacy, access to information, and financial resources hinder the ability of communities to respond to and prepare for climatic changes.



5.1.1 Adaptation needs

211. The adaptation needs in Somalia are:

212. **Access to climate-smart technologies:** farmers need access to climate-smart technologies such as, drought and flood tolerant forage and crop varieties, to enhance productivity and mitigate climate change impacts. Diversification of livelihoods, particularly for those practicing rainfed cropping and pastoralism, is a key strategy to enhance resilience.

213. **Capacity building and knowledge transfer:** providing training programs, for example, Farmer Field Schools, and extension services can enhance farmers' technical knowledge and skills in dairy management. This includes training on climate smart practices, breeding strategies, disease control measures, and effective use of water resources.

214. **Financial and market support**: ensuring access to affordable finance and micro-credit services enables communities to invest in productive assets, infrastructure development, and value addition. Additionally, supporting farmers in accessing fair and transparent markets and promoting value chain linkages can enhance their incomes and improve market resilience, both locally and internationally.

215. **Strengthening infrastructure:** investing in irrigation and rural infrastructure, such as improved dykes, water harvesting infrastructure, road networks, electricity supply, and milk collection and processing facilities, can improve irrigation efficiency and reduce transportation costs, post-harvest losses, and improve overall market access for farmers.

216. **Climate information and early warning systems:** developing and disseminating climate information, early warning systems, and advisory services can assist farmers and pastoralists in making informed decisions related to range management, choice of crop/livestock varieties, and disease control. This helps communities anticipate and adapt to climate-related risks. Market information systems form a key component of these early warning systems.

217. **Policy support and institutional strengthening:** developing supportive policies and regulations that address sector specific needs, as well as strengthening the institutions involved in research, extension, and market development are crucial for enabling a conducive environment for agriculture and livestock production to thrive. Collaboration between governments, research institutions, financial institutions, and development partners is required to address the identified key barriers and adaptation needs.

218. Adaptation needs closely relate to maladaptation risks due to the interlinkages between resources, capacities, and coordination which can have significant impacts on adaptation practices and their outcomes. Maladaptation, as a concept, generally refers to adaptation initiatives that cause additional vulnerabilities instead of limiting them (Chi et al. 2021). Even though initiatives can foster adaptation in the short term, there is always a risk that they affect territories, sectors, and peoples' long-term capacity to manage climate change impacts. Initiatives falling under the maladaptation umbrella may not only waste resources but could also aggravate the consequences of climate change. The responses could either be infrastructural, institutional, or behavioural and their impacts would range from being ineffective, adversely affecting others, making the targeted communities more vulnerable reversibly or irreversibly (Schipper, 2020).

219. An example of maladaptation in Somalia has been observed in the traditional flood recess agriculture (Dhasheeg) in the Jubba Valley. The majority of Jubba Valley farmers did not irrigate their farmland and thus fully rely on rainfall and seasonal flooding to meet their water needs. Agricultural development projects ignored the existing local knowledge on the use, management, and tenure of this lands. As a result, conflicts arose over these valuable resources (Besteman, 1996). To avoid this, development projects should start from local social characteristics and cultural values that could have an influence on risks and environmental dynamics, consider and develop local skills and knowledge related to climate-related hazards and the environment, besides building new skills that the community is capable of acquiring (Magnan, 2014).

220. Other possible areas to bear in mind for maladaptation in this project are (i) introduction of non-native crops or livestock in an attempt to diversify agricultural production or increase yields (ii) overuse of groundwater in regions where surface water sources are scarce. Over-extraction of groundwater without adequate management can lead to depletion of aquifers, saltwater intrusion, and land subsidence, further exacerbating water scarcity and environmental degradation and (iii) infrastructure development without considering climate risks. Inadequate consideration of climate risks in infrastructure planning and design can lead to increased vulnerability to climate impacts and higher costs for repair and reconstruction in the long run.

5.2 Barriers

221. To effectively reduce the vulnerability of Somali communities, the project must remove a series of interconnected barriers:

222. **Barrier 1: Lack of panning capacity and weak local governance have prevented the implementation of climate resilient natural resources management at the landscape level.**

223. Although there is knowledge of the links between environmental degradation, climate vulnerability and poverty, efforts have not yet been made to create democratic decentralized management systems that fully consider the role played by healthy landscapes in local development. Prolonged periods of civil conflict have severely disrupted governance structures and the rule of law. The lack of stable and effective institutions has made it difficult to implement comprehensive land use policies and plans. The focus thus far has been on restoring basic governance and security institutions.

224. Effective governance is also hindered by unclear land tenure rights and land ownership, frequent disputes, and the absence of a widely recognized and enforced legal system for land registration. There is also – due to the weakness of the state, a lack of enforcement of land use and environmental regulations.

225. Due to the clan-based social structure in Somalia, land use planning must consider local dynamics and conflicts. Effective engagement with communities is necessary to ensure that land use plans are acceptable and beneficial to local stakeholders, but such engagement is often limited by lack of trust in authorities and insufficient mechanisms for public participation.

226. A patriarchal culture prevails in Somalia, and women are often excluded from political decision-making at national and community levels. At the community level, in rural areas, most decisions are made by clan-based committees that are entirely composed of men, excluding women.[34]

227. Despite these challenges, there are ongoing efforts to improve land use planning in Somalia. International organizations and governmental bodies are working to build local capacities, develop better governance structures, and implement projects aimed at sustainable land management and environmental conservation. However, significant efforts are still needed to create a robust framework for land use planning that can support Somalia's resilient development and environmental sustainability. As State structures are recovering, developing integrated landscape-level natural resource management approaches will be crucial, both as a way of promoting climate-resilient sustainable development and as a way of preventing further conflict.

228. **Barrier 2: Local communities do not yet have the technical or institutional capacity to fully participate in the management and allocation of natural resources, particularly water and land, which are in scarce supply already.** Locally, there is limited localized knowledge and data on the impacts of landscape degradation on development. Poverty, conflict and food insecurity have led local communities towards short-term, maladapted, and unproductive practices that further exacerbate this degradation. Land management practices are predominantly guided by communal ownership and clan-based governance systems, which are integral to the pastoral and agro-pastoral ways of life. These practices, deeply rooted in the customary law known as "xeer," enable collective use of land for grazing, farming, and settlement, supporting the mobility essential for pastoral communities. For example, clans share access to crucial resources such as water points and grazing areas, which are managed through verbal agreements and respected within the community. This system facilitates the nomadic lifestyle, allowing pastoralists to traverse large areas in search of pasture and water following seasonal patterns, which is vital in the arid and semi-arid regions of Somalia.

229. Furthermore, educational attainment among women is very low. Overall, 75% of women aged 15–49 have not attended any formal schooling. This makes them more likely to be excluded from traditional

top-down literacy-based extension services, that tend to be oriented towards men due to land ownership and decision-making structures in families and communities.

230. Traditional practices are increasingly maladapted to current and future climate conditions. Degraded and climate vulnerable landscapes fail to provide the basic ecological services – whether productive or protective, and this is even further exacerbated by the destruction – after years of conflict – of main infrastructure assets, especially water infrastructure.

231. In response, there is a gradual push to integrate traditional management practices with more modern, climate informed, land use planning. However, the transition towards sustainable approaches to environmental stewardship that aligns with both traditional and modern management cultures requires long-term efforts and capacity at local level.

232. **Barrier 3: There has, to date, been insufficient dissemination of technology on climate resilient agriculture and livestock production**. Local communities do not have access to practices and technologies that could make their livelihoods more resilient, and do not have access to climate information services. While it is known that a transition from pastoralism to agro-pastoralism would be more resilient and would provide increased avenues for development, there has yet been any significant effort to assist local population in effecting this transition. Most poor households continue to rely on subsistence agriculture and pastoralism. The use of rain-fed agriculture with minimal mechanization and reliance on natural rainfall limits crop yields. Access to modern irrigation systems is scarce. This lack of reliable water sources for irrigation directly affects the productivity and sustainability of agricultural practices. Additionally, the limited access to agricultural processing facilities and effective post-harvest storage solutions exacerbates the loss of produce due to spoilage and pests. Market access is also hindered by poor infrastructure and transportation, reducing the ability of farmers to sell their crops at fair prices and further invest in improving their agricultural practices.

233. Similarly, pastoralist households face significant challenges due to unsustainable grazing practices and limited access to water for their livestock. Overgrazing is common, driven by the need to maximize short-term returns from limited land resources, which contributes to land degradation and reduces the land's long-term viability for supporting livestock. The scarcity of water points further exacerbates these challenges, as pastoralists have to travel long distances to access water, putting additional stress on both the animals and the pastoralists. Moreover, there is a lack of facilities for processing livestock products, such as milk, which limits the economic benefits pastoralists can derive from their herds. The absence of proper storage facilities for meat and dairy products leads to significant losses and reduced profitability. The difficulties in accessing markets, compounded by the lack of preservation technologies, mean that pastoralists often cannot capitalize fully on their livestock's economic potential, perpetuating a cycle of poverty and unsustainable resource use.

234. Limited access to technologies is also particularly exacerbated among women, whose access to agriculture extension services is limited due to time and mobility constraints as a result of unpaid care work responsibilities and social norms. Women often don’t participate in technical and vocational training as they tend to be organized far away from their village. Low levels of education and literacy among women are also a constraint on their participation.

235. **Barrier 4: local communities and producers have very limited access to finance and markets**, perpetuating the trend in which rural poor bear the brunt of the risk in transitioning towards climate resilient practices. Rural Finance Institutions themselves lack the capacity to develop or deploy finance in ways that would support climate resilient livelihoods and value chains, which prevents the emergence of an agri-food private sector that could act as an engine for socio-economic development locally. Formal financial institutions are scarce in rural areas, and where available, they often require collateral, formal documentation, and proof of stable income—conditions that many rural households

cannot meet. According to a report by the FAO[80], these requirements, coupled with the inherent risks of agriculture in a region plagued by environmental and socio-political instability, severely restrict access to traditional banking services. Consequently, many in these communities turn to informal sources of credit, which can carry prohibitively high interest rates, exacerbating the cycle of poverty and limiting investment in sustainable agricultural practices.

236. Furthermore, women's entrepreneurship is constrained by low levels of literacy and access to support services and networks, limited mobility and free time, as well as limited access to and control over land and other assets that might support access to finance. Women also have limited access to financial literacy, vocational, and business skills training. As a result, their main source of capital to start their businesses is remittance. Most women entrepreneurs are engaged in petty trading ventures as a survivalist-oriented business activity.

237. However, there are signs of progress with the introduction of mobile banking and microfinance initiatives aimed at increasing financial inclusion. Organizations like IFAD have been active in promoting mobile money solutions, which have seen a rise in popularity among rural populations. Mobile connectivity in Somalia has been increasing. The growth in mobile internet users suggests a potential to improve agricultural practices and market access for rural communities by providing real-time information on weather, market prices, and innovative farming techniques. This connectivity can play a crucial role in enhancing food security in rural areas, but it has not yet been leveraged for the transmission of climate information or market information.

238. Additionally, village savings and loan associations (VSLAs) have been established, offering a community-based approach to savings and lending that provides members with more accessible and flexible financial options. These initiatives represent critical steps toward broader financial inclusion, offering hope for economic improvement and increased resilience against the challenges facing rural Somalia. However, most of the small agri-food businesses are micro-enterprises that operate with little capital in the informal market. Adding to this, remoteness and isolation prevent the addition of value to most commodities, and the degradation of rural markets and roads prevents the circulation of goods that would enable local communities to cope during climate extremes.

239. **Barrier 5: The government's support to natural resources planning and climate adaptation is limited by its weak technical capacity, and by the bias towards crisis responses of recent years**. Somalia struggles with a shortage of trained professionals in urban planning and environmental management, as well as a lack of reliable data on land characteristics, usage, and ownership. Climate and environmental information services are not yet available in all States. The observational network for weather and climate data is underdeveloped, with insufficient coverage of automated weather stations and manual rainfall gauges. There are significant gaps in historical and real-time climate data, which hinder accurate forecasting and modelling. As with many government services, there is a shortage of trained meteorologists and technicians, which limits the ability to analyze and disseminate climate data effectively. Dissemination of climate information to rural and remote communities is challenging, affecting the timely delivery of weather forecasts and advisories.

240. Records of land ownership and usage are incomplete and often outdated, making it difficult to enforce land use policies and resolve disputes. In addition, the legal frameworks governing land registration and property rights are weak and not uniformly enforced across different regions. There is a significant lack of local expertise in geographic information systems (GIS) and land surveying, which are essential for modern land management practices. There has been some progress in establishing flood and drought early warning systems through projects like the FAO-SWALIM (Somalia Water and

[80] https://www.fao.org/policy-support/policy-themes/access-to-finance/en/

Land Information Management). These systems help monitor hydrological data but need further expansion and enhancement to cover more areas and provide more precise forecasts.

241. **Barrier 6: Lack of Climate Information Services impede climate resilient agriculture.** Access to climate information services among last mile users is severely limited, posing significant challenges for managing the impacts of climate variability and change. Despite the critical need for accurate climate forecasts, early warning systems, and agricultural extension services to mitigate these impacts, the infrastructure and systems to provide such services are underdeveloped. First, there is a lack of necessary hydro-agro-climate infrastructure and material capacity to gather, analyse and disseminate climate information effectively. This includes insufficient weather stations, inadequate technology for data collection and analysis, and poor telecommunications infrastructure that hampers the flow of information. Years of civil conflict and instability have devastated Somalia's institutional capacities. The absence of a strong, centralized government for long periods has made it difficult to implement coordinated, nationwide programs including those for climate monitoring and information dissemination. Even where data is available, the dissemination tools are often not sophisticated enough to reach all segments of the population, particularly in rural or remote areas. Many regions lack access to the internet and other digital communication technologies that could facilitate the wider distribution of climate information. Financial resources for climate services have been limited. Investments in climate information systems are often deprioritized in favor of immediate humanitarian needs arising from ongoing conflicts and recurring natural disasters.

242. In addition, there are barriers to women's access to information. Ninety-three percent of women in Somalia do not access any form of media at least once a week. Media access is especially low among the poorest category of women, due to low literacy rates and limited mobility, however opportunities are arising thanks to mobile connectivity: 67% of rural women and 59% of women living in nomadic communities own a mobile phone.

5.3 ToC - Impact Statement

243. The project is premised on the following theory of change:

- IF local communities' capacity is strengthened to implement sustainable landscape management and climate resilient agriculture and an institutional enabling environment is improved,
- THEN the resilience of local communities and ecosystems to climate change will be enhanced,

244. BECAUSE livelihoods will be derived from sustainably managed landscapes and adapted climate resilient agriculture and supported by adequate enabling environment.In order to shift from subsistence agriculture to resilient livelihoods, a number of elements must be in place. This includes first the restoration of the landscapes (land, water and vegetation) to productive states that can also withstand the forthcoming climate changes. To this end the project will mobilize both traditional and modern nature-based adaptation measures at the landscape level, that will in turn feed into agricultural productivity and rural livelihoods.

245. The project will also drastically increase the dissemination of climate resilient agriculture practices in line with current livelihoods methods (agro-pastoralism and crop farming) to ensure local communities are equipped to practice agriculture in resilient manners. This should be supported by an increased dissemination of adequate climate information. Therefore, the project will work with governments at local, State and Federal levels to ensure that their level of capacity for extension, climate information and land governance are strengthened.

246. The overall yield increase from the discussed interventions can be significant, ranging broadly from 20-50% depending on the specific context and effectiveness of implementation. These interventions not only enhance yields but also contribute to long-term sustainability, resilience to climate change, and improved livelihoods for farming communities. Paul et al. (2020)[81] demonstrated that integrating improved forage technologies with food crops can result in a 60% increase in grain and stover yields. A study by Enfors et al. 2011[82] showed increase of between 17-41% in maize yields due to conservation agriculture whilst a yield increase of 4 to 19% can be achieved by use of drought resistant maize variety[83].

247. Folberth et. al (2013)[84] further emphasizes the potential for yield increases through improved nutrient supply, irrigation, and cultivars. It was also demonstrated that conservation agriculture and use of crop residue as a cover crop in the long run improved soil water storage efficiency and grain yields[85]. Agroforestry systems increase crop yield while maintaining delivery of regulating/maintenance ecosystem services. Agroforestry increased crop yield for trials conducted on both farms and research stations in 77 and 68% of all cases[86].

5.4 Targeting

5.4.1.1 Selection of project sites

248. The project sites were selected in consultation with the Somali and State governments based on detailed climate and socio-economic vulnerability analysis during the concept note stage. The climate risk was computed by province (spatial aggregation) using the CRTB for the baseline period. The FAO Climate Risk Toolbox – CRTB, hosted on the FAO Hand-in-Hand Geospatial Platform, was developed by the FAO Risks team (FAO Office of Climate Change, Biodiversity and Environment – OCB), in collaboration with the FAO AgroInformatics team (FAO Digitalization and Informatics – CSI Division) as an open-access resource to mainstream climate-resilience at early design stages of agricultural investment projects, policy plans, and decision-making processes worldwide, through the identification of climate risk hotspots, the vulnerability and adaptive capacity of agricultural systems and targeted communities, in order to ensure early incorporation of measures for project and policy interventions to manage and modulate climate risks as well as recommendations to promote agricultural transformation and adaptation to climate change[87].

249. The CRTB included a series of guiding questions, each of them associated with climate-related geospatial information and data which allow the production of climate risk maps. The different components of risk (hazard, exposure, and vulnerability) were aggregated based on the latest IPCC

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[81] Paul, B. K., Koge, J., Maass, B. L., Notenbaert, A., Peters, M., Groot, J. C., & Tittonell, P. (2020). Tropical forage technologies can deliver multiple benefits in Sub-Saharan Africa. A meta-analysis. *Agronomy for Sustainable Development*, *40*(4), 22.

[82] Enfors, E., Barron, J., Makurira, H., Rockström, J., & Tumbo, S. (2011). Yield and soil system changes from conservation tillage in dryland farming: A case study from North Eastern Tanzania. *Agricultural Water Management*, *98*(11), 1687-1695.

[83] Mwangi J, N., W. Catherine, M., Shem, K., John, N., & Fergus, S. (2020). Rainfall variability, soil heterogeneity, and role of trees in influencing maize productivity—the case from an on-station agroforestry experiment in semi-arid Kenya. Forests, Trees and Livelihoods, 29(1), 34-52.

[84] Folberth, C., Yang, H., Gaiser, T., Abbaspour, K. C., & Schulin, R. (2013). Modeling maize yield responses to improvement in nutrient, water and cultivar inputs in sub-Saharan Africa. *Agricultural Systems*, *119*, 22-34.

[85] Unger, P. W., Schomberg, H. H., Dao, T. H., & Jones, O. R. (1997). Tillage and crop residue management practices for sustainable dryland farming systems. Annals of Arid Zone, 36(3).

[86] Kuyah, S., Whitney, C. W., Jonsson, M., Sileshi, G. W., Öborn, I., Muthuri, C. W., & Luedeling, E. (2019). Agroforestry delivers a win-win solution for ecosystem services in sub-Saharan Africa. A meta-analysis. Agronomy for Sustainable Development, 39, 1-18.

87 FAO. 2021a. Mainstreaming climate risk management into FAO programming. Rome. https://www.fao.org/documents/card/en/c/CB2669EN/

definition of risk[88], and modulated by the adaptive capacity component. As a result, the CRTB produced a set of maps that considered the overall climate risk for the baseline period, as well as near-term (2021-40) and mid-term scenarios (2041-60), respectively for a low emission scenario (SSP1-2.6) and a high emission scenario (SSP5-8.5).

250. *Hazard* referred to the occurrence of meteorological (e.g., extreme temperature), climatological (e.g., drought), or hydrological (e.g., flood) events or trends. Hazard layers include extreme temperatures and precipitation, ocean temperature change and acidification, as well as drought, flooding, rainfall-triggered landslides, and wildfire factors, mainly at 25km resolution. Data for the hazard layers was primarily retrieved from the IPCC interactive atlas which hosts daily climate data from 1981 to 2010 and climate projections for SSP1-2.6 and SSP5.8.5.

251. Human and natural *exposure* to climate hazards was determined by the climate zone, the geographical characteristics of targeted areas, the population density, the agricultural and other socio-economic activities undertaken. The exposure layers assessed the presence of agro-ecological systems, such as crops, shrubs, forests, grassland, mangroves, fishery biomass, protected areas, areas under the sea level, population density in the selected area, mainly at 1km resolution. Data was primarily retrieved from the Dynamic Land Cover Map.

252. *Vulnerability* was determined by the social and economic conditions of the targeted population. Vulnerability assesses development, poverty, and gender equality indexes, conflicts, migration, food insecurity, economic, and heath indicators retrieved by UN databases, including UNDP, WB, FAOSTAT.

253. *Adaptive capacity* was defined as actors' ability to prevent or reduce climate impacts by implementing effective practices and technologies. It largely depends on the support provided by public and private institutions through research and investment in technological developments and social, agricultural and disaster risk insurance programs, as well as on communities' means of adaptation. The Adaptive capacity layers assessed the access to climate information, electricity and internet, infrastructure development, as well as national institutional support through policy and financial mechanisms for climate-resilient agriculture currently available at national level. Data was retrieved from UN databases, including UNDP, WB, FAOSTAT.

254. The computation of the climate risk within the CRTB was performed through 4 steps:

- Layers within each risk component are aggregated, e.g., for Hazard baseline:
- (Hazard baseline indicators>threshold / total Hazard baseline indicators)
- The climate risk is calculated for the baseline period:
- (Hazard baseline + Exposure + Vulnerability) – Adaptive Capacity
- The climate risk is calculated for the different future scenarios and Shared Socio-economic Pathways, where changes in projected hazards are compared to the baseline period: [Hazard baseline + (Hazard future*0.25) + Exposure + Vulnerability] – Adaptive Capacity

255. The Figure 58 represents the map of climate risks.

88IPCC, 2022: Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press. Cambridge University Press, Cambridge, UK and New York, NY, USA, 3056 pp., doi:10.1017/9781009325844.

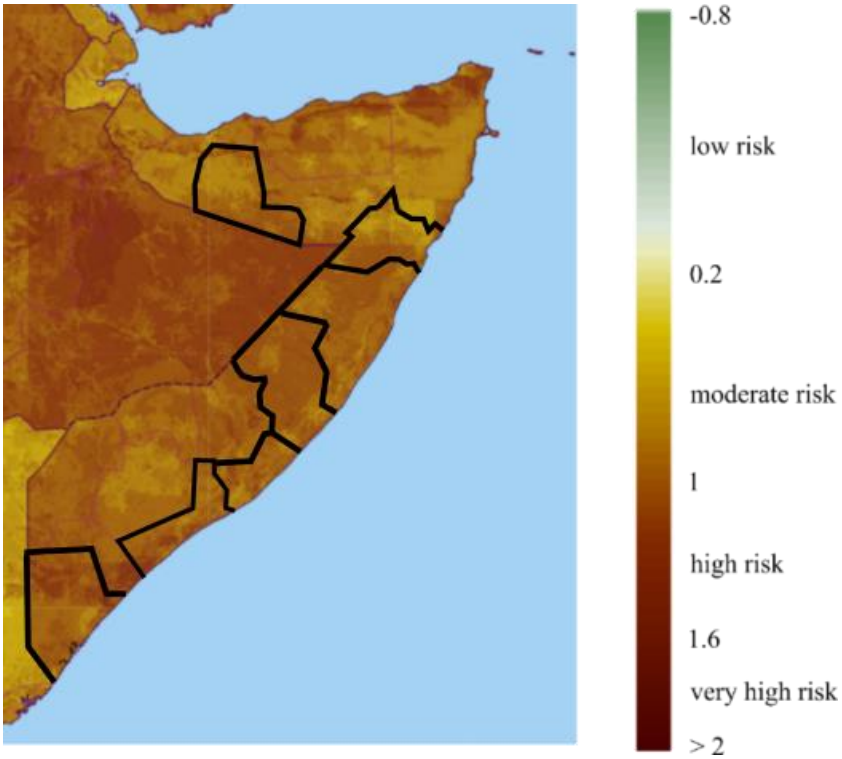


Figure 58. Somalia climate risk for the baseline period. Climate risk is calculated according to the IPCC AR6. The CRTB considers nine geospatial layers for the calculation of climate hazard, nine geospatial layers for the calculation of exposure, eight layers for the calculation of vulnerability, and eight layers for the calculation of adaptive capacity. This information is then combined (climate risk = hazard + exposure + vulnerability - adaptive capacity) to give a holistic view of climate risks. Darker colors indicate higher climate risk.

256. Given that the entire country is considered vulnerable, the project opted target the top three highest vulnerability cropping regions and three where the agro-pastoral system prevails. The project areas are selected as follows; (i) Southwest: Lower Shabelle region, (ii) Hirshabelle: Middle Shabelle region (iii) Jubaland: Lower Juba region, and other four regions where the agro-pastoral system prevails; (iv) Puntland: Nugal region, (v) Somaliland: Todgheer region, (vi) Galmudug: Mudug region and (vii) Galmudug: Galguduud region. From these regions, districts were selected on the basis of needs, feasibility and local ability to participate.

257. These regions were selected in close consultation with the government considering the government's priority areas for developing in areas that have been newly liberated from Al-Shabaab, where no major investment project had been implemented. The final list of districts in which this project will be implemented is as follows:

Project Districts	**Regions**	**State**
Afgooye	Lower Shebelle	Southwest
Qoryooley	Lower Shebelle	Southwest
Baraawe	Lower Shebelle	Southwest
Kurtunwaarey	Lower Shebelle	Southwest
Cadale	Middle Shabelle	Hirchabelle
Kismayo	Lower Juba	Jubaland

Eyl	Nugal	Puntland
Garowe	Nugal	Puntland
Odweyne	Toggheer	Somaliland
Hobyo	Mudug	Galmudug
Jowhar*	Middle Shabelle	Hichabelle

*This district is financed from cofinancing through the TRANSFORM project.

258. Because the project will not necessarily work aligned to administrative borders, the final stage in geographic targeted has involved mapping sub-watersheds in the areas that will serve as a basis for landscape planning and to map the areas that will be subject to restoration.

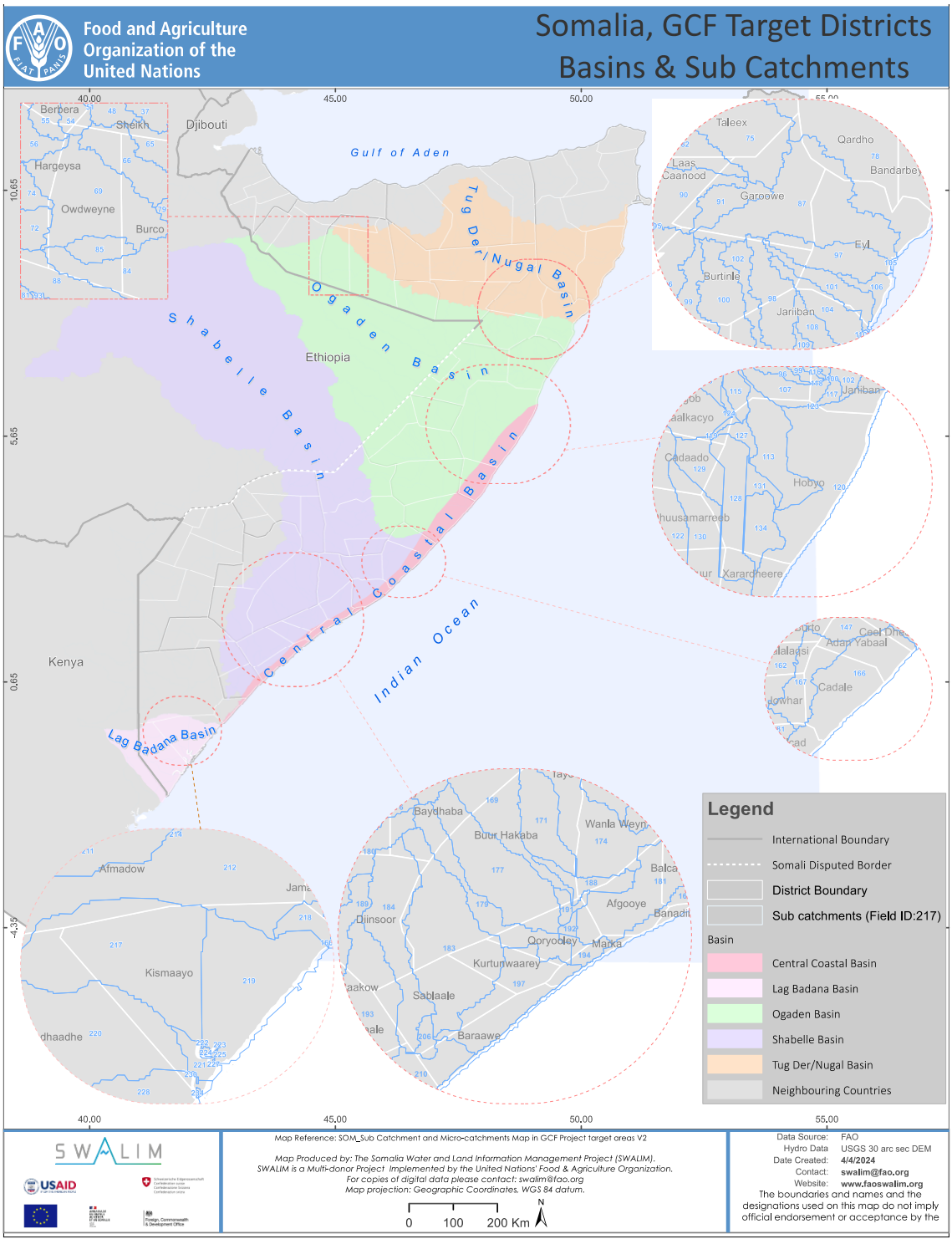


Figure 59: Map of sub-watersheds in project districts. Source (SWALIM)

259. The 31 sub-watersheds are listed with the respective areas in Table 18:

Table 18: List of sub-watersheds

Region	District	Sub-Watershed ID	Area in hectares
Togdheer	Owdweyne	69	727,152
Togdheer	Owdweyne	85	112,300
Nugaal	Garowe	87	863,658
Nugaal	Garowe	91	151,247
Nugaal	Eyl	97	251,434
Nugaal	Eyl	101	161,100
Nugaal	Eyl	105	3,300
Nugaal	Eyl	106	83,800
Mudug	Hobyo	113	538,547
Mudug	Hobyo	120	1,604,574
Mudug	Hobyo	123	300
Mudug	Hobyo	127	82,350
Mudug	Hobyo	128	514,428
Mudug	Hobyo	131	104,634
Mudug	Hobyo	134	278,936
Middle Shabelle	Cadale	166	1,217,453
Lower Shabelle	Afgooye	181	634,110
Lower Shabelle	Qoryooley	191	49,249
Lower Shabelle	Qoryooley	192	21,698
Lower Shabelle	Baraawe	197	235,650
Lower Shabelle	Kurtunwaarey	197	235,650
Lower Juba	Kismayo	217	563,125
Lower Juba	Kismayo	219	364,154
Lower Juba	Kismayo	221	34,150
Lower Juba	Kismayo	222	493
Lower Juba	Kismayo	223	200

Lower Juba	Kismayo	224	2,268
Lower Juba	Kismayo	225	900
Lower Juba	Kismayo	227	150
Lower Juba	Kismayo	230	400
Lower Juba	Kismayo	234	850
TOTAL ha			8,838,259

5.4.1.2 Description of Beneficiaries

260. The ultimate beneficiaries of this project are women, children and men living in the targeted districts. The total population of the targeted area[89] is distributed as follows:

Table 19: Population in targeted districts

Region	District	area_km2	area_ha	Total population estimate	Population density (pp/ ha)	of whom IDPs	of whom non-displaced
Lower Juba	Kismayo	9,246.78	924,677.56	303,700	0.33	64,100	239,600
Lower Shabelle	Afgooye	3,954.87	395,486.50	472,223	1.19	66,200	406,023
Lower Shabelle	Baraawe	3,301.21	330,120.63	54,775	0.17	4,400	50,375
Lower Shabelle	Kurtunwaarey	2,544.54	254,453.67	64,467	0.25	5,000	59,467
Lower Shabelle	Qoryooley	3,211.20	321,119.62	126,545	0.39	4,200	122,345
Middle Shabelle	Cadale	5,824.93	582,493.22	70,925	0.12	1,500	69,425
Mudug	Hobyo	25,535.73	2,553,573.36	159,016	0.06	500	158,516
Nugaal	Eyl	9,360.90	936,090.09	143,834	0.15	22,000	121,834
Nugaal	Garowe	8,623.00	862,300.20	280,557	0.33	24,600	255,957
Togdheer	Owdweyne	8,351.42	835,142.36	82,889	0.10	42,900	39,989
Middle Shabelle	Jowhar	4,633.75	463,374.95	365,900	0.79	23,600	342,300

261. The first group of beneficiaries are local community members and households, characterized by:

- Low access to water (national average 52%) and sanitation (national average 38%[90])
- Limited access to energy from non-woody sources (national average 40%)
- High prevalence of food insecurity (over 44% face moderate to acute food insecurity[91])
- Large household size (6.2 people on average)
- Majority aged under 18 (63%)

[89] https://data.humdata.org/dataset/cod-ps-som and https://spatial.faoswalim.org/layers/geonode:SOM_Adminbnda_Adm3_Districts_UNOCHA#/

[90] 2020, https://somalia.un.org/sites/default/files/2020-04/Somalia-wash-profile-February-2020.pdf

[91] 2024, https://www.unocha.org/publications/report/somalia/somalia-situation-report-17-mar-2024

- Low level of access to productive assets: 17 animals on average in agro-pastoralists households, (sheep, goats, camels and cows) and less than 1 ha under crop for farming households (maize, sorgho, sesame)

262. Within the project area, target groups include agricultural cooperatives, farmers, PLWDs (Persons Living with Disabilities), youth, governmental staff, men, and women from diverse ethnic and socio-cultural backgrounds, including members from groups often referred to in other contexts as "indigenous." Somalia is characterized by a relatively homogenous ethnic composition, mainly of ethnic Somalis who share the same language, religious beliefs, and cultural heritage. However, some diversity exists among Somalis. For example, the Bantu farmer communities along the Shebelle and Juba rivers maintain their historical cultural distinction such as liberalism in gender segregation, absence of clan alliances, less armed/violent disputes, language marked by Kiswahili accent/words.

263. Most project sites are home to minority and marginalized groups that encounter significant challenges, including issues related to protection, discrimination, and restricted access to healthcare services, although they do not fit the international definition of Indigenous Peoples. When mentioning Indigenous Peoples, the project refers to not only Indigenous Peoples but also minority and marginalized groups within Somalia. Consequently, the project will engage both communities traditionally recognized as indigenous in international contexts, and other non-indigenous groups, ensuring social inclusion and the safeguarding of rights for all marginalized and excluded communities. This approach is mainstreamed within the project's activities and is subject to responsive and proactive monitoring.

264. The second group of beneficiaries include cooperatives (particularly seed growers), micro and small agricultural enterprises (particularly processers, transformers), who will receive capacity building, material and technical assistance and training.

265. The third group of beneficiaries includes government staff at Federal, State and district levels, as well as staff from financial institutions, who will receive training and capacity building from the project.

266. Beneficiary participation in the project will be voluntary on the basis of a Free, Prior Informed Consent procedure that will be launched at the start of the project. A census of organized groups will also take place to ensure that all relevant stakeholders are participating in project activities. Participation will be limited to one member per household. Other criteria will include:

- Must not be a part of Al Shabbab and commit to not supporting the group.
- Have access to land and/or livestock
- Testify to an absence of land conflict
- Commit to participating in project trainings

267. 50% of beneficiaries at local level, particularly trough the Farmer Field Schools will be women. However, while the project will aim to endure that 50% of institutional beneficiaries are women, this may not be feasible considering the levels of employment among women in public service is limited.

268. Additional information on beneficiaries and selection criteria can be found in Annex 23.

6 Description and Feasibility Analysis of activities

6.1 Outcome 1 Restored landscapes are resilient and sustainably managed

269. Activities under outcome 1 are designed to restore and increase the natural productivity of ecosystems to ensure that they recover their resilience in the face of existing and projected climate change.

270. Current levels of landscape degradation are high and are due to both man-made causes and direct climate change impacts. Aridity is high in the targeted regions, making the landscape particularly vulnerable to soil erosion due to wind and rainfall. As a result, natural productivity is low, and climate changes over the past decades have caused it to further decrease, leading to migration, famine or severe food insecurity, and conflict.

271. Restoring landscapes to a point of resilience and balance requires multiple elements: reducing the exposure of land and vegetation to extremes such as high heat, strong winds, severe rainfall events and other erosion inducing factors; restoring natural soil productivity by increasing land cover and nutrient cycling; and improving soil moisture retention and aquifer recharge. The mark of a resilient ecosystem in this case would be the maintenance of land productivity dynamics, and the cessation – or reversal – of land degradation trends.

272. The dynamics in the land productivity indicator is related to changes in the health and productive capacity of the land and reflects the net effects of changes in ecosystem functioning due to changes in plant phenology and biomass growth, where declining trends are often (but not always) a defining characteristic of land degradation.[92] Land degradation is also monitored through SWALIM using the LADA-WOCAT methodology and remote sensing data, though the last assessment is dated 2009[93], as illustrated in Figure 60 and Figure 61. This outcome will be measured through remote sensing imagery, by comparing Land Productivity Dynamics and Normalized Difference Vegetation Index (NDVI) as well as through field-validation through the SWALIM work under Outcome 3. Baseline data is provided in the figures below.

[92] LAND PRODUCTIVITY DYNAMICS (LPD). 16 years period (year corresponds to the last year of the period i.e. 2001-2016) - Land Productivity Dynamics data is derived from NDVI product of MODIS/Terra Vegetation Indices 16-Day L3 Global 250m SIN Grid V006 https://publications.jrc.ec.europa.eu/repository/handle/JRC80541 sourced from Earthmap.org on March 24, 2024

[93] FAO-SWALIM, Land Degradation Assessment and a Monitoring Framework in Somalia, 2009. https://www.faoswalim.org/resources/site_files/L-14%20Land%20Degradation%20and%20a%20Monitoring%20Framework%20in%20Somalia_0.pdf

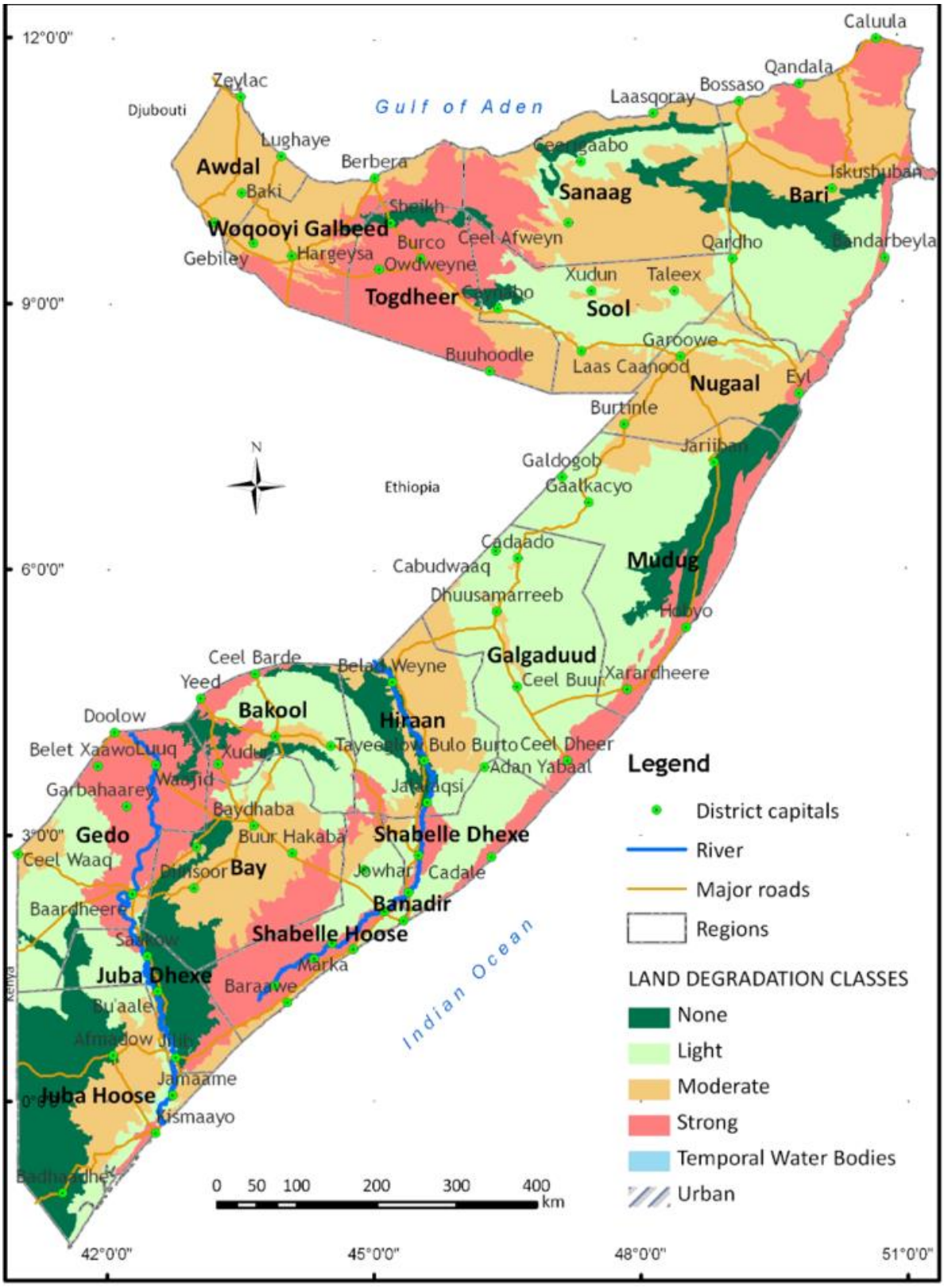


Figure 60: Map of land degradation, 2009 (source: SWALIM)

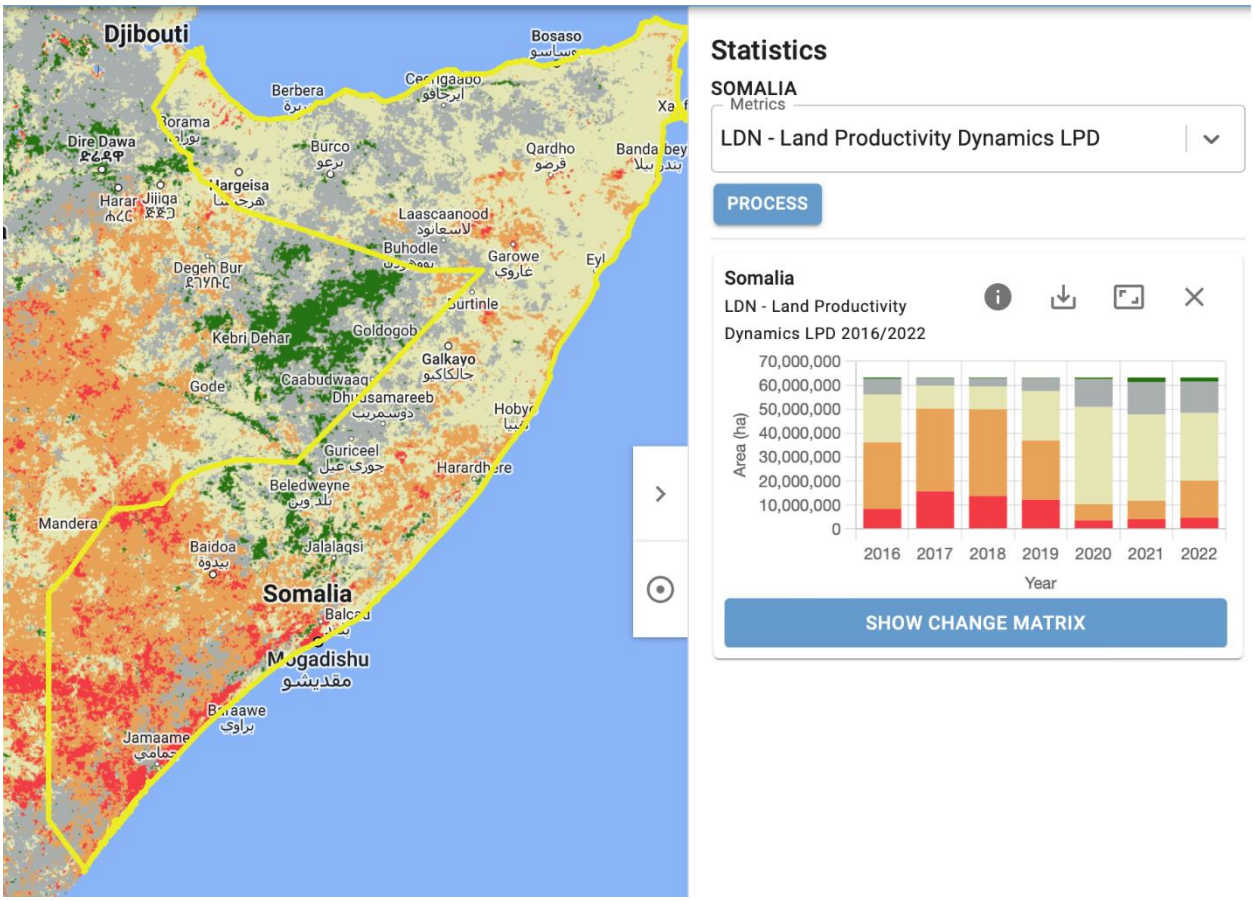


Figure 61: change in Land productivity dynamics, 2016-2022 (Source Earthmap.org, retrieved June 2024)

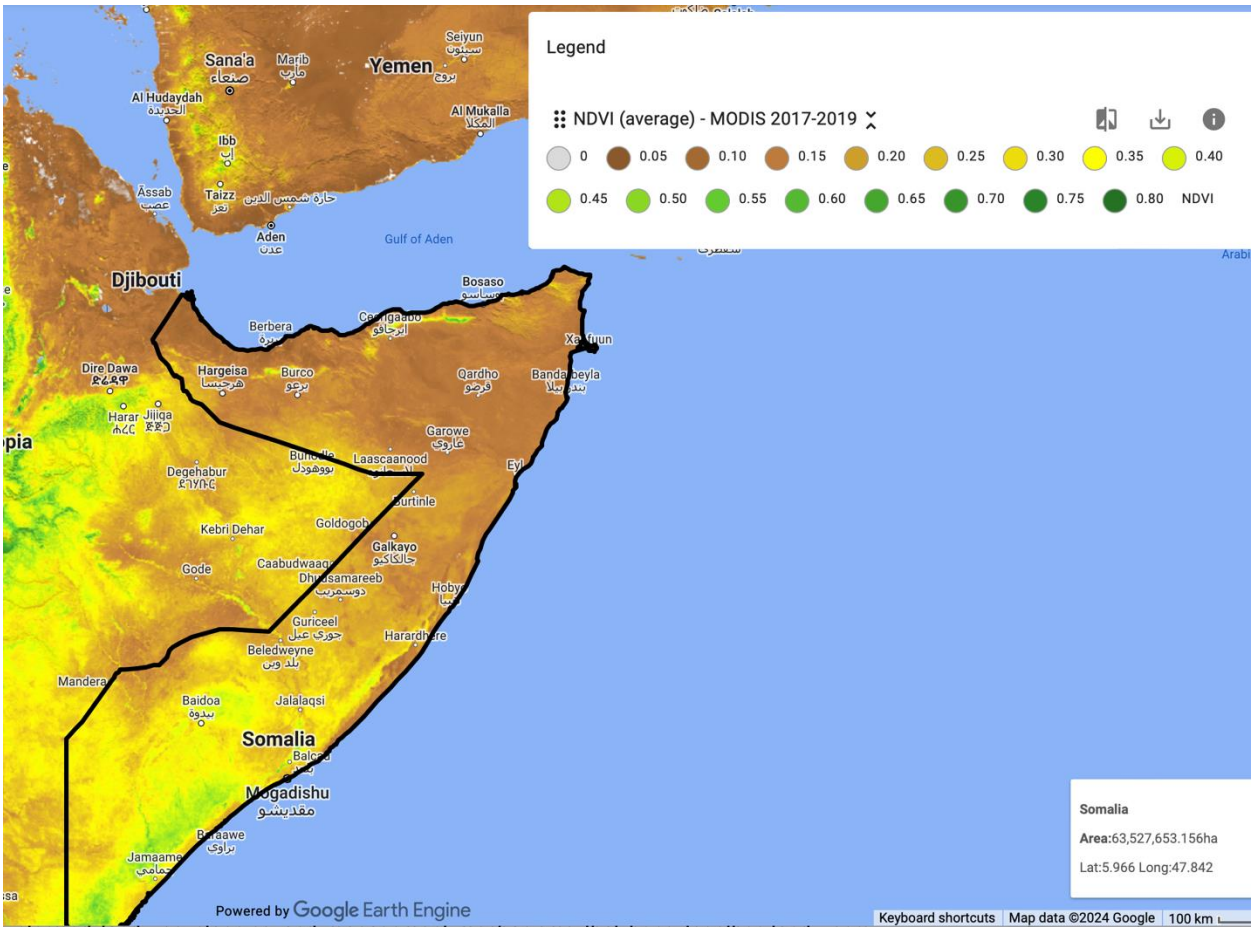


Figure 62: Normalized Difference Vegetation Index (NDVI) at baseline, 2017-2019 (Source earthmap.org, retrived June 2024)

273. Two main outputs and activities serve to achieve this outcome. Output 1.1 is designed to improve local and district-level planning and land use management systems, and output 1.2 groups activities that deliver well-targeted and climate informed landscape restoration. Activities under outcome 3, which build the capacity of stakeholders to collect data on landscape productivity and ecosystem health, will also inform this activity and ensure its long-term sustainability. The increased productivity of the landscapes is expected to feed into the resilience of livelihoods, thereby also reducing the vulnerability of local communities.

6.1.1 Output 1.1. Improved participatory landscape and natural resources management and governance are established

274. Under this output, the project will support the establishment and strengthening of participatory climate-informed land use planning and management mechanisms that bring together land users, communities and governments towards an optimal use of ecosystems for resilience. By the end of the project, it is expected that 41,800 ha of landscape will be brought under improved, sustainable and climate-informed management.

6.1.1.1 Activity 1.1.1 Develop climate-informed inclusive landscape management plans

275. Most of the available data on the health of watersheds is insufficient or inadequate to support climate-informed land use planning. The last study of land cover or areas affected by land degradation dates back to 2009[94] and it was conducted on the basis of dot grid at 500 m spacing. It is not a wall-to-wall mapping but the analysis of the land cover features intersected by each dot of the grid. Futhermore, there are gaps in data where areas were inaccessible. A country-level baseline study is necessary to be able to determine the areas most at risk, and to determine priority interventions both during the project and after.

276. To conduct this study (sub-activity 1.1.1.1), the project will mobilize the expertise the data networks developed for the SWALIM project, and mix satellite data with ground-truthing observation to characterize the following key parameters:

- Land Cover
- Soil Types,
- Level of Land Degradation

277. The study will relate the land parameters to climate parameters such as mean annual rainfall, temperature, and types of soil erosion to provide a comprehensive baseline. This study will also serve as a basis for measuring progress in the restoration of landscapes (output 1.2) in project sites. In addition, the project will also provide a detailed assessment of the invasion of Prosopis in the Northern regions, through the combination of remote sensing, GIS and local ground truthing. (sub-activity 1.1.1.2). To detect Prosopis invaded areas, SWALIM uses the spectral information of satellite images acquired during the dry season, as Prosopis generally shows a high chlorophyll content in January/February/March, while other species have a very low content of the same. The information from satellite is then supported, integrated with and validated through information collected in the field (visual observation).

278. This will also serve as a basis for direct intervention under output 1.2 for the removal and management of Prosopis from rangelands and agricultural land. Both sub-activities will be delivered by FAO in close collaboration with the MoECC, who will also be capacitated to continue these exercises in the future (Outcome 3). In the first few years of the project, data will be housed in SWALIM servers and placed at the free access of all relevant stakeholders.

6.1.1.2 Activity 1.1.2 Develop climate-informed inclusive landscape management plans

279. In year 1 of the project, while the baseline studies are being prepared, the project will work with local communities to develop participatory climate informed landscape management plans (LMP). This will require first conducting a participatory mapping and targeting exercise with local communities to determine the “boundaries” of the community-owned land to be managed. This is particularly important when relating to the traditional land tenure systems, lack of formal land rights, and the gradual “settling” of pastoralists into agro-pastoralism livelihoods. The landscape management planning will therefore be supported by land tenure experts who are knowledgeable in Somali customary rights to ensure a smooth transition.

280. This planning will also be paired with the first Free Prior Informed Consent (FPIC) process of the project, which will serve as a way to inform local beneficiaries of their rights and potential benefits under the project (*sub-activity 1.1.2.1*), and which will serve to finalize the formation of groups targeted under the project (refer to section 5.4.1.2 for information on beneficiaries). The FPIC procedure will will consider the effective and inclusive participation of Indigenous people Peoples and/or minority and

[94] https://www.faoswalim.org/resources/site_files/L-14%20Land%20Degradation%20and%20a%20Monitoring%20Framework%20in%20Somalia.pdf

marginalized groups living in the project area, as well as those other Indigenous People and/or minority and marginalized groups (such as nomadic pastors and hunter gatherers that depend on the resources of the project area of influence). The procedure for FPIC is detailed under Annex 6 (ESMF). Specific gender-oriented dialogues will also be organized in each project site (31 sub-watersheds) on the importance of including women in landscape management committees and in consultations to design landscape management plans, as well as issues related to sexual exploitation, abuse and harassment and gender-based violence (SEAH/GBV).

281. The landscape management plans will also include a mapping and allocation between different land uses (cropping, livestock, free pasture, conservation zones, tree planting, markets and water infrastructure, or other use). This will be conducted with a specific conflict prevention lens in order to codify land use and rights of access to land between the different communities and land users. To this end, the project will conduct a climate- and gender-oriented participatory assessment of water and land-related conflict risks as part of the LMP process (*sub-activity 1.1.2.2*).

282. The management, operationalization, monitoring, and long-term sustainability of the landscape management plans will be entrusted to Landscape Management Committees (LMC). The LMC will include participation from all groups, including: women, men, youth, elders, PLWD, herders, farmers, local NGOs and associations (minimum 20 people, maximum 35 people representing the villages in the areas covered). Members will serve for 2 years, with possibility to renew for 1 year. Elections to the first LMC will be undertaken through a participatory exercise at the same time as the initial FPIC on the basis of self-nominations. Second elections will be convened by LMC themselves. Each Committee will elect members to the following functions, taking care that women represent at least 50% of members (30% youth) and that at least 30% of functions are filled by women.

- Chair
- Vice-Chair
- Secretary
- Treasurer
- Monitoring and Implementation Agent

283. The committee may also delegate specific functions to rangeland, water, and/or finance sub-committees according to its needs, specifically if communal management of natural assets is required. The responsibilities of the LMC, which will meet twice per year, will be to:

- Approve each LMP;
- Consider and approve priority activities and budgets for implementation of LMP annually
- Monitor the execution and results of LMP implementation activities
- Enforce allocation rules and conduct conflict prevention and management
- Enforce and monitor the site specific Environmental and Social Management plans
- Serve as relays for the project's Grievance and Redress Mechanism
- Collect and conserve data related to landscape management and liaise with SWALIM and other stakeholders
- Receive reports from sub-committees
- Manage committee and community financial resources, including any arising from the payment of membership dues and user fees as appropriate.
- Disseminate information to the public about landscape management initiatives and opportunities
- Call for assemblies, public meetings and elections following the replacement or departure of members.

284. The project will provide training to the committees and sub-committees on the adoption of by-laws, elections, record keeping, as well as participatory monitoring and community-based implementation

monitoring methods. Material support for the first few years of operations will also be provided, including through the construction of small, solar powered offices for committees, in which to hold meetings and store community equipment. (*sub-activity 1.1.2.3*)

285. The initial mapping exercises have shown 31 sub-watersheds in the targeted regions where the project will work. Each of these will be the object of a landscape management plan following initial training on the basics of climate-informed landscape management (sub-activity 1.1.2.4). Landscape management plans will be developed in a participatory manner, with the support of project technical experts and local NGOs. Each Landscape Management Plan will be established for a period of 6 years and will include the following elements:

- Assessment of land and water resources and their degradation using data collected in activity 1.1.1, presented in a user-friendly format.
- Maps of current land use and land users, and an overview of land use rights;
- Land use plans and allocations by use (e.g. water infrastructure, conservation, rangeland, cropland);
- Priority landscape restoration activities to be delivered over the period;
- Monitoring and evaluation plan;
- Budget for activities and the maintenance/operations of landscape management

286. Should there be delays in developing landscape management plans, or should the LMP not be finalized before the second year of the project, the project team in consultation with MoECC and MoAi will propose priority restoration activities in and around the targeted landscapes.

287. The activities under output 1.1 are delivered through FAO as EE. By the end of the second year of the project, it is expected that 31 landscape management plans will be validated with a list of priority interventions approved by each committee. The total area covered by the LMPs will be upwards of 8.8 million ha in 31 sub-watersheds.

6.1.2 Output 1.2 Agricultural and Agro-pastoral Landscapes are rehabilitated.

288. Under output 1.2, communities will come together to implement their landscape management plans. This will include changing land use and land allocation on the basis of agreed priorities, for example setting aside land under fallow or rehabilitation (or for regeneration) and setting up mechanisms for sustainable land use designed to increase landscape resilience.

289. In total, the project will support the rehabilitation of 41,800 ha of degraded land. Restoration activities will be conducted by local non-governmental organizations, civil society organizations and private sector firms following a set of established terms of reference and technical specifications for each type of work. Each service provider will be trained and capacitated for the development and supervision of environmental and social management plans on all areas under restoration, wherever applicable according to the project's ESMF (refer to Annex 6).

6.1.2.1 Activity 1.2.1 Conduct landscape restoration through local landscape management committees and community-based associations

290. The project supports two types of restoration activities according to the specific locations. Technologies used for landscape restoration are listed in Table 20. Each community will select, from the menu of available options, the priority restoration options and map their planned implementation. The pre-selected restoration options are based on available cartography, tested technologies and approaches, best practice and research, and climate projections (refer to chapter 2, CRVA).

291. Two main groups of restoration options are proposed: the first has as a direct objective to retain water within the landscape, increase soil moisture, and provide water during dry periods; the other

group is designed to restore soil and land productivity at landscape level, mainly through management of invasive species, restoration of land cover and reduction of erosion.

292. All technologies have been tested successfully through various projects in Somalia before, including by FAO. The landscape restoration methods proposed here are also complemented by land management and reclamation at farm level, which will also include some anti-erosive measures, water storage and retention, the creation of agro-forestry and the introduction of agro-silvo-pastoralism production systems (Refer to outcome 2). Outcome 1 activities are delivered through NGOs and local governments on communal land, whereas activities under Outcome 2 are delivered with local communities on their own land.

Table 20: List of landscape restoration options

Restoration option	Climate problem/ landscape degradation issue	Specifications
Half-Moon structures	Aridity, high temperatures, run-off, land degradation	Half-moon structures are crescent-shaped embankments constructed to capture and retain rainwater, thereby reducing runoff and increasing water infiltration. This technique helps to revitalize degraded lands, making them more suitable for agriculture by improving soil moisture and reducing erosion. The bunds will be 0.3m high and 0.3m width.
Contour bunds	Aridity, high temperatures, run-off, land degradation	Contour bunds[95] are useful on sloped land (2-5%) and control run-off and soil erosion. Contour bunds reduce the length of slope and allows more water to seep into the soil. *The bunds will be 1.5m bottom width, 0.5m top width and 1 m height. With an average spacing of 50m. Bunds can be constructed out of soil or out of rock. Refer to* Figure 64
Sand dams or Sub-surface dams	Aridity, high temperatures, run-off, land degradation	Sand dams are reinforced walls built across seasonal sandy river. This would be applied mostly in southern regions. The project would support construction of 3m deep wall, 1m top width and 2m bottom width. This is an activity we have not done so far. It can be started progressively and hopefully do 1000 m long storage dams. There are many wide sections of rivers up to 100m width each where sand dams can be built. Refer to Figure 65
Berkad	Aridity, high temperatures, run-off and evaporation, land degradation	Berkads are large, long basis with vertical walls, typically covered in brick or cement to reduce seeping. Water is collected through an open catch-pool, a small reservoir in which water flows and that may contain sediment. The project will use a design based on 5m wide by 15m long and 3m deep. It includes excavation, building the walls and roofing with iron sheets on wooden frame to reduce evaporation and maintain water quality through heat induced distillation. Refer to Figure 67.[96]
Riverbank rehabilitation (gabions)	Run-off, soil erosion, flooding	Gabion walls are established along rivers that are subject to recurrent flooding during rainy seasons. Gabions are resistant to currents, and use locally available materials. Works include shaping of the banks and embankment, protection of the tow of the bank with gabion boxes, rip rap and some vegetation. This will include excavation of areas 2.40m wide x 263M long and 0.80m deep to receive gabion boxes. Earth filled flood embankments can also be built, which are comprised of compacted earth fill with hand compactor using borrow material in layers not exceeding 30cm at Optimum Moisture Content (OMC) to attain 95% Maximum Dry Density (MDD). The embankment side slopes shall be 1:2 (farm side).

[95] Singh, R. (2023). Bunds. In: Soil and Water Conservation Structures Design. Water Science and Technology Library, vol 123. Springer, Singapore. https://doi.org/10.1007/978-981-19-8665-9_5

[96] https://blogs.worldbank.org/en/nasikiliza/turning-sand-water-biyoole-project-somalia

		Combinations of the two approaches (earth filled and gabions) are also possible. Refer to Figure 63[97]
Hafirs/ Water Pans	Aridity, run-off, land degradation	This includes excavation and shaping of the water pan bank to a maximum depth of 3m and Side slopes of 1:2 (earth pans without geo-membranes). Each structure contains an average 24,000 m3 of water which, under future evaporation conditions can provide water to 400 households year-long. Fencing, installation of solar panels and pumps, water storage tanks, water troughs and water draw off points for people and pipes from tank to the water storage will also be included. *Refer to* Figure 68
Management/ Control of Prosopis	Land degradation, soil erosion, loss of arable land.	This form of land reclamation involves the total removal of the trees including the roots to avoid the stump regrowing. It can be done manually or mechanically, however, manual control is preferred to prevent disturbance of land that could initiate soil erosion. Removed trees can be used as a source of livelihoods, for example by processing pods into animal feed supplements, and turning the trees into charcoal (instead of Acacia98). Removal of prosopis will be offset by reforestation, planting alternative multi-use tree species, appropriate pasture grass, perennial browse shrubs, and food crops that offer a range of alternative livelihood options to affected communities. Another portion of land where prosopis will be removed will be converted to agroforestry.
Reforestation	Land degradation, reduction in soil organic matter. Low productivity.	This will include planting and looking after the planted seedlings for 6 months through local communities. An estimated 625 trees will be needed per ha. Materials from local nurseries will be sought (established under Outcome 2). Species to be planted at landscape level and on farmland (through agro-forestry) will be multi-purpose and will provide added livelihoods (food, fodder) this includes[99]: - Acacia Species: Acacias are native to Somalia and well-suited to arid environments. They are known for their drought resistance and can help in fixing nitrogen in the soil, improving soil fertility. Varieties like Acacia Senegal can also provide economic benefits through products like gum arabic. - Ziziphus Mauritiana (Jujube): This fruit tree is adapted to a range of environmental conditions and is tolerant of drought and poor soils. It can provide food as well as shade and contribute to soil stabilization. - Balanites aegyptiaca (Desert Date): This tree is highly drought-resistant and can grow in very arid conditions. It provides food, oil, and medicine and is known for its role in traditional agroforestry systems, helping to maintain ecosystem balance. - Adansonia digitata (Baobab): Known for its ability to store water in its thick trunk, the baobab is another indigenous species that can withstand harsh drought conditions. Its fruits are highly nutritious, and it serves multiple uses in both human and animal diets. - Moringa oleifera: Although not originally native to Somalia but well-adapted, Moringa can grow under arid conditions and provides excellent nutritional value through its leaves, which are rich in vitamins and minerals. For the pasture lands Acacia, Croton, Date palms, Tamarind, among others will be considered.

[97] Stevanovic, Zoran. (2015). Damming underground flow to enhance recharge of karst aquifers in the arid and semi-arid worlds. Environmental Earth Sciences. 75. 10.1007/s12665-015-5086-z.

[98] https://somalia.un.org/en/96679-invasive-prosopis-tree-turning-livelihood-menace-source-income-somaliland

[99] https://www.unep.org/news-and-stories/story/somalia-attempts-revive-lands-blighted-deforestation

		The selection of species will be based on best available knowledge guided by the MoeCC, in collaboration with regional centers such as CGIAR.

Figure 63: small gabion dams in Somaliland. Source: Stefanovic, Z.

Figure 64: example of contour bund.

Figure 65: Sand dam at Rabaable, Somalia. Source: Worldbank

Figure 66: Half-Moon structures. Source: WFP

Figure 67: Berkad (source SWALIM)

Figure 68: Haffir

Figure 69: Prosopis invasion in Somalia. Source: FAO

293. The project will procure required material and provide training to LMC members on the functions and anticipated benefits of selected techniques (*sub-activity 1.2.1.1*), in order to facilitate supervision. Materials can include:

- Stones, gabions (and associated transport)
- Seeds, saplings
- Fencing, netting and textile (ie geo-membranes) material
- Shovels, pickaxes, wheelbarrows, hammers
- Crushing machines
- Pellet making machines (for prosopis transformation)

294. For each region, the project will support the development of an ESMF and implementation of activities under each Landscape Management Plan will be subject to a conflict-informed environmental and social management plan (ESMP) in line with the requirements of the project's ESMF and the principles of conflict risk management. (refer to Annex 6 for full details on the process). Service providers, private sector firms and the LMCs will be required to abide by the provisions of each ESMP.

295. Following the first year of LMP implementation, the project will also support the participatory monitoring of LMPs (*sub-activity 1.2.1.3*). The project will ensure that data on the landscape management practices and results are collected annually to serve as a basis for the completion of annual Landscape restoration reports, and for transmission to the MoECC and MoAI, to support further research and analysis under Outcome 3. To this effect, some data collection and observation equipment may be installed at the seat of the LMC, such as small weather stations (temp, rainfall, wind) or river monitoring equipment. Data collection protocols that can be easily administered locally will be developed by MoAI and MoECC and will include, wherever possible, the following indicators of ecosystem health:

- Land cover by land use type (e.g. rangeland, cropland)
- Main tree species found (e.g. prosopis, acacia)

- Soil moisture
- Temperature
- Rainfall
- River/stream flow
- Run-off rates

296. Regular visits and field testing will be conducted by the MoECC (sub-activity 1.2.1.4).

6.2 Outcome 2 – Local livelihoods are resilient

297. Activities under this outcome are designed to ensure that local communities derive increased and qualitatively improved climate resilient livelihoods from agriculture, despite prevailing and forthcoming climate conditions. The project targets existing value chains (maize, sesame, sorghum) which are climate vulnerable staple crops, as well as livestock production (sheep, goats, cows and camels). In these value chains the project also supports the transition from extensive to intensive cropping and from pastoralism to agro-pastoralism as key adaptation strategies. Given that a significant limitation is posed by water scarcity in Somalia, the project also focuses on securing resilient water supply for agricultural production through combinations of ecosystem-based adaptation (outcome 1) and infrastructure-based solutions at both landscape and farm level. Outcome 2 reaches 623,881 beneficiaries, at least 50% of whom are women.

6.2.1 Output 2.1. Resilient water supply is secured and sustainably managed.

298. Similarly to the activities under Output 1, participatory governance of water resources will be established as a principle to enable local communities to collect, manage and distribute water in a manner that is sustainable and climate-sensitive. The project works to establish data systems and governance mechanisms to enable State and district governments to support local water management; and with local communities to help them access improved and resilient water supply.

6.2.1.1 Activity 2.1.1. Strengthen water management capacity at State and local level

299. In the perspective of decentralizing and democratizing natural resources management, the project will support the establishment and capacity of water user association committees (WUAC) that will oversee the rehabilitation, operation and maintenance of water infrastructure and resources in all the sub-watersheds (sub-activities 2.1.1.2 in the 10 GCF districts, and 2.1.1.3 in Galkayo). In all project sites, WUAC will be placed under the overall umbrella of landscape management committees to ensure consistency of approach and coordination. The roles and responsibilities of WUAC will be to oversee irrigation water management, mobilization, allocation and maintenance. Each WUAC will be formed of approximately 50 people (50% women, and 30% of young people) with adequate representation from all vulnerable groups and water users.

300. Committees will receive leadership, governance and management training, as well as training on climate-informed operations and management of water in their territory (sub-activity 2.1.1.2). The female WUAC members will also receive training on leadership, and all members will be sensitized on the importance of women's full participation in the work of the Committee, including in decision-making and in monitoring. Each committee will also be endowed with the material means for conducting supervision and monitoring of water infrastructure. This may include for example, observation equipment and tools (water quality and quantity), material for recording performance and maintenance of water works and office supplies.

301. To support the long-term sustainability of water management activities, and to ensure long-term operationalization of water infrastructure, the project will work with the WUAC to develop fee-based systems for the various types of infrastructure and allocation modalities. Fees will be established in a

participatory manner, based on social acceptability and on contractual arrangements between the WUAC and the communities that are using the water infrastructure. Social acceptability criteria will include gender-specific assessments, including gender-based ability to pay and rules governing access and sharing of water.

302. **Water fees.** Current prices for water are high and fluctuate according to region. Few people are able to afford them, and there is no regulation of private water suppliers which can lead to even higher water costs, particularly during droughts. This situation forces many households to rely on distant and unsafe water sources. The issue of water access is compounded by the high risks associated with water collection, particularly for women and girls, who may face dangers such as physical or sexual assault at water points. Furthermore, past attempts at instituting water user fees in Somalia and other countries have often been met with failure, due to a lack of proper consultation and consideration for farmers' needs to see benefit from the water installation before confirming willingness to pay.

303. The project will therefore work with national authorities to develop a model for water fees and the regulation of private water suppliers that is aligned to national laws and regulations. Water user fees may for instance be developed for a portion of the operations and maintenance activities, while other fees are covered from other government sources. Following this exercise, towards the end of year 5, the project will work with the targeted WUAC and their constituents to develop fees, assess their feasibility, and pilot their application during the project's execution phase. (sub-activity 2.1.1.3). Fee design will incorporate the following principles:

- Affordability for households (all types of households including women and children-headed households), will be ensured and aligned to current private market prices.
- Inclusivity of the Water user Association Committee (to include all types of water users)
- Payable in cash or through exchange of goods (ie crop) that can be resold by the WUAC, or in-kind in the form of services (operations and maintenance work, or other).
- Fees must be directed towards the operation and maintenance of a given water infrastructure.
- Capacity to monitor implementation will be built, including to ensure adequate and equitable allocations are set, and non-members do not benefit from water services.

304. Each WUAC will also be trained in monitoring adherence to rules and agreements, record keeping, financial management and conflict resolution. Note that membership in the WUAC is itself free of charge, however only members will benefit from water services and only WUAC can participate in decision making about water allocations.

305. At State level, to support the devolution of water management and to strengthen the information base that supports it, the project will fund a water accounting and audit survey, focused on the three Southern states (where most irrigation projects are located). This will provide data on existing water availability, withdrawals and irrigation potential under various climate scenarios (sub-activity 2.1.1.5). The methodology for Water Accounting and Auditing was developed by FAO in 2016[100] and includes "the systematic study of the status of, and trends in, water supply, demand, accessibility and use. Water auditing considers trends in water supply, demand, accessibility and use in the broader context of governance, institutions, public and private expenditure, laws, and the wider political economy of water". It is a participatory process. The project will use the latest WaPOR system and methodology (WaPOR 3) which leverages remote sensing data and ground measurements to generate information. Data is publicly accessible and can be used to monitor crop production (particularly around rehabilitated landscapes and irrigation works, under Output 2.1 and 2.2), providing advisory services to farmers (Output 3.3), ecological water accounting and monitoring irrigation.

[100] https://www.fao.org/land-water/water/water-management/water-accounting/en/

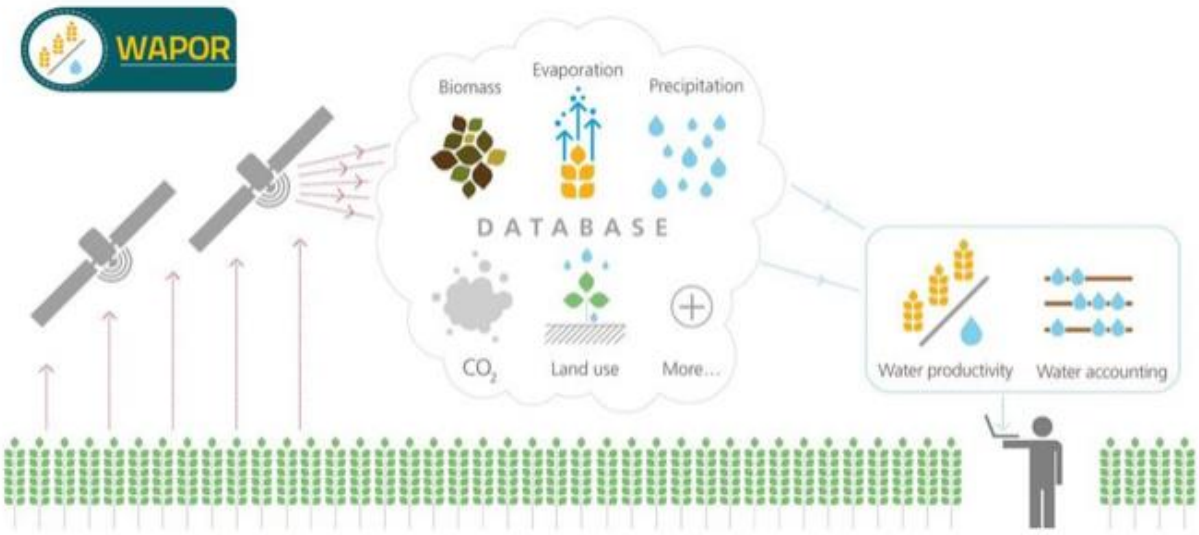


Figure 70: Illustration of WaPOR

306. To support the integration of Water accounting and WaPOR works into the mainstream of government activity, the project will provide training for MoAI staff at State and Federal levels on water accounting, water monitoring (quantity and quality) and the use of WaPOR to inform irrigation and crop planning. The project will also support the dissemination of the WAA and WaPOR information to Landscape Management Committees and Water user Association Committees to further enhance planning.

307. Data collected during the water accounting exercise will be combined with data obtained under output 1.1 on land use, as well as crop monitoring data emerging from project sites and other districts under production. It will be housed by FAO in the WaPOr open data system and made available to MoAI, MECC and all State actors for improved knowledge and monitoring. (sub-activity 2.1.1.6).

308. This data and data system also be combined with the information collected on landscape restoration (activity 3.1.3) and food/nutrition security (activity 3.1.4). The resulting systems will be coordinated and open access sets of information at high resolution that will enable all State and non-state actors (LMC, WUAC) to manage land and water through a climate lens, with the view to ensuring long-erm sustainability of livelihoods.

6.2.1.2 Activity 2.1.2 Increase access to water resources and climate smart irrigation infrastructure

309. Following the El Niño-induced widespread floods of 2023, there have been an up surge in reported open breakages along the Juba and Shabelle rivers. A total of 190 Open breakage points, 76 Canal flooding points, 518 River overflow points and 23 points closed with sandbags have been identified along the Shabelle River while 109 Open breakage points, 1 Canal flooding points, 226 River overflow points and 5 points closed with sandbags have been identified along the Juba River which require immediate attention[101].

101 https://www.faoswalim.org/content/status-river-breakages-along-juba-and-shabelle-rivers-issued-march-2024

310. In order to secure resilient livelihoods for vulnerable communities, access to water for irrigation needs to be upgraded and stabilized, particularly in the light of impending climate changes, as highlighted in Chapter 3.

311. All the targeted regions have a lack of water mobilization and conservation infrastructure, and those in place have either been destroyed during the conflict or degraded due to erosion and lack of maintenance. Water demand is due to increase, and if any efforts to stabilize population and ensure their continued food security are to succeed, water availability must be ensured. Therefore, building on data arising from the water accounting audits undertaken in the first year of the project, as well as the data from the soil and water baseline study under output 1, the project will upgrade and rehabilitate significant water infrastructure.

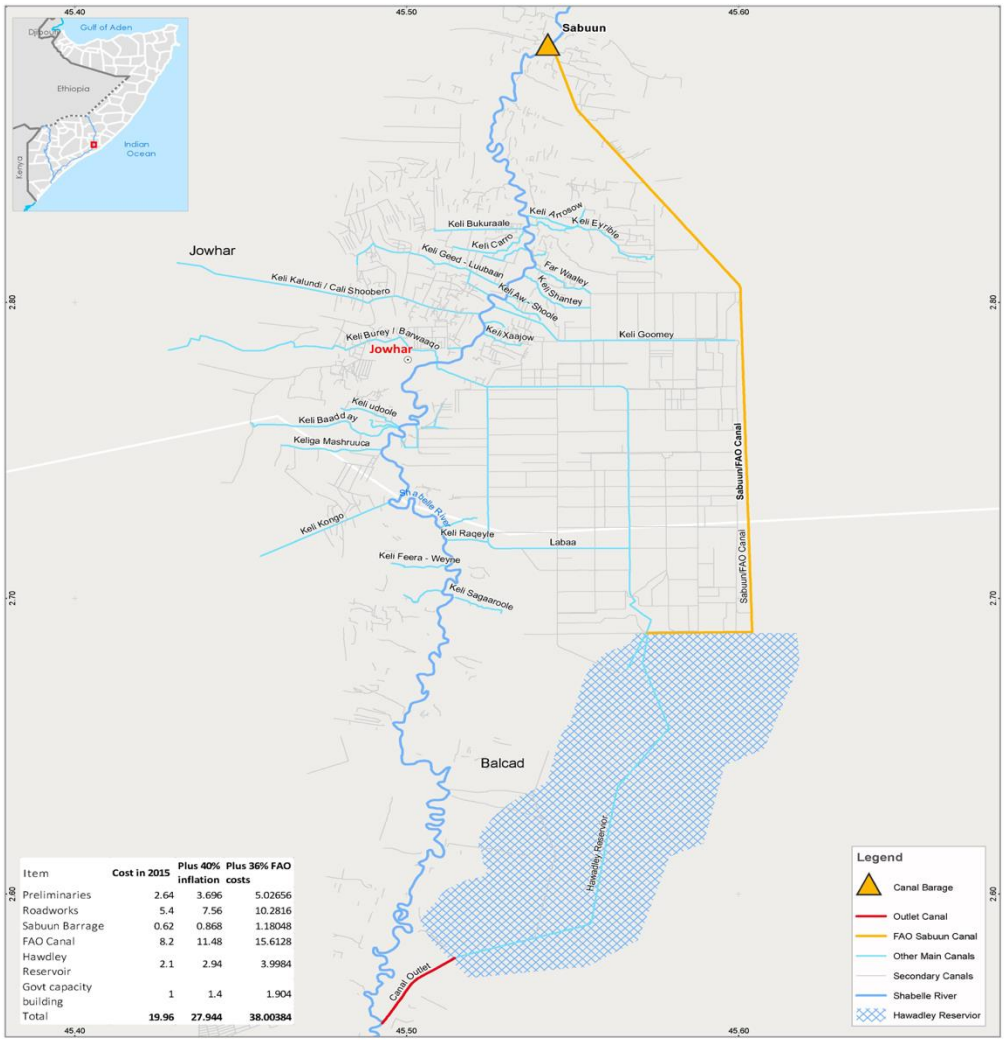
312. Throughout these activities, the project will ensure that women are consulted in the design and delivery of all rehabilitation works, and that the works take into account all possible uses of water (irrigation, livestock and domestic).

313. In Jowhar, through cofinancing from FAO (by using the source from the USAID-Funded TRANSFORM) project, the Sabuun Barrage and the primary canal that provides water to 4 districts (Jowhar, Afgoye, Merka and Balcad), will be rehabilitated, serving 1.5 million people and irrigating an estimated 50,000 ha of land (sub-activity 2.1.2.1).

1) **Sabuun Barrage rehabilitation:** This is a 35m wide barrage wall across the river at Sabuun village, incorporating seven 4m wide radial gates to regulate the upstream water level. This infrastructure will be rehabilitated in year one, after the engineering feasibility study has been completed. This activity involves three steps: (i) Removal of existing metal, installation of new gates, riveting, and installation of a new mechanical system into the existing concrete infrastructure; (ii) Rehabilitation of top deck of the barrage so that it can also be used as a bridge as it used to be, and rehabilitation of the shoulder structures around the gate; (ii) Replacement of the hydraulic gates and operating gear for the main water control structures.
2) **Supply Canal rehabilitation:** This is a 25m wide supply canal head regulator with five 4m wide x 1.3m high vertical lift gates controlling flow of water into a 24 km long supply canal with a design capacity of 50 m3/s. This activity will be carried out in four stages: (i) reinforcement of the canal intakes and outlets; (ii) Replacement of the existing gates with new metal structures; (iii) Reinforcement of the sides of the canal; (iv) Desilting of the supply canal.

3) **Outlet Canal rehabilitation:** This is a 20m wide reservoir outlet regulator with four 4m x 1.8m vertical lift gates for controlling the return flows to the river, via a 25m3/s capacity outlet canal of 1.8 km long. The outlet canal rehabilitation will consist of three major components: (a) Civil works at the outlet regulator, such as dredging and bank works upstream and downstream of the structure, reinstatement of the upstream and downstream erosion protection works (earthworks and concrete block revetment), and minor concrete repairs. (ii) Gates and mechanical works including at the outlet regulator, such as 4 new vertical lift gates, replacement of all operating gear (including provision of spare parts), replacement of the stop long gantry beam and hoist equipment, and provision of a full set of stop-logs; (iii) the outlet canal itself will require bush clearing and earthworks, with the installation of benchmarks every 1 km along the canal banks.

314. These works were subject to a detailed engineering feasibility study conducted by FAO and USAID and are currently under implementation. Refer to Figure 60.



Item	Cost in 2015	Plus 40% inflation	Plus 36% FAO costs
Preliminaries	2.64	3.696	5.02656
Roadworks	5.4	7.56	10.2816
Sabuun Barrage	0.62	0.868	1.18048
FAO Canal	8.2	11.48	15.6128
Hawdley Reservoir	2.1	2.94	3.9984
Govt capacity building	1	1.4	1.904
Total	**19.96**	**27.944**	**38.00384**

Figure 71: Rehabilitation of Sabuun barrage and irrigation canals in Jowhar

6.2.1.2.1 Irrigation Canal Rehabilitation

315. GCF proceeds will be used to also upgrade, rehabilitate and repaid irrigation in the four districts that have rivers and existing irrigation projects: Kismayo, Kurtunwarey, Qoryoley and Afgoye. A total of

16 irrigation canals will be rehabilitated: main canals approximately 10km long, each with 20km of secondary canals and 40km of tertiary canals).

316. The current state of each scheme will be determined in an engineering prefeasibility study under FAO supervision that will also include the development of ESMPs for the rehabilitation works. SWALIM has developed an Irrigation Management System, that provides information on ongoing and planned irrigation projects. This will be used to prioritize and map the selection of irrigation projects to be rehabilitated through GCF funding[102].

317. In most of the cases, river embankments are eroded, and barrages, pump sluice gates and canal systems show significant sedimentation and vegetation growth which reduces the canals' hydraulic sections. Silting up of the drainage system is accelerated by the lack or degradation of terminal outlets and the flat topography of the irrigation area, which restricts drainage water from returning into the rivers by gravity.

318. The result will be that 80,000 ha will be under improved and increased irrigation, benefiting 80,000 households (1 ha per household) or 496,000 people (50% of which will be women). For the purposes of calculating the area that will be irrigated with each rehabilitated canal, the project has assumed that on average, each irrigation project has a zone of influence of 10km and width of 5km. The area irrigated is 10,000 mx 5,000m = 50,000,000m2 = 5,000Ha. Emphasis will be placed on ensuring the full active participation of women in all consultative meetings prior to, and during, the rehabilitation works, to ensure that their needs are taken into consideration and to verify that works are not creating additional work or insecurity for women.

319. In addition, in all 10 districts, the project will disseminate water savings technologies that will increase water use efficiency. This will include particularly the provision of solar powered water pumps and drip irrigation materials. Links between these and the ecosystem-based adaptation water retention works under Outcome 1 will be made, leading to increased crop production. The water pans will provide water for livestock and thus improve livestock production.

320. All rehabilitated infrastructures will be managed and operated by the WUAC established in activity 2.1.1 according to agreed water uses and with a focus on equitable access and conflict prevention. In each site, the project will work with WUAC to also deploy water saving technologies to farmers and producers, including drip irrigation kits and solar operated pumping systems[103]. This will increase water use efficiency in all cropping systems, and will be supported by training at local level for all users. The primary advantage of drip irrigation over traditional methods (like flood or furrow irrigation) is that is brings water directly to the root zone of plants, reducing losses due to evaporation and runoff, which are likely to increase due to climate change.

321. Global analyses indicate that drip irrigation not only conserves water but can also boost crop yields by significant margins when compared with other irrigation types like flooding, border, furrow, and sprinkler systems. For example, in situations of water scarcity, using the appropriate amount of drip irrigation (about 100-120% of the plant's needs) can increase crop yields by 28.92% relative to flooding irrigation and by lower but still substantial percentages relative to other methods[104]. Studies have shown

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[102] https://spatial.faoswalim.org/layers/geonode:SOM_Irrigation_Canals_FAOSWALIM2018#/

[103] Omar, Abdiwahab & Mohamud Hassan, Sadak & Mohamed, Mohamed. (2022). Drought Effects in Somalia and Solution Proposals. African Journal of Climate Change and Resource Sustainability. 1. 13-25. 10.37284/ajccrs.1.1.807.

[104] Yang P, Wu L, Cheng M, Fan J, Li S, Wang H, Qian L. Review on Drip Irrigation: Impact on Crop Yield, Quality, and Water Productivity in China. *Water*. 2023; 15(9):1733. https://doi.org/10.3390/w15091733 and otherwise https://www.ifc.org/content/dam/ifc/doc/mgrt/impact-of-efficient-irrigation-technology-on-small-farmers-ifc-brochure.pdf#:~:text=URL%3A%20https%3A%2F%2Fwww.ifc.org%2Fcontent%2Fdam%2Fifc%2Fdoc%2Fmgrt%2Fimpact

that poor households in Somalia derive immediate benefits from access to drip irrigation, increasing household production sometimes by a factor of 2 to 3, despite high initial investment costs for the irrigation systems[105]. Savings in terms of labour and farming time are also felt, particularly for women and girls.

322. Moreover, drip irrigation can lead to a more efficient use of fertilizer by reducing leaching, and it can also help in lowering soil salinity, further promoting better crop health and increased yields. In addition to water and yield benefits, drip irrigation contributes to other sustainable agriculture practices by enhancing soil health, nutrient management, and reducing the incidence of disease.

323. All WUAC members will receive training on how to maintain the irrigation systems and drip irrigation systems to reduce siltation, degradation of filters, and to reduce maintenance costs in the long run. Proceeds from the savings groups set up under Output 2.3, as well as fees and dues from the water user fees will be used to support ongoing operations and maintenance of the systems. In addition, adequate water management techniques will be integrated into the curriculum of all Farmer Field Schools (FFS) and Agro-Pastoral Field Schools (APFS) under output 2.2.

6.2.2 Output 2.2. Local communities practice locally-specific Climate Resilient Agriculture

324. Activities under this output are designed to transfer and rapidly scale the application of climate resilient agriculture practices, approaches, and inputs to producing households in the project sites, and to reinforce the support provided by local extension services to the adoption of climate resilient agricultural practices. The activities here are based on previous experience by FAO and other donors on the organization of producer groups and value chains.

325. Throughout the activities under output 2.2 and 2.3, the project will use the Gender Action Learning System as a means to ensure adequate integration of gender-specific needs and aspirations. Gender Action Learning System (GALS) is a community-led empowerment methodology using specific participatory processes and diagram tools that aims to give women as well as men more control over their lives as the basis for individual, household, community and organizational development[57]. The methodology as well as the steps of the GALS methodology are described in a manual developed by IFAD[58]. GALS includes a Participatory Gender Review which is a qualitative and quantitative assessment of needs and achievements in terms of gender relations, and Livelihoods and Value Chain Development activities aiming to increase income, production and access to markets. Refer to Annex 8, Gender Action Plan, for further detail.

6.2.2.1 Activity 2.2.1. Disseminate CRA practices to farmers

326. The dissemination and scaling of CRA practices will be primarily done through the Farmer Field School (FFS) and Agro-Pastoral Field School (APFS) model, which has been successfully used globally by FAO to rapidly disseminate better food production practices. The specific type of group, and the curriculum, will be adapted to local conditions: APFS will naturally be more focused in the Northern areas where pastoralism is a major strategy.

327. In numerous studies[106], and in FAO experience, FFS demonstrate high potential to enhance human, social, natural and financial capital. Human capital takes the form of critical thinking, innovation, confidence, and quality of life. Effects on social capital included mutual trust, bonding, collective action,

[105] For example, https://www.usaid.gov/sites/default/files/2022-05/IA%20of%20small%20scale%20pump%20irrigation%20in%20Somali-Region.pdf

[106] See for instance, https://link.springer.com/content/pdf/10.1007/s12571-020-01046-7.pdf

networking, and emancipation, all of which are key in the Somali context both as a natural social coping mechanism but also in a context of reconstruction. Other improvements include enhancements in food production, diversification, and food security. Financial capital can also be enhanced through increased income and profits, savings and loans schemes, with a potential to reduce poverty. (Refer to Outcome 3 for the linkages to savings and loans).

328. Conditions for successful FFS as noted by FAO[107] include the clear definition of the problem, the availability of well-trained facilitators, a well-organized community and local buy-in, support and goodwill of the authorities, availability of appropriate technologies, as well as of adequate resources, government policy and logistical support. At the beginning of the project, FAO with MoAI will develop a curriculum that will include detailed technical packets on all the proposed technologies and practices (sub-activity 2.2.1.1). Inputs from a Gender analysis and GALS process will be instrumental in ensuring the concerns and capacities of women producers are integrated into the curriculum.

329. Trainers and Facilitators, some of whom may be selected from along existing extension offices in project districts, will receive extensive training over 6 weeks on the practices and technologies, and the requirements of facilitating FFS in Somalia. (sub-activity 2.2.1.2). Conscious efforts will be made to select women and young people to act as lead farmers and FFS facilitators, bearing in mind they will be better able to reach their peers.

330. Both FFS and APFS will be constituted as groups of 30 producers (men and women) who meet regularly in a local field setting, under the guidance of trained facilitators. Each FFS will receive material and technical support in addition to regular training and exchange visits, over the course of two years. (sub-activity 2.2.1.3). The project will strive to achieve 50% of women members in all groups, however the possibility of women-only groups will also be retained.

year 1	year 2	Year 3	Year 4	year 5	Year 6	Year 7
Training of Trainers and Curriculum	FFS Cohort A: 84 groups	Refresher A: 84 groups	Refresher B: 84 groups	Refresher C: 84 groups	Refresher D: 84 groups	Refresher E: 84 groups
		Cohort B: 84 groups	Cohort C: 84 groups	Cohort D: 84 groups	Cohort E: 84 groups	N-A

Figure 72: sequencing of FFS and APFS

331. Throughout the process, the Government of Somalia, through MoAI and its network of extension services, along with FAO, will provide technical and logistical backstopping, supervision and monitoring of the FFS throughout the project (sub-activity 2.2.1.6). This will include providing coordination support, logistical and material support (through the procurement of inputs and tools), supervision (both financial and technical) and monitoring (in terms of collecting data on results achieved).

332. The “menu” of agricultural practices to be promoted during the project will be tailored to the local conditions, projected climate change, existing production systems and value chains, and priorities of the local community. Selection of specific technologies and practices will also be aligned with the LMP developed under Output 1.1, and the project will support linkages between LMC and FFS in the region. For example, FFS members may be invited to participate in LMC meetings, some may also be sitting as representatives in the LMC, or LMC members may visit FFS for information exchange. Table 21proposes a list of technologies that farmers may select from, in alphabetical order.

Table 21: Technologies promoted under FFS and APFS

[107] FAO, Farmer Field School Implementation Guide, Farm Forestry and Livelihood Development, 2011

Technology (by alphabetical order)	Adaptation benefit
Agroforestry	Trees in farms for nutrition and income, and sylvopastoral systems for fodder. It will help reduce exposures to heatwaves and other extreme events
Biogas	Production of biogas helps reduce pressure on land and reduces deforestation for energy. It also helps reduce the impact of livestock herds on the local environment (particularly water), especially when livestock is stabled rather than ranged. Side benefits may include the creation of off farm jobs. When combined with proper cookstoves, biogas can provide cleaner cooking fuel.
Contour farming	Relevant in places of sloped land (2-10%), to reduce soil and nutrient losses from erosion. Furrows and crop rows can be used to retain water and slow run-off. Contour farming reduces the need to fertilize and can absorb the impact of heavy rains. As a mode of land preparation, it can also be combined with the use of fodder crops or with the integration of trees in agro-pastoral or agroforestry production systems.
Cover crops	Cover crop roots reduce erosion, retain moisture in the soil and prevent soil compaction, further reducing the need for tillage. Maintenance of soil fertility, reduction of erosion due to rainfall and wind. Increased yields and access to food through diversification.
Crop rotation and intercropping.	Increased soil fertility through nutrient cycling, increased access to food and nutrition through diversification. Allows for risk hedging and selection of more climate-appropriate crops, avoiding crop losses.
Drip irrigation	Increased access to water, increased water use efficiency and increased production and productivity. Hedges against high temperatures and evaporation. Allows for night-time irrigation and production of bumper crops. When combined with protected agriculture (greenhouses, can yield significantly increased production of more varied crops, including vegetables).
Fodder production	Will be introduced mostly in the north where pastoralism is prevalent, but will also serve as a supplement for the raising of small cattle in southern districts. Fodder production allows for increased livestock production and productivity, reduced rangeland degradation, reduced land degradation, reduced risk of livestock losses. It can be combined with cropping in an agro-forestry or agro-pastoral system.
Greenhouses	Greenhouses, shading and other forms of protected agriculture (ie roofs) can prevent wilting of crops during high heat, prevent damage to crop during severe rainfall events, and reduce crop water demand. Additional crops are possible under controlled conditions, particularly for food diversification (vegetables and other crops).
Home gardening	Home gardening will be promoted as a means of ensuring food and nutrition diversification.
Improved breeds and seeds	Improved breeds of cattle will be promoted to increase livestock productivity and resilience, reduce disease burden, improve breeding stock and reduce emissions. Improved seed material will also be distributed. Improved material will be drought and flood resistant where necessary.
Improved cookstoves	Improved cookstoves help reduce deforestation and land degradation by reducing the need for energy. They can also reduce labour burden for women and girls, improve indoor air quality. Biogas fuels can also be used for cooking in certain areas.
mechanization of land preparation	Will be promoted in areas where the areas cultivated have been subject to excessive siltation and erosion, or in cases where contouring is required. This can help increase land under production, and reduce labour.
Microbasins, rock ponds, small catchments	Improved water retention, increased access to irrigation at farm and household level (house gardens) leading to increased production, productivity and diversification
Minimum tillage	Will be promoted as way to reduce the risk of land degradation and erosion, and to increase soil fertility.
Mulching	Reduced land degradation, reduced risk of erosion, increased soil fertility, improved productivity.

Rainwater harvesting	Improved water retention, increased access to irrigation at farm and household level (house gardens) leading to increased production, productivity and diversification
Rangeland rehabilitation	This may involve set aside zones for natural regeneration, assisted regeneration through seeding, and planting of rangeland species. Leads to increased rangeland productivity, reduced risk of erosion and flood, increased livestock production.
Ratooning	Consists in not removing the entirety of plans during harvest, leading to a potential second growth from the same seed material. Leads to increased productivity, increased yields per ha, and reduced labour.

333. In total, the project reaches over 85,932 people through FFS and APFS, 50% of which will be women, and 30% will be youth. Participation in the FFS and APFS will be voluntary and be subject to the following criteria (in addition to the general criteria highlighted in section 8.5:

- Only one participant per household, aged over 16.
- Must agree to provide their own land on which to practice the technologies.
- Agree to participate in all trainings and meetings (the project supports travel costs for field days)
- Must not already be a member of other farmer groups under this or other projects (however, FFS/APFS members can become members of savings groups under output 3.2).

6.2.2.2 Activity 2.2.2. Build the capacity of MoA at Local, State and Federal level to support communities in the adoption of CRA practices.

334. The project will develop and deliver a full public service retraining program related to climate resilient agriculture (sub-activity 2.2.2.1), which will be designed based on the findings of a detailed decentralized needs assessment. Preliminary assessments show the following elements that must be included in the programs:

- Climate change and Climate Resilient Agriculture practices: principles
- Climate Resilient Agricultural technologies for Land, Water, Crop and Livestock
- Climate-informed land use planning
- Development and delivery of gender sensitive advisory services
- Social inclusion, gender mainstreaming and participatory processes
- Designing climate-informed extension services and packets
- Leveraging climate information and data to support local communities

335. This program will be delivered to existing staff during the project (including women and youth extension staff), and will also be deployed to all new MoAI recruits at federal and State levels, through NGOs and with the collaboration of academic institutions, particularly Universities. It is expected that the program will be adopted by MoAI as part of its regular training mandate.

336. Short term training for technical staff and extension staff who are immediately involved in project implementation will also be developed and deployed in all project districts. The focus of these trainings will be the technologies listed in Table 21. The purpose of these trainings is to ensure that capacity exists at local level to support the FFS and the continued scaling and dissemination of the climate resilient agricultural practices promoted by the project (sub-activity 2.2.2.2)

6.2.3 Output 2.3 Farmers derive increased income from sustainable natural resource management and climate resilient value chains

337. Under output 2.3, activities are targeted towards the development of value chains that are more resilient. Where output 2.1 and 2.2 were targeted at ensuring livelihoods and production were

conducted according to the principles of climate resilience, output 2.3 activities are aimed at actors beyond producing households. The purpose of these activities is to ensure that supply chains, particularly input supply chains, are sustainable and sufficiently organized and structured to ensure continuity and gradual upscaling of project outputs and activities. This will also contribute to accelerating the transition from subsistence-based agricultural activities to more economically viable, market-oriented production and processing. Seed and input supply chains are also means by which the project builds the capacity of the private sector, currently very informal and unstructured, to play a constructive role in adaptation to climate change.

6.2.3.1 Activity 2.3.1. Improve access to climate resilient inputs for crop and livestock production

338. Roughly 95% of farmers rely on informal seed sources, and the quality and reliability of seeds are often compromised. The need to secure climate adapted seeds is urgent if the producers are to gain full adaptation benefits from the climate resilient practices above. Experience in Somalia has shown that the sole use of adapted seed material can double or triple production and productivity. Emergency seed interventions have been used to respond to dire food security need; however these are not intended as sustainable in the long-term and fail to create formal seed systems that can withstand demand. The government recently launched the Somali Seed System Recovery Initiative, with support from the World Bank, that will feed into this renewal. The project also builds on FAO experience from 2016-2019 through the SOMASEED project that trained 226 seed growers [108] and initiated the multiplication of 40 land races.

339. The activity is aimed at strengthening and reorganizing the seed distribution system, in line with MoAI priorities and with the needs of local producers. There is an urgent need to secure stable supply of resilient seed material, to ensure that appropriate climate resilient varieties are being used and multiplied locally in all the value chains. This includes trees, fodder and crop varieties. As a first element, the project will support a comprehensive seed market dynamics analysis, which will include a mapping of input sources at country and State level, an analysis of demand/supply and projections aligned to climate scenarios, and an analysis of prices and storage capacities. The study will also consider a gender-sensitive seed value chain analysis to understand sources of seed for women, their ability to pay and storage capacity. This study will be used as a basis for policy reform in the area of gender-sensitive seed subsidies and price management by the MoAI. (sub-activity 2.3.1.1)

340. The MoAI will also receive extensive technical support and training on the quality assurance, certification and implementation of seed certification norms and standards (sub-activity 2.3.1.2). This will include technical and financial support for the characterization of resilient seeds and their certification according to improved seed testing protocols, including through the establishment of improved test and trial sites and laboratory testing facilities. Assistance from the ICRISAT and other CGIAR centers will be sought for this process. Norms related to maize, sorghum, sesame, and fodder seeds will be reviewed, to ensure clear bills of quality and terms of reference are applied uniformly and communicated to seed growers. While initially the project will promote “truthful labelling” where labelling is done by farmers, the Quality Declared Seed standard will be promoted, meaning that seed producers will eventually be registered.

341. The proposed reorientation of the current informal seed system is towards a hybrid model that focuses on the production Standard Seed by farmers under guidance and certification by the responsible seed certification authorities. These systems are most appropriate for self-pollinated crops and crops like sorghum and sesame. The project proposes a combined approach for seed sector

[108] https://openknowledge.fao.org/server/api/core/bitstreams/e2c7177d-b2e7-4735-be25-93aa2c569d64/content

development in which seed of self and open-pollinated crops are produced by farmers, whereas hybrid crops (for which a regular supply of fresh seed is needed) are produced, marketed, and distributed by commercial seed companies and cooperatives. The project will engage with existing private sector partners including the Sesame Seed Growers' Association, Shabelle Agro-Corporation, Som Seed Agri, Darusalam Seed Company, and the Center for Social and Economic Transformation[109].

342. In order to launch multiplication, the project will acquire appropriate, internationally certified foundation seed material through the CGIAR and distribute it to local farmers' associations and cooperatives who will act as seed multipliers (sub-activity 2.3.1.3). Women's groups will be organized to engage in seed multiplication. Seed multipliers will receive training and material support to conduct seed multiplication with a view to becoming autonomous seed providers by the end of the project. Seed fields will be isolated from other crops – hence participants in this part of the project will not be the same as those participating in the FFS and APFS under output 2.2. Seed growers will receive training on good agronomic practices for seed production (leading to certification as Quality Declared Seed (QDS) by the competent seed certification authority). This will include weed management, pest and disease control, removal of off-type or diseased plants (rouging), appropriate fertilization, water management, harvesting and processing[110].

343. During the project, the project will acquire seed from these multipliers for distribution to project beneficiaries under the FFS and APFS models (sub-activity 2.3.1.4). By the end of the project, pricing for the seeds will be established together with the cooperatives, aligned to norms and rules set by the MoAI for seed pricing and subsidies, and considering issues of equity and the ability to pay of the producers. A similar model will be followed for the production of fodder, where the project will purchase foundation seeds and also create 8 fodder processing facilities in support of agro-pastoral communities in the main livestock producing districts. Training and material supports will be provided to cooperatives (sub-activity 2.3.1.5). Inputs to fodder facilities may also originate from the prosopis control activities under taken under Outcome 1.

344. The project will support 20 seed growing cooperatives (3 seed types), 30 fodder seed cooperatives (12 seed varieties), and 30 nurseries (at least 20 of these groups will be made up of women). Seed varieties that will be explored will include:

Maize	Sesame	Sorghum
- Siman hybrid: stress tolerant hybrid maize developed by CMMYT[111].	- Yemen variety[112]	- Caudatum race[113]

345. For tree production, which will be required for the establishment of agroforestry in the project sites, the project will also work with cooperatives and farmer associations to establish nurseries. The project will establish 30 nurseries which will be run and operated as small businesses by their members, at least 10 of which will be made up of women's groups (sub-activity 2.3.1.8). Tree species that will be

[109] https://www.adaptation-undp.org/sites/default/files/resources/SCALA%2520Somalia%2520Report-FINAL-15Mar_0.pdf
[110] https://cgspace.cgiar.org/server/api/core/bitstreams/bcd1d707-e3db-45de-82f3-a8c025447149/content
[111] https://satg.org/siman-hybrid-revolutionizing-maize-farming-for-prosperity-in-somalia/
[112] Ismaan, H.N et al. Evaluation of new sesame varieties for grouwth and yield performance in summer season in Afgoi, Somalia, 2020
[113] Manzelli, M. et al Agro-biodiversity and subsistence farming systems of south somalis – collection and agronomic assessment of somali sorghum, 2006.

promoted for growing will include: Leucena, Cassia, Calliamdra, Sesbania, Grevillea, Mango, and Avocado.

346. Finally, to ensure that waste is reduced, that seeds maintain quality levels, and that input prices are controlled, the project will build climate resilient input storage facilities that will be collectively managed (sub-activity 2.3.1.9) and kept separate from other crops. Each storage facility (25m^2) will have the following climate resilience characteristics:

- Raised floors to avoid humidity and run-off during rainfall events;
- Humidity and drainage control (roof, gutters, and sidewalks);
- Temperature control (solar powered cooling or aeration);
- Windows/light control (to avoid burning);
- Pest and dust control (windows and mesh).

347. Each facility may also be equipped with rooftop rainwater harvesting equipment. Wherever possible, input storage facilities may be located near processing plants, markets, villages and other access points to facilitate transportation and create added market and networking opportunities. The seed storage facilities (10 in total) will be managed by a seed cooperative.

348. Seed growing and multiplying cooperatives, fodder producing facilities and nurseries will become small private sector agri-businesses, thereby contributing to the generation of additional income for agricultural households and the revitalization of the input supply chain locally. To ensure that prices of seed remain within affordability for farmers in the region, the project will work with

Figure 73: example of fodder storage shed lacking resilience characteristics.

6.2.3.2 Activity 2.3.2. Build the capacity of producer groups to develop sustainable climate-informed business plans

349. In order to further strengthen the value chains, the producer groups, cooperatives and associations will also receive capacity building in terms of their business and finance capacity, to ensure the growth and stability of the sub-sector as a key element of ensuring resilient livelihoods can be pursued throughout the region.

350. The project will select 410 groups among existing small businesses, seed grower cooperatives, nurseries, producers and associations and will provide them with training on value addition, processing,

packaging and marketing. (sub-activity 2.3.2.1). Training will remain focused on maize, sorghum and sesame value chains and will include, for example:

- Drying, roasting, and milling techniques
- Oil production
- Climate-proof packaging

351. Selection of the 410 groups will occur in year 3 and be based on the following criteria:

- Have been in production for at least 3 years
- Have registered sales for at least 2 years
- Have between 25 and 50 producing members
- Have undisputed access to their productive land
- Have access to water
- Have a bank account, an electronic money account or a savings account for the group
- Have documented group by-laws;

352. The groups will receive assistance and training on the development of climate informed business plans for selected processing and value addition activities, such as milling, drying, roasting, oil pressing, paste-making, and full transformation into food goods (ie. Baking). For the fodder producing groups, the project will also support transformation and processing including pellet making and milling (sub-activity 2.3.2.2). Each group will receive technical assistance for the design of 5-year business plans that aim at transforming their production units into self-sustaining private sector businesses. This may include acquisition of processing material, construction of facilities, acquisition of improved seeds and materials, negotiating contracts and participating in agricultural fairs or markets. It will not include acquisition of land or land expansion.

353. The project will procure initial material investments, such as small processing machinery and equipment, to support the growth of the agri-food private sector. In addition, the project will support the construction and rehabilitation of climate resilient food storage facilities (including solar powered cooling and climate control) at district level (sub-activity 2.3.2.3). Groups will be required to participate at the level of 10% of the cost of the storage facility, which will also be self-managed. This will facilitate access to market, price control, and importantly, reduce wastes and losses for value added commodities. Producer groups and cooperatives will then receive support in submitting their business plans to micro-finance or rural finance institutions under activity 2.3.3.

6.2.3.3 Activity 2.3.3. Increase MSME, cooperatives and farming group access to agricultural credit

354. The groups above and the FFS and APFS convened under output 2 will also receive support in accessing agricultural credit and rural finance, also as a way to strengthen the sustainability of value chains, and to ensure long-term financial autonomy and self-replication of the production systems. In this activity the project will work both on the demand and supply of rural finance.

355. First, a sub-set of the FFS and APFS groups will be supported in establishing savings and loans groups or associations (VSLA). Among each cohort of FFS/APFS, the project will select those with the best production and performance, who have produced enough surplus to be able to pool savings for various reinvestment initiatives. It is expected that the top 15 FFS/APFS groups will be selected in each cohort (a total of 75). The formation of VSLA seeks to realize an increase in household savings, investments, and, therefore, income through value addition on products to increase their demand, supply, and availability in the market. Using the group platforms, members meet weekly and are trained to save by purchasing shares at an agreed price per share. Adhering to religious ethos, the accumulated amount is disbursed as interest-free loans. Members are responsible for repayment within

a set period. Members are also encouraged to contribute to a social fund that serves as insurance for the VSLA members during emergencies. The approach has already been demonstrated in Somalia through the FAO's Long-Term Cash and Livelihood Assistance programme, and by other partners as well, including in the targeted regions (e.g. ACTED). VSLA are self-managed groups that do not receive external funding but provide a safe way to collectively save money.

356. Particular attention will be paid to the active participation of women in VSLA, including in decision-making roles. As semi-formal mechanisms, VSLA can be very accessible to women's needs in particular since there are barriers to women's access to formal finance. Women-only VSLA may also be explored in certain settings, if gender mixing creates barriers for women. All VSLA will be supported through registration, establishment of internal rules and governance, financial literacy and bookkeeping. The Groups will receive two-day training session on book keeping, savings and loan methods, record-keeping, and loaning systems (sub-activity 2.3.3.1). In VSLAs, community members form a self-managed group in which money is saved and members can take out loans from the savings to invest in a project or to cover sudden cash needs.

357. The purpose of VSLA will be to support the financial activities of the group or its individual members, including climate resilience requirements. Specific investments and loans that will be supported through this project include resilience-building measures at household or collective level, such as:

- Acquisition of improved seeds and breeds of livestock
- Mechanization of land preparation
- Improvement of water storage and irrigation canals
- Acquisition of telecommunication equipment for receiving agronomic and EW advisory
- Acquisition of improved cooking fuel and stoves
- Acquisition of small processing or agricultural equipment

358. These groups, as well as the cooperatives and small businesses (including seed multipliers, fodder producers and nurseries) will also be supported in accessing microfinance institutions that will also be capacitated to support climate resilience investments (sub-activity 2.3.3.2). This will include support for the development of business plans using FAO's Rural Invest tool and the organization of brokering meetings between business owners (especially women) and financial institutions to help them present their business plans. Among the available microfinancing partners in the area, the project will work with partners such as:

- KIMS
- Himilo
- Somali Microfinance and Financial Inclusion Center
- Maal Microfinance
- And others,

359. The purpose will be to ensure that microfinance products are flexible and adapted to the necessities of the agriculture sector, with reasonable repayment terms and accessible to all, including Women, persons living with disabilities and Internally Displaced Persons.

360. Another promising model, which has been tested in Somalia and provides unique advantages in terms of consolidating value chains is the Producer- Public-Private-Partnership model (PPPP). The model creates a system similar to contract farming and secures income for vulnerable producer households whose production is guaranteed to be purchased at a fair price, under certain production conditions, by large buyers and bulkers.

361. 4Ps involve cooperation between a government, business agents and small-scale producers, who agree to work together to reach a common goal or carry out a specific task while jointly assuming risks and responsibilities, and sharing benefits, resources and competencies[114].

362. The 4P approach is used as a "pull" mechanism to finance business plans jointly submitted by private companies and farmers organizations in which they propose to enter in a partnership agreement. For these business plans, project financing focuses on the delivery of public or semi-public goods that would not be funded by the private sector company otherwise. Using public resources is justified to address a "market failure" where the perceived high risks and transaction costs of working with small producers are preventing private companies from starting market-based business relationships[115].

363. In this context, producer groups contribute their production assets, labour and inputs. Public sector agencies, in this case MoAI – including with funding from this project - invests in public goods, such as roads, post-harvest storage, and improved policy settings. FAO or the MoAI may serve as brokers[116]. Selection criteria for the companies who will participate in this initiative will be:

- Institutional mandate and alignment to needs (e.g. finance, marketing, processing).
- Financial stability.
- Ability to scale operations.
- Commitment to sustainability and inclusion.

364. The project will develop 3 4Ps agreements between farmer cooperatives, Microfinance institutions, Somali Bankers Association and lead wholesalers, for example the Sesame exporters platform (sub-activity 2.3.3.4). This will involve the following steps:

- Defining the rationale for the partnership, and in particular the market demand. Establishing the rationale requires an assessment of major opportunities and challenges to be addressed by the 4P, and the main incentives for each actor to commit to the partnership on a long-term basis
- Identification and selection of suitable 4P partners. Partners can be selected either through a competitive process, or through a careful scouting and due diligence process, identifying any areas required capacity development, particularly for producers.
- Development of the business case, in which producers and companies agree on the business model: e.g. contract farming schemes, out-grower schemes, supply-based arrangements or cooperative models.
- Developing the financing package and arrangements, considering all financial requirements including public goods and services (e.g. transport, major water infrastructure, market infrastructure, technology), semi-public assets (production or processing plants) and private assets (working capital, land and others), and finally funding from project -supported public goods.
- Negotiation of governance mechanisms and in particular conflict mitigation, rules for communication and risk management.
- Development of a monitoring and evaluation system to measure success and feed into future iterations of the arrangements.

365. **Rural Finance**: Access to formal finance in Somalia is very limited. The financial market in Somalia is at its nascent stage with only thirteen licensed banks and three microfinance institutions currently

[114]

[115] https://www.snv.org/update/public-private-producer-partnerships-4ps-approach-more-ps-merrier

[116]https://www.ifad.org/documents/38714170/40314128/Public-Private-Producer+Partnerships+%284Ps%29+in+Agricultural+Value+Chains.pdf/853d82f8-45c9-4493-b2da-b509112cc0b3?t=1555415705000

operating[117]. A vast majority of the rural population relies on informal financial services, with formal financial institutions having minimal reach. Microfinance services have been gradually improving access, but a large portion of rural households still lacks sufficient financial services. Only 15% of Somalis aged 15 and above hold an account in a financial institution[118]. Despite ongoing reforms, significant financial infrastructure-related barriers remain, including high collateral requirements due to the absence of credit market infrastructure e.g., collateral registry, movable asset registry, client identification and and credit information systems. In 2021, the Central Bank of Somalia established a national payment system (NPS) enabling commercial banks to electronically transact with each other

366. Several other barriers hinder access to rural finance in Somalia: persistent conflict and instability in many regions created a high-risk environment that discouraged investment and the establishment of financial institutions. Weak institutional capacity and regulatory frameworks, and the absence of tailored financial policies for the rural sector have created serious obstacles. In addition, poor communication networks have limited outreach, and rural inhabitants have limited knowledge and understanding of financial products and services, which affects their ability to utilize these services effectively[119]. Finally, religious and cultural practices and social norms can restrict certain groups, especially women, from participating in formal financial systems.

367. Some financial institutions offer various types of agricultural products, some of which are illustrated in Table 23[120]. However, the offer remains very limited.

Table 22: examples of financial institutions offering agricultural finance

Institution	Type of product
Dahabshiil Bank[121]	Agricultural loans, micro-loans, savings accounts (financing of equipment like tractors, green houses, power machines and solar system facilities).
Kaah International Microfinance (KIMS)	Micro-loans for small-scale farmers, savings accounts, training
International Bank of Somalia	Agricultural loans, savings products, mobile banking
Agro Bank[122]	Tractors and equipments Agro line of credits Crop production Smart farming Greenhouse farming Irrigation and water management

368. Requirements for access to finance typically include business registration or land certification, collateral assurances, proof of activity or sales and a business plan.

[117] https://centralbank.gov.so/wp-content/uploads/2023/07/CBS-Policy-Brief-0022023-.pdf
[118] https://www.businesscalltoaction.org/member/kaah-international-microfinance-services
[119] https://www.ilri.org/knowledge/publications/state-finance-drylands-formal-and-informal-finance-kenya-mali-and-somalia and
[120] https://centralbank.gov.so/licensed-banks/
[121] https://dahabshilbank.com/business-agribusiness-finance
[122] https://agrobank.so/product_and_services/

369. Access to loans is relatively low, reflecting broader challenges in the financial sector. Only about 2% of households have loans from banks, while 26% manage to secure loans mostly from merchants and traders. This highlights a significant reliance on informal lending channels rather than formal banking institutions. The financial landscape in Somalia is heavily influenced by issues such as high markup rates charged by financial institutions (12% and higher[123]) and a lack of sufficient support for micro, small, and medium enterprises (MSMEs) to sustain and expand their businesses. These challenges are exacerbated by limited access to financial services in rural and remote areas, making it difficult for a larger portion of the population to secure financial support.

370. Cultural issues also prevent traditional, donor-driven rural finance and agricultural finance from reaching more MSMEs. Financial Institutions in Somalia have used the Murabaha model (Cost-plus Mark-up) as a shari'a compliance model of financing, however, it is not accepted everywhere, does not allow for cash transactions and leads to a lack of competition in the services offered[124].

371. Mobile money systems and application are gaining in popularity, particularly in areas where there are many IDP, banks are not available, and cash is rarely used. In Somalia, mobile money plays crucial role in the development of the financial sector as mobile money services is used to transfer and save money. A study highlighted that 63% of mobile money users save their funds to their mobile phones and receive remittance money through their mobile accounts[125]. Main mobile money services are:

- Zaad: Operated by Telesom, Zaad was one of the first mobile money services launched in Somaliland and has become widely popular across the region.
- EVC Plus: Provided by Hormuud Telecom, EVC Plus is extensively used in southern and central Somalia. It offers a range of services including money transfers, bill payments, and mobile recharges.
- Sahal: Sahal is another major mobile money service, run by Somtel. It facilitates various transactions such as sending and receiving money, paying bills, and purchasing airtime.
- Golis Telecom: While less prominent than Zaad, EVC Plus, or Sahal, Golis Telecom also offers mobile money services, mainly in Puntland.

372. These services have become integral to everyday transactions in Somalia, offering an alternative to traditional banking and significantly increasing the accessibility of financial services, especially in rural or conflict-affected areas. They play a critical role in the economy by enabling digital payments and improving the security of financial transactions.

373. To increase the offer of financial services, working on the supply side of the rural finance continuum, the project will also provide support to select financial institutions (MFI, FI, mobile money services or bankers associations) to develop innovative financial products that are responsive to the needs of the sesame, sorghum and maize value chains in a context of climate change and climate variability (sub-activity 2.3.3.5). To ensure accessibility the project will engage financial institutions to influence development of financial products that are suitable for women and youth agripreneurs, such as non-collateral based credit systems.

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[123] Field level consultations, 2024

[124] https://www.zawya.com/en/world/africa/challenges-of-access-to-finance-for-msmes-in-somalia-i901c9lu

[125] https://www.researchgate.net/profile/Abdinur-Mohamed/publication/352761656_Measuring_the_Contribution_of_Mobile_Money_Services_to_Financial_Inclusion_The_Case_of_Hormuud's_Evc-Plus_in_Somalia/links/60d6d0d4a6fdccb745e43f8c/Measuring-the-Contribution-of-Mobile-Money-Services-to-Financial-Inclusion-The-Case-of-Hormuuds-Evc-Plus-in-Somalia.pdf?origin=journalDetail&_tp=eyJwYWdlIjoiam91cm5hbERldGFpbCJ9

374. Products may include:

- Micro-finance loans (in cash or in kind)
- Advance payment systems
- Crop and Processing Insurance
- Micro-enterprise grants and 0% loans.
- Non-collateral loans through group guarantee systems

375. The project will also explore the following Islam-compliant modalities[126]:

- Murabaha: a cost-plus financing method commonly used for agricultural equipment and inputs. In this arrangement, the financial institution purchases the goods and sells them to the farmer at a profit margin agreed upon in advance. This method is compliant because it involves a tangible asset and does not charge interest.
- Mudarabah: A partnership where one party provides the capital, while the other provides expertise and management. Profits are shared as per the agreement, but loss is borne only by the provider of the capital, which makes it suitable for new agricultural ventures where the outcome is uncertain.
- Musharakah, where all partners contribute capital and share profits and losses according to their respective investment. This instrument can be used to fund larger agricultural projects, like farm expansions or cooperative agribusiness ventures.
- Ijarah, that allows farmers to lease equipment or land without the need to purchase them. The bank buys and leases the equipment to the farmer for a fixed rental payment. The lease agreement does not involve paying interest, which aligns with Islamic principles.
- Salam contracts, in which the financial institution pays in advance for agricultural products that are to be delivered at a future date. This is beneficial for farmers who need funds to grow crops but is contingent upon certain conditions to ensure delivery.
- Istisna: a contractual agreement for manufacturing goods and commodities, allowing cash payment in advance and future delivery or a sale that can be settled at a future date. Istisna can be used to finance the construction of agricultural facilities like greenhouses or storage units.

6.2.3.4 Activity 2.3.4. Increase all-season access to market for smallholder producers, cooperatives and farmer groups

376. Finally, the project will invest in rehabilitating key rural infrastructure that has been degraded either due to conflict or natural causes in order to ensure that producers can access markets to both acquire inputs and sell products. Functioning markets, regardless of climate conditions, particularly in times of flooding or other climate extremes, offer important coping strategies on multiple levels. From an economic perspective, access to markets allows the creation of value and breaks the cycle of subsistence farming; from a social perspective, particularly in a fragile context functioning and accessible markets create poles where households can access social services and safety nets, as well as social networks. Input supply chains cannot function without accessible markets. Therefore, the project will rehabilitate rural roads and upgrade them to withstand harsher climate conditions, including heat and severe rainfall. (sub-activity 2.3.4.1). Road rehabilitation will be done according to the following process, with the cooperation of the Ministry of Transport and MoAI. Given that a number of large scale investments in the rehabilitation of transport infrastructure are currently underway in Somalia (with support from GIZ, World Bank and others), the project will prioritize rural roads within the

[126] https://islamicmarkets.com/publications/guidelines-on-islamic-financing-for-agriculture

vicinity of the targeted agricultural landscapes. Consultations will be organized with local communities, and in particular with women's groups, to ensure social acceptability of the infrastructure.

377. An estimated 150km of rural roads will be rehabilitated to ensure resilience to climate impacts, as follows:

- Resurfacing to avoid water pooling, stagnation, an gully formation during rainfall events;
- Elevation and slope management above flood prone areas
- Retracing where roads have been excessively damaged
- Elevation with side ditches to channel runoff, connected to water reservoirs and ponds for retention of flooding waters
- Use of gravel or stone and compaction methods.
- Rehabilitation of culverts where necessary
- Use of vegetation for shading

Figure 74: unpaved, degraded road in Somaliland. Source : uncredited.

378. The project will not support repaving of roads using concrete, polymer or other materials other than native materials, for reasons of cost and feasibility.

379. The project will also construct intermediary markets and district level and informal regrouping points at village levels (2.3.4.2). This will include construction or rehabilitation of basic buildings up to resilience standards (elevation, drainage, temperature and shading). These will be located near water access points, for example near the works constructed under Outcome 1, or the irrigation canals under Outcome 2. Water access points and shaded stables will be provided for livestock to promote exchanges, and there will be climate resilient grain storage facilities. Gender sensitive designs for all market infrastructure will be developed, including for example sex-segregated sanitation facilities, and measures to ensure safety and security for women and girls in the market place.

Figure 75: Hargeisa Livestock Market without resilience measure. Source: ILRI

6.3 Outcome 3 - An improved institutional enabling environment for sustainable landscape management and climate resilient agriculture is in place at State and Federal Levels

380. Activities under Outcome 3 form part of the project's sustainability and upscaling strategy. The aim is to create conditions and an enabling environment for the replication and broader adoption of project results. Given the fragile conditions of the Government of Somalia, strengthening of capacity is required to ensure that Federal Member States can implement new norms for climate resilient agriculture. The activities support the institutional capacity of the Government of Somalia at various levels.

381. considers legal frameworks and modalities for monitoring their implementation (the normative elements of institutional capacity), while output 3.2 strengthens the informational capacity of the Government of Somalia, in particular its capacity to generate and disseminate useful, relevant and timely climate information to last mile users.

6.3.1 Output 3.1. Legal frameworks and implementation modalities for NRM and CRA are improved

6.3.1.1 Activity 3.1.1. Update legal and institutional frameworks for sustainable landscape management.

382. This activity recognizes that significant changes need to be effected to the national legislative and policy apparatus to support the transition towards climate resilient development pathways. This includes, in particular, the institutionalization of approaches such as landscape management as integrated adaptation strategies and as innovative governance frameworks that can build communities across traditional lines. The project will therefore work with MoECC to develop new pathways for the monitoring of landscape management approaches that cut across sectoral lines. This will be done on the basis of a needs assessment study, which will also include considerations related to the

decentralization of landscape management approaches at State level, and the potential complexities of enforcing Landscape Management Plans across administrative boundaries (sub-activity 3.1.1.1).

383. Following this study, the project will bring Federal Member states and districts together, learning from the experience of the landscape management committees established under outcome 1, to develop new regulations, by-laws and other instruments to consolidate landscape management and upscale it to the rest of the country. (sub-activity 3.1.1.2). New legal and institutional frameworks will also address any gender gaps identified (refer to Annex 8, Gender Action plan). The experience of landscape management committees will also be useful in the design of a LSMP manual, tailored to the specific Somali context, covering all the elements of the landscape approach on the basis of lessons learned nationally and internationally (sub-activity 3.1.1.3).

384. The project will also work with MoECC to develop a strategy on the management of Prosopis, as an invasive species that severely restricts agricultural development potential. The Strategy will also build on project experience with the removal, management and re-use of prosopis that was deployed under outcome 1, and on the results reported by landscape management committees in terms of benefits of such approaches (sub-activity 3.1.1.4). Finally, the project will also assist with the development of a set of new construction, building and infrastructure standards that will enshrine the principle of resilience and will formalize adaptation in any reconstruction and future construction efforts throughout the country, drawing on the climate studies and assessments conducted in the project (sub-activity 3.1.1.4).

6.3.1.2 Activity 3.1.2. Strengthen policy dialogue and coordination between sectoral ministries at State levels

385. Furthermore, the project will work at National and State level to increase intersectoral coordination between various ministries. The landscape management approach provides an opportunity to break down stove-piped sectoral management of natural resources in order to generate multiplied adaptation benefits for vulnerable communities and groups, in particular women. The project therefore will assess the existing coordination mechanisms at federal, state and local level, and make recommendations on improvements that can facilitate the adoption of more integrated approaches (sub-activity 3.1.2.1). A proposal will be made on the design of an improved coordination framework (sub-activity 3.1.2.2) that can also facilitate meaningful participation of women and the devolution of adaptation benefits to vulnerable groups. A gender-oriented gap analysis and policy dialogues will be supported by the project. In order to build knowledge and networks, the project will also integrate regional and international knowledge and policy best practice into national policy making. These improved coordination frameworks will be formalized, and operationalized in the project States (3.1.2.3) towards the end of the project.

6.3.1.3 Activity 3.1.3 Strengthen the capacity of MoECC to manage, monitor and govern natural resources and implement Ecosystem-based Adaptation

386. To support effective decentralization and to create an enabling environment in which landscape management is facilitated by government frameworks and support, the project will build the capacity of the MoECC to understand, plan and monitor ecosystem-based adaptation to climate change. Training will be provided to district, State and Federal level MoECC officials on climate change and Ecosystem-based adaptation solutions (sub-activity 3.1.3.1), especially focusing on staff that will be acting as support to landscape management committees established under output 1.1. Staff will also be supported in learning how to facilitate participatory monitoring of landscape restoration measures (sub-activity 3.1.3.2) and efforts will be made to identify and support existing or incoming female staff to benefit from these trainings. This will be particularly important as a way to ensure that all local stakeholders are aware and can measure the immediate benefits of landscape restoration, whether environmental, economic and social. This will serve as a way to facilitate broader upscaling and

replication later on. To this end, the MoECC will be supported in rehabilitating local monitoring and observation infrastructure, which will include offices and weather stations, as well as field testing facilities to support continued research into the applicability of ecosystem-based adaptation (sub-activity 3.1.3.3). The project will also support the development of the implementation plan for the National Environmental Management and Protection Act (sub-activity 3.1.3.4) and the operationalization of the Environmental and Social Impact Assessment regulations (sub-activity 3.1.3.5).

6.3.1.4 Activity 3.1.4 Build capacity for the monitoring, assessment, analysis and early warning related to the impacts of climate on food and nutrition security.

387. In a similar vein, the MoAI, local universities and NGOs will also receive support to conduct monitoring, assessment and early warning of food security at decentralized levels (sub-activity 3.1.4.1). This will include provision of training and materials for the collection of data, assessment, analysis of the linkages between food production/availability and climate conditions, in order to develop more reliable food security warnings at district level. Each district will then conduct, through a collaborative Food Security working group, seasonal assessments and analysis of the impacts of climate on food and nutrition security (sub-activity 3.1.4.3). This will be linked to the existing IPC working group and Federal food security early warning systems currently in place. Each State will emit two annual briefings.

388. The project will also provide interactive training sessions on climate change adaptation and the effects of climate change on the environment to media professionals and the institutions in charge of Early Warning and Disaster Risk Reduction (sub-activity 3.1.4.4). The training sessions aim at enhancing stakeholders' understanding and awareness of climate change impacts but also at establishing permanent links between media professionals and the institutions to involve media professionals in the creation of Early Warning systems in the country.

389. This Capacity Development initiative objectives are to:

- Ensure that all stakeholders understand the effects of climate change in Somalia and its underlying causes
- Promote Information/data collection and knowledge sharing/exchange
- Keep stakeholders abreast about climate action in the country
- Limit fake news and fake information
- Create links between media and institutions in charge of DRR and EW

390. The format of this training would be 3 days face to face interactive training sessions targeting Journalists, media professionals, Line Ministries Communication Officers (approx.. 25 persons), weather forecast officers. Main topics will include:

  - The basics of Disaster Risk Reduction, EW, different concept of DRR,
  - Climate Change and DRR, global trends, Vulnerability and Resilience, Key DRR messages
  - Early Warning Systems, overview for broadcasters, phases of disaster management, capacity building for local communities
  - Gender and disability sensitive early warning, communicating to excluded groups
  - Common Alerting Protocol (CAP), introduction to CAP, key facts, format and contents of CAP messages
  - News and current affairs, good reasons to report on disaster risk reduction, roles and responsibilities of media, practical tips for journalists and media, issues and ethics for journalists and editors
  - Documentaries and educational programmes, programming tips, documentaries, educational programming, taking DDR to the next level

391. Each session will include a feedback final questionnaire in order to assess the level of knowledge acquired during the training.

6.3.2 Output 3.2 Increased access to climate information among last mile users

6.3.2.1 Activity 3.2.1. Collect, disseminate and share relevant climate and land data to support decision making at all levels

392. The years of conflict Somalia have collapsed the hydro-meteorological monitoring network. Under the SWALIM project, FAO and partners have been working to recreate the climate information service network. Since 2002, FAO-SWALIM has taken the lead to “re-collect” all the datasets that were scattered and are often only available in different formats from various agencies. Currently, there are over 100 manual rainfall stations, eight synoptic weather stations and 11 automatic weather stations in the country. Data from the manual stations is transmitted to SWALIM’s Nairobi office on a regular basis through satellite, gprs, e-mail or telephone.

393. Seven automatic weather stations are strategically located in the northern parts of the country, including Hargeysa, Borama, Sheikh, Aburin, Burao, Dollow, Garowe and Galkayo. The other automatic weather stations are located in the south in Baidoa and Mogadishu, as seen in Figure 76. The stations record rainfall, temperature, relative humidity, atmospheric pressure, wind speed, wind direction and solar radiation. Data from these automatic stations is received by SWALIM in near-real-time through satellite feeds every four hours. This weather monitoring has been made possible through the partnership between SWALIM and the Somali line ministries, as well as other agencies present on the ground. The data is then processed and disseminated to the public as information through SWALIMs information dissemination channels.

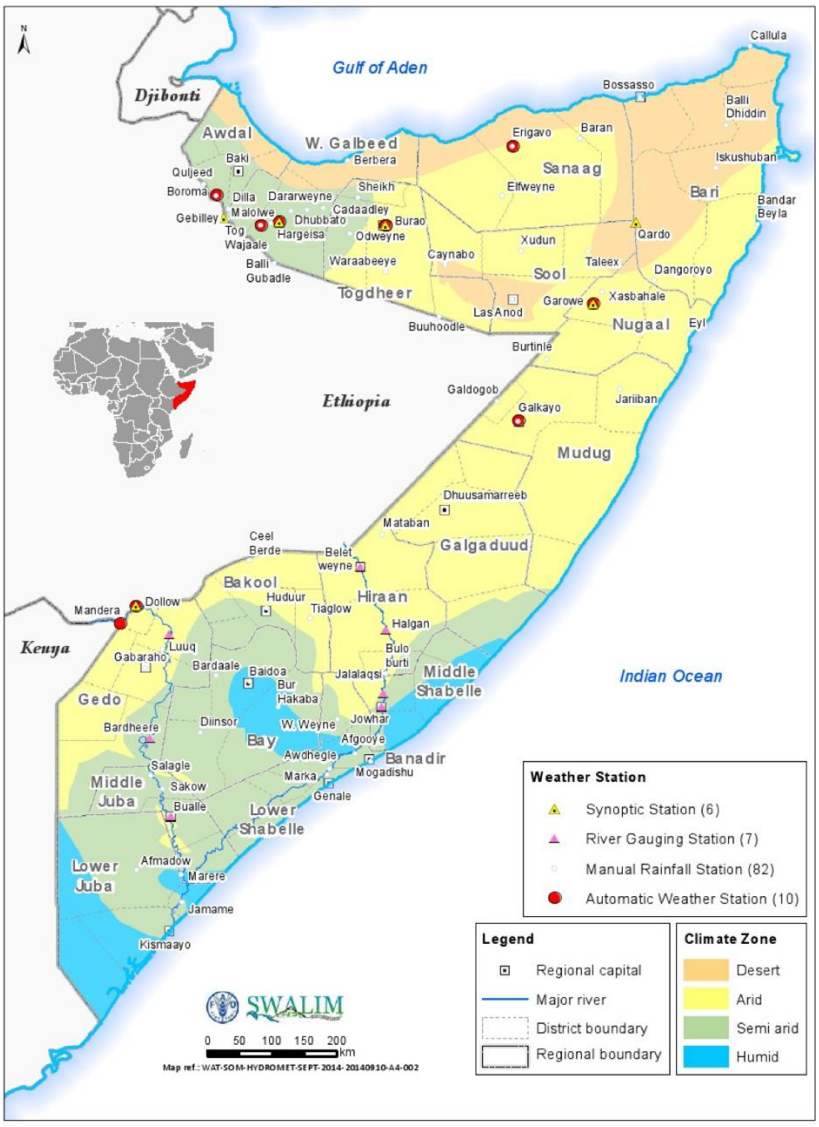

Figure 76: Map showing weather stations (source: SWALIM)

394. Currently, SWALIM produces most of the climate information that is emitted in the project regions. This includes rainfall forecasts for each season, seasonal forecasts, early warnings and crop projections. They are delivered through email upon subscription. The IPC food security assessments are also closely tied to climate information and are produced quarterly.

Bulletin Name	Description
Three Day Rainfall Forecast	A daily update that provides cumulative rainfall forecast for the next 72 hours. The bulletin provides a quick overview of the weather over the whole of Somalia in English and Somali.
Flood Watch	A weekly update on rainfall and river levels within the Juba and Shabelle river basins in Somalia. The bulletin provides rainfall performance for the previous week and the forecast for the coming week.
Dekadal Rainfall Update	An update of rainfall activities in Somalia over the last ten days (dekad). The bulletin compares the current dekad to the long-term average to ascertain if the rainfall performance is above or below normal.
Regional Monthly Weather Updates	A monthly update produced by SWALIM, in collaboration with the Ministries of Agriculture from both Puntland and Somaliland monthly during the rainy seasons that gives an update on the weather in each region. Available in English from March to June and from October to November.
Drought Watch	A bulletin that is produced only during periods of drought in the country, that reviews the current situation in terms of rainfall, vegetation, and river levels. These details are analysed along with other data to give the current and potential socio-economic impact of the drought on the ground.
Alerts	A variety of alerts which are produced as needed in response to crisis or emergency conditions. The alerts provide early warning in cases where flooding, drought or any other weather-related hazard is foreseen in the near future.
Gu/Deyr Rainfall Outlook	A seasonal update that is produced at the beginning of the Gu and Deyr rainy seasons (March and September). It shows the rainfall forecast for the coming season and reviews potential impacts for different sectors such as agriculture and livestock.
Gu/Deyr Rainfall Perfomance	An update that is produced at the end of the Gu and Deyr rainy seasons (in June and November). It highlights the general performance of rainfall during the previous season, the impact on agriculture and vegetation conditions and better assessment of the state of production areas.

Figure 77: Currently produced climate information products by SWALIM

395. SWALIM also developed the Flood Risk and Response Management Information System (FRRMIS) as a web-based information dissemination and sharing platform based on GIS. Data is monitored at strategic weather and river-level stations are collected in real time. Satellite imagery provides information on river bank state and breakage. Depending on levels, alerts are sent to affected communities through SMS and radio. Finally, SWALIM also conducts drought monitoring using the Combined Drought index, a statistical index comparing the present hydro-meteorological conditions with the long-term average characteristics in the same seasonal period. The system shows the spatial or point distribution of drought conditions in the country, ranging from mild to extreme levels.

396. The project will work with the MoECC and the climate information service providers at Federal and State levels to redesign and deploy an open-access GIS-based climate information platform, on which users will be able to access forecasts at 3 and 10-day intervals. Seasonal forecasts will be improved, and the early warnings and regular forecasts will also be linked to agronomic advice (sub-activity 3.2.1.1). All information will be made publicly available free of charge on an online climate information platform associated with the ones developed by FAO Somalia SWALIM flagship programme. State level staff with a meteorology and/or agrometeorology background will also receive training and capacity building for the deployment and use of the climate information. Information products that will be shared include, but are not limited to:

- Rainfall forecasts Bulletins on weekly basis during the rainy season
- Seasonal weather forecast
- Bulletins on rainfall season performances
- EW alerts in case of floods, droughts or cyclones

397. The project will conduct an assessment of how men and women and persons living with disabilities access and use information on climate and agriculture, and identify the barriers to use digital services.To ensure that all last mile users receive early warning information and can act on it in a timely and appropriate manner, the project will partner with local radio and cell phone service providers to expand the use SWALIM's Digniin platform, to deliver digital early warning messages and decision support tools for agricultural producers via SMS and radio (sub-activity 3.2.1.2). The Digniin platform is an android and web based early warning system that combines with the FRRMIS. The android application is used by field monitors to collect information on river levels, rainfall and flooding. The web application is used for dissemination of the early warning information including sending out of early warning SMS in case of flood or cyclone emergencies.

398. The activity will build on the rapid growth in cell phone connectivity and disseminate information to crop and livestock producers either directly to the users mobile phones or deliver the messages through the relay of group and community leaders (FFS, associations, savings groups, cooperatives).

399. Information will be free of charge, however, towards the end of the project, the MoECC will establish the modalities for continued operation of the system, including exploring cost-sharing mechanisms, cost recovery and pricing options for long-term affordability and sustainability, on the basis of documented lessons learned and benefits from this project. (sub-activity 3.2.1.3)

400. In addition, to further strengthen the capacity of the Ministry of Environment and Climate Change to undertake climate informed landscape management and planning, the project will work with the MoECC to establish an Information Management Center (IMC) at decentralized level. The IMC will be established in Kismayo and will serve as a center for data collection, analysis, management, archival and dissemination of information on all aspects related to natural resources present in Jubaland. The center will be tasked with production of land use maps, monitoring land degradation, water availability, collecting and aggregating all data and information from studies developed in this project (under outcome 1) and distributing the information that can serve to deploy climate-informed land use planning, landscape restoration and water management practices. (sub-activity 3.2.1.4). The IMC will be staffed by MoECC and other relevant ministries staff, and operated by MoECC in collaboration with MoAI and MoEWR as part of the transfer of SWALIM's functions to the government, and thereby integrated into Somali institutions. The IMC will be modelled on the existing IMCs that have successfully been established in Somaliland and Puntland. (sub-activity 3.2.1.5).

401. Finally, the project will support the development of radio programs, awareness and distance learning targeting the population (sub-activity 3.2.1.6). Although there is an ongoing transition in the Somali media landscape as online media is growing in importance, the Somali's population still relies on radio and the information that people hear on the radio or read/see online is quickly spread throughout the community. The awareness raising radio programs will be developed and disseminated through local radio stations reaching the communities at the district and community level.

402. The awareness raising process will adopt a variety of radio formats: Public Service Announcements (average length 2 minutes each), magazines (20 to 30 minutes each), Q&A sessions with experts. Gender specific content will be developed to ensure accessibility of messaging. The dissemination will take place through local radio stations reaching the communities at the district and community level. Ad hoc Public Service Announcements and radio magazines will be designed in 2 main languages Maay and Maxaa Tiri.

7 Sustainability and Exit Strategy

7.1 Sustainability

403. The project's sustainability exit strategy is ingrained in all the project interventions. All activities are designed to be sustainable in the long term, and plans are integrated to ensure that the Somali government can maintain and upscale the key strategies promoted in this project. A significant aspect of the project's exit strategy is included in Outcomes 1 and 3.

404. First, the project creates a basis of information and knowledge that will be integrated into future policy making; for example, the baseline study of land cover and land degradation will be integrated into the information systems created under Output 1.1, 2.1, and 3.2 and can be leveraged to prioritize interventions by the government or other donors. Capacity built for monitoring landscapes, climate conditions, crop production and food security will also feed into long-term agricultural policy-making

and operations at both State and Federal levels. The project also includes measures to strengthen the capacity of the government in terms of monitoring the implementation of rules and regulations related to natural resources use and management.

405. Second, at the local level, the creation of landscape management committees and strengthening of water user committees, which are expected to outlast the project duration, will create a lasting foundation for community-based management of natural resources, nested within the context of decentralization. These committees will create lasting capacity among their members (who are expected to change regularly) to understand and manage natural resources in a climate informed manner. These institutional structures are expected to outlast the project duration and to serve as a basis for further institutionalization of the watershed-based landscape management approach.

406. Third, all infrastructure and landscape restoration activities are designed with an exit strategy in mind. The development and institution of fee-based systems for water management, the promotion of standards for the construction of climate proof infrastructure, the formalization of water user committees as key management bodies create conditions under which future land and water management can be continued by the beneficiaries themselves. In particular, all community groups (FFS, WUAC, LMC) will receive training and capacity building for the continued operations and maintenance of all infrastructure and natural assets. The creation of a fee-based system for water management plays a key part in the exit strategy, as it creates a lasting basis for financing of water services. Although there remains a high level of dependency on external resources for investment in water infrastructure, the government of Somalia is committed to invest in the operation and maintenance of all works. The project works with the MoAI to develop an irrigation master plan, which will include recommendations on water financing.

407. Care has been taken not to create systems or institutions that create undue financial burden on the beneficiaries or on the Government. For example, under Outcome 3, work to develop early warning systems, agrometeorological information dissemination and other e-extension, is conducted with a view to ensuring the autonomy and financial viability of the system, and continued affordability for end users. Pricing will be limited to a minimum to ensure continued service, and modalities for the establishment of user fees for e-extension will also be explored.

408. Another element of the project's exit and sustainability strategy is the strong emphasis on building the capacity of government actors in delivering support to local producing households. While it is understood that significant support is needed due to the dire situation experienced in the country, it is also agreed that all systems and services will be owned and continued by the government in the long-term. This includes information management centres, early warning systems, all databases and, of course, any infrastructure upgraded by the project. The project develops training programs that will fill both immediate capacity gaps and long-term gaps, to ensure the climate risk management aspects are mainstreamed in all aspects of the MoECC and MoAI's work.

409. Further detail on sustainability and exit strategy considerations are included in the table below:

Output	**Sustainability considerations**	**Exit Strategy**
Output 1.1 Improved participatory landscape and natural resources management and governance are established at watershed and village levels	Increased access to better information will help create long-lasting and effective governance and management systems. Landscape management committees will continue to exist as long as there is interest and investment in the restoration and management of landscapes. Benefits of landscape management will be documented to support the work of LMCs.	In the long term, data systems and all information products will be transferred over to the Government for ownership and replication. Landscape Management Committees will eventually become part of the local governance system at

		watershed level. Replication of the system by government will require a policy change that will be facilitated by the project.
Output 1.2 Output 1.2 Agricultural and Agro-pastoral Landscapes are restored and sustainably managed	Restored landscapes will continue to provide ecosystem services. Active management by local communities and governments is required to ensure long-term sustainability. The productivity related benefits of landscape restoration, as evidenced trough the project's participatory monitoring system, will create incentives for the continued investment in landscape management.	The project will hand over the management and maintenance of all rehabilitated landscapes and structures to the local communities.
Output 2.1 Resilient water supply is secured and sustainably managed	Long-term benefits of increased water supply will outlast the project duration, with the proper management and maintenance. Systems for operations and maintenance will be set up by the project. Furthermore, the government will continue to invest in irrigation and water infrastructure.	The water infrastructure will be co-managed by local communities and the government through fee-based systems. The government manages all large-scale irrigation systems.
Output 2.2 Local communities practice locally-specific Climate Resilient Agriculture	The capacity and knowledge created by the project will create a new baseline of agriculture in the targeted areas. Trainers and facilitators including lead farmers can continue to provide extension service from within and outside government. Increased productivity and access to food create a powerful incentive for the continuation of project benefits and activities beyond project duration.	By working jointly with extension services and local communities, the project creates conditions for the broader upscaling of CRA practices promoted.
Output 2.3 Farmers derive increased income from sustainable natural resource management and climate resilient value chains	Support provided to value chains development will create a pull effect on local producers, which will help further strengthen sustainability of activities. Increased access to finance and value addition capacity, along with the supported seed systems, will also support long-term sustainability of all project interventions, by generating profit and reinvestment.	Working with farmer organizations, private sector and financial institutions fosters the autonomy of the agriculture sector and markets.
Output 3.1 Legal frameworks and implementation modalities for NRM and CRA are improved	This output builds the capacity of government institutions to foster the right conditions for agricultural development in the targeted regions and country wide. Institutional reforms and training, as well as the new information products developed by this project, will be broadly disseminated among government staff, including through permanent training programs integrated into the mainstream of MoAI activities.	All deliverables and outputs under the project are owned by the government and support the operations of the MoAI and MoECC at federal and State level.
Output 3.2 Increased access to climate information among last mile users	Enhanced early warning systems allow local communities to reduce their exposure to risk. As such, they are sustainable, but require stable funding.	EWS and all data systems, including SWALIM IMC, will be owned and maintained by the government in the long term.

7.2 Operations and Maintenance Plan

410. Operations and maintenance modalities and estimated costs are described in the table below.

Output	Modalities	Estimated costs	Responsible party

Output 1.1 Improved participatory landscape and natural resources management and governance are established at watershed and village levels	No major Operations and Maintenance costs are foreseen. The continued meetings of the Landscape management committees will need to be supported as long as work is foreseen to implement landscape management plans.	Annual cost of meetings up to 10,000 USD per year per committee.	GoS
Output 1.2 Agricultural and Agro-pastoral Landscapes are restored and sustainably managed	Each type of infrastructure and work is subject to community-based management system. Costs may include regular de-silting of canals, water monitoring, repair to gates and sluices, and repairing of walls. For reforestation, maintenance operation includes irrigation during the project and growth phase, pest control, pruning and harvesting. Rehabilitated riverbanks need minimal monitoring.	Estimated cost of 3% of initial installation cost per ha depending on the type of work.	Communities and beneficiaries Rivers are monitored by the government.
Output 2.1 Resilient water supply is secured and sustainably managed	The operations and maintenance of irrigation works is assured by Water user association committees through collaborative allocation and fee-based systems. Works may include repairs to canals, regular de-silting, repairing of gates and sluices.	Estimated cost of 3% of initial installation cost per ha.	Communities and Governments for large-scale, remote works.
Output 2.2 Local communities practice locally-specific Climate Resilient Agriculture	No major operations and maintenance foreseen. Maintenance and operation of processing facilities, post-harvest structures and market installation will be done by community groups and producer groups using pooled resources, fee-based systems or VSLA.	Estimated costs of 5% of initial installation per year.	Communities, producer groups, MSME
Output 2.3 Farmers derive increased income from sustainable natural resource management and climate resilient value chains	Maintenance and operation of processing facilities, post-harvest structures and market installation will be done by producer groups, MSME and private sector.	Estimated costs of 5% of initial installation per year.	producer groups, MSME and private sector.
Output 3.1 Legal frameworks and implementation modalities for NRM and CRA are improved	No operations and maintenance foreseen.		
Output 3.2 Increased access to climate information among last mile users	Operation and maintenance of information management centers and data systems will be ensured by FAO and Government until government is able to fully integrate the IMC into its structures. Costs include staffing, building maintenance, and regular data and program costs.	250,000 annually	FAO and MoAI

8 Implementation modalities

411. FAO will serve as the Accredited Entity (AE) for this project. As such, FAO will be responsible for the overall management of the project, including (i) all aspects of project appraisal; (ii) administrative, financial and technical oversight and supervision throughout project implementation; (iii) ensuring funds are effectively managed to deliver results and achieve objectives; (iv) ensuring the quality of project monitoring, as well as the timeliness and quality of reporting to the GCF; and (v) project closure and evaluation. FAO will ensure these responsibilities in accordance with the detailed provisions outlined in the Accreditation Master Agreement (AMA) between FAO and GCF.

412. FAO's role as AE will be attributed to the relevant offices and divisions in FAO Headquarters located in Rome, Italy (HQ), Regional Office for Africa located in Accra, Ghana, Sub-Regional Office for East Africa located in Addis Abeba, Ethiopia, the Country Representation Office for Somalia (FAO-Somalia).

413. In order to fulfil the AE functions, FAO will set up a dedicated Project Task Force (PTF) in line with FAO project cycle guidelines. The PTF will be composed by the Budget Holder (BH), the Lead Technical Officer (LTO), Funding Liaison Officer (FLO), HQ Technical Officer and other technical officers, as appropriate.

414. The PTF will remain independent from the Executing Entity functions also performed by FAO (see Project execution section below). In line with the GCF policy on fees adopted through GCF Board Decision B.19/09, the above-mentioned segregation of responsibilities within FAO will ensure that the Organization can independently and effectively perform the AE functions listed in the GCF General principles and indicative list of eligible costs covered under GCF fees and project management costs.

8.1 Executing entities

415. The project will be executed by FAO and the Government of Somalia acting through (i) the Ministry of Environment and Climate Change (MoECC) (ii) the Ministry of Agriculture and Irrigation (MoAI in a co-execution modality to deliver the project activities funded by GCF proceeds.

416. FAO will act as EE and will ensure strong country-driven execution of project activities and will be in charge of the execution of selected activities funded by GCF proceeds based on its comparative advantages. This will allow Somalia to benefit from the technical and operations experience of a specialized development assistance agency from the United Nations (UN), while providing opportunities for the government to increase their capacity through technical assistance and development and implementation of activities under the three components. FAO will also execute the activities co-financed by FAO.

Activity	Sub-activity	Executing Entity (EE)			Funding source
		FAO	GoS-MoECC	GoS-MoAI	
1.1.1 Strengthen the information base for climate-informed local land use planning	1.1.1.1	x			GCF
	1.1.1.2	x			GCF
1.1.2 Develop climate-informed inclusive landscape management plans	1.1.2.1	x			GCF
	1.1.2.2	x			GCF
	1.1.2.3	x			GCF
	1.1.2.4	x			GCF
1.2.1 Conduct landscape restoration through local landscape management committees and community-based associations	1.2.1.1	x			GCF
	1.2.1.2	x			GCF
	1.2.1.3	x			GCF
	1.2.1.4		x		GCF
2.1.1 Strengthen water management capacity at State and local level	2.1.1.1	x			GCF
	2.1.1.2	x			GCF
	2.1.1.3	x			GCF
	2.1.1.4	x			GCF
	2.1.1.5	x			GCF
	2.1.1.6	x			GCF
2.1.2 Increase access to water resources and climate smart irrigation infrastructure	2.1.2.1	x			FAO
	2.1.2.2	x			GCF
	2.1.2.3	x			GCF
2.2.1 Disseminate CRA practices to farmers	2.2.1.1	x			GCF

	2.2.1.2	x			GCF
	2.2.1.3	x			GCF
	2.2.1.4			x	GCF
2.2.2 Build the capacity of MoA at Local, State and Federal level to support communities in the adoption of CRA practices	2.2.2.1	x			GCF
	2.2.2.2	x			GCF
2.3.1 Improve access to climate resilient inputs for crop and livestock production	2.3.1.1			x	GCF
	2.3.1.2	x			GCF
	2.3.1.3			x	GCF
	2.3.1.4			x	GCF
	2.3.1.5			x	GCF
	2.3.1.6	x			GCF
	2.3.1.7	x			GCF
	2.3.1.8	x			GCF
2.3.2 Build the capacity of producer groups to develop sustainable climate-informed business plans	2.3.2.1	x			GCF
	2.3.2.2	x			GCF
	2.3.2.3	x			GCF
2.3.3 Increase MSME, cooperatives and farming group access to agricultural credit	2.3.3.1	x			GCF
	2.3.3.2	x			GCF
	2.3.3.3	x			GCF
	2.3.3.4	x			GCF
2.3.4 Increase all-season access to market for smallholder producers, cooperatives and farmer groups	2.3.4.1	x			GCF
	2.3.4.2	x			GCF
3.1.1 Update legal and institutional frameworks for sustainable landscape management	3.1.1.1	x			GCF
	3.1.1.2		x		GCF
	3.1.1.3	x			GCF
	3.1.1.4		x		GCF
	3.1.1.5		x		GCF
3.1.2 Strengthen policy dialogue and coordination between sectoral ministries at State levels	3.1.2.1		x		GCF
	3.1.2.2		x		GCF
	3.1.2.3		x		GCF
3.1.3 Strengthen the capacity of MoeCC to manage, monitor and govern natural resources and implement nature-based solutions	3.1.3.1		x		GCF
	3.1.3.2		x		GCF
	3.1.3.3		x		GCF
	3.1.3.4		x		GCF
	3.1.3.5		x		GCF
3.1.4 Build capacity for the monitoring, assessment, analysis and early warning related to the impacts of climate on food security, climate	3.1.4.1	x			GCF
	3.1.4.2	x			GCF
	3.1.4.3	x			GCF
	3.1.4.4	x			GCF
3.1.5 Build capacity of MoAI for climate informed water management infrastructure planning.	3.1.5.1			x	GCF
	3.1.5.2			x	GCF
	3.1.5.3			x	GCF
3.2.1 Collect, disseminate and share relevant climate and land data to support decision making at all levels	3.2.1.1	x			GCF
	3.2.1.2		x		GCF
	3.2.1.3		x		GCF
	3.2.1.4		x		GCF
	3.2.1.5	x			GCF
	3.2.1.6		x		GCF

Figure 78: activity by Executing Entity

8.2 Project governance and supervision

417. The project will establish a Central Project Implementation Unit (CPIU) that will be functional for the entire duration and be responsible for day-to-day implementation of the project, with support from FAO offices in each FMS. The main functions of the CPIU, following the guidance of the PSC and project technical committee (PTC), will be to ensure overall efficient management, coordination, implementation, and monitoring of the project through the effective implementation of the annual work plans and budgets (AWPBs).

418. The CPIU will be led and managed by a project-recruited Technical Advisor and National Technical Coordinator (NTC) who will be appointed by FAO and will be responsible for overall project management and coordination with project stakeholders. The CPIU will also include the following core personnel (part time);

- Administration and Finance Officer,
- Compliance Officer,
- Operations Officer,
- Procurement Officer,
- Project Implementation Specialist,
- HR specialist,
- National Specialists in the area of admin, HR, finance, procurement and operation,
- National Field Support Assistants,
- International and national technical specialists for outcomes 1-–3,
- International and national Environmental and Social Safeguard Specialists,
- International gender, social inclusion and Indigenous Peoples specialist,
- National gender specialist,
- National conflict and risk management specialist,
- National Indigenous Peoples and Land Tenure

419. The project's Monitoring, Evaluation and Learning plan will be supported by a MEL Unit, who will be supervised by the CPIU. The head of Monitoring and Evaluation, with support from other project staff, international and national consultants and experts, will be responsible for overseeing all activities related to information collection related to the project indicators (e.g. household surveys and for managing the project's learning, communications and knowledge sharing strategy.

420. The CPIU will coordinate closely with the field officers posted at the 6 FAO Somalia field offices located in all target states, who will supervise the day-to-day project operations in each district, liaising with the Focal Points (appointed by the respective EE) in each district. National M&E specialists, National Finance Specialists, and National Field Support Assistants will be located in the FAO Somalia field offices to closely support the operations in the field.

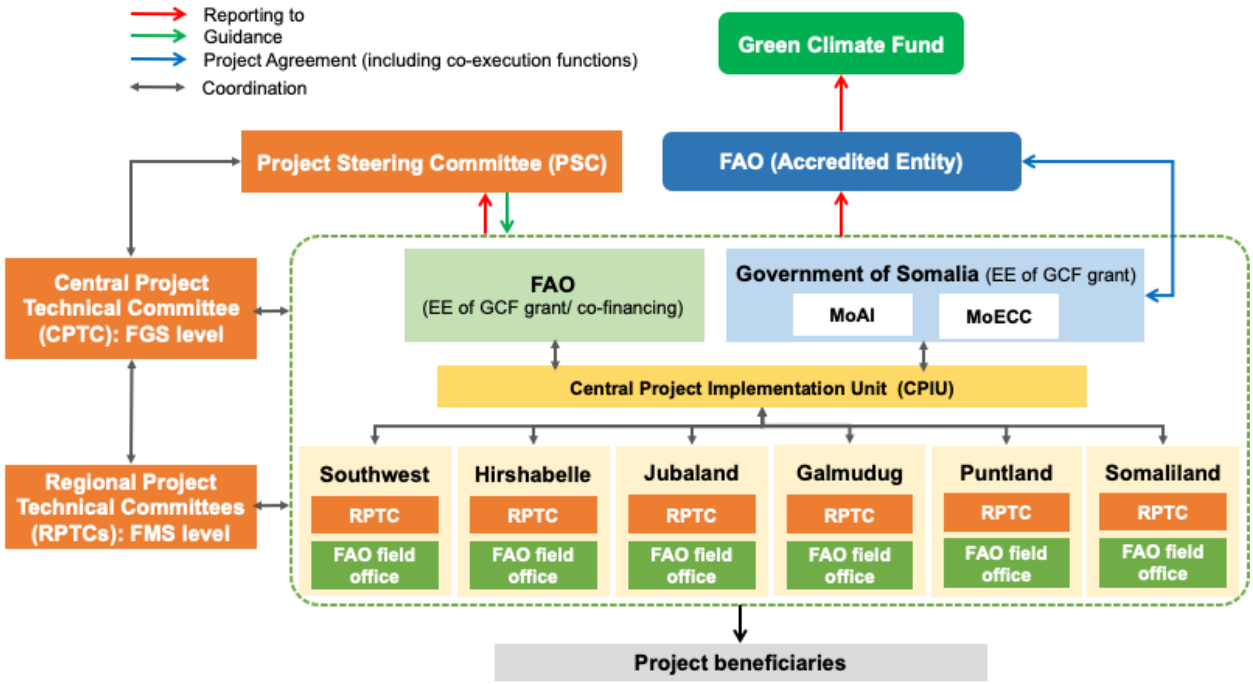

Figure 79: Project implementation arrangements

8.3 Flow of funds

421. FAO will provide in-cash (grant) co-financing through (from the USAID-funded TRANSFORM project which is executed by FAO), for a total amount of 15.19 million. The executing entity of co-financing is responsible for reporting of co-financing activities and their disbursement amount to the AE in accordance with the detailed provisions outlined in the GCF policies as well as AMA, Funded Activity Agreement (FAA) between FAO and GCF and the co-financing agreement signed between the co-financier and FAO in its capacity of AE. FAO will be responsible for executing and managing their co-financing under the coordination of the Central Project Implementation Unit (CPIU) and through the Project Steering Committee (PSC).

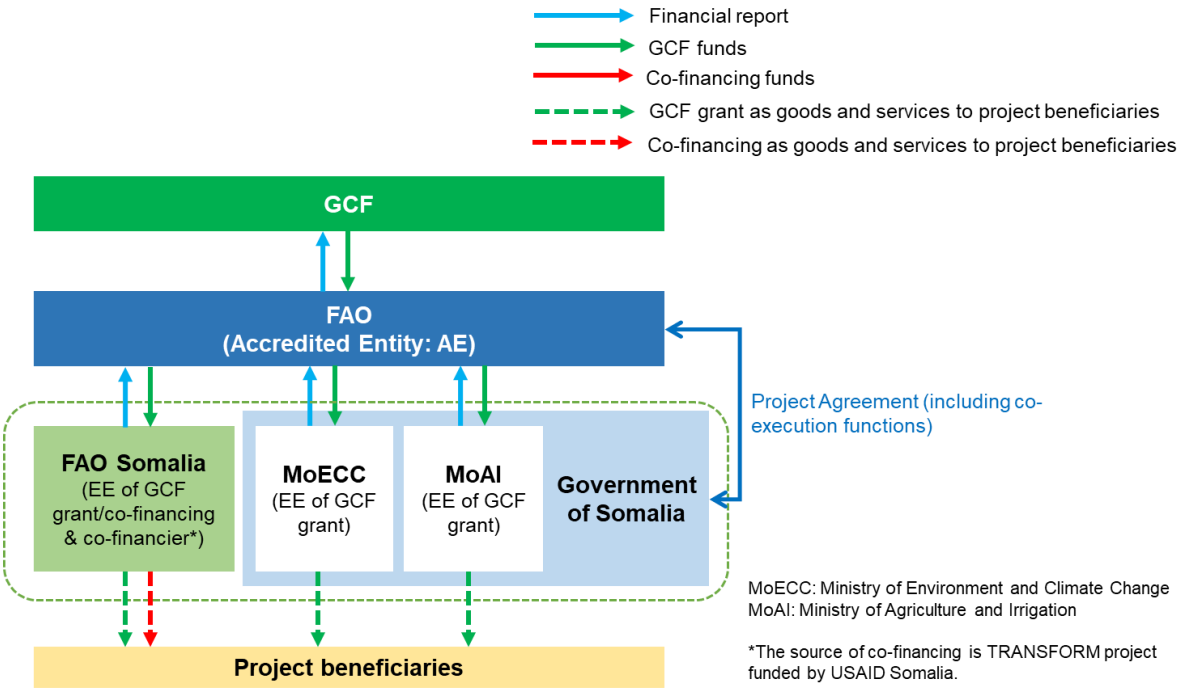

Figure 80: flow of funds

8.4 Financing package and cofinancing

422. Somalia, one of the world's most fragile states and LDCs, stands at a critical juncture where the convergence of several challenges demands urgent attention. The nation grapples with a myriad of issues, and the agriculture sector is at the heart of socio-economic recovery. Somalia's agricultural sector remains particularly vulnerable, with local populations facing extreme vulnerability to climate variability and climate change, in a context where scarcity is already stark. Currently, four million people in Somalia (21 percent of the population) are facing Crisis or Emergency food insecurity, according to the latest Integrated Phase Classification (IPC). An estimated 1.7 million children below the age of 5 face acute malnutrition in 2024, including 430,000 who are likely to be severely malnourished.

423. Somalia is very much exposed to Climate extreme events as demonstrated in Chapter 2. The country is therefore in need to access to Climate Finance Instruments, providing resources to address Climate Change and at the same time contributing to build the resilience of ecosystems and communities. Large-scale investments programs, such as the ones funded by the GCF, are also relevant in the context of Somalia, where emergency response and humanitarian aid prevail.

424. Most of the interventions have thus far focused on governance, peace-building, and disarmament, with urgent food aid and food security interventions taking the forefront. If recovery is to be sustainable, and local communities can gradually move on from survival and subsistence, development has to be conducted in climate-informed manners. The country has just ended the HIPC transition program and has finally gotten rid of massive debt. With a GDP of 10 billion in 2022, it cannot be expected to take on new loans. Although public expenditures are rising (1 billion USD in 2024, a 4 percent increase from 2023), over two thirds of resources originate from external aid.

425. Somalia's ability to invest in crucial sectors such as water and agriculture remains limited. With limited fiscal space, public investment in agriculture remains dismally low, hindering the development of resilient farming practices and infrastructure. Grant financing presents a viable avenue to inject much-needed capital into the agricultural sector, enabling the implementation of sustainable initiatives

aimed at mitigating climate risks and improving productivity. The project also creates the conditions for the emergence and strengthening of an agri-food private sector, one in which communities, with adequate support, can begin to create their own economic opportunities. Currently, the absence of accessible finance mechanisms further exacerbates the plight of farmers, and the risks involved in transitioning to climate-resilient development pathways, stifling innovation, and inhibiting adaptation to climate change.

426. Somalia's NDC 2021 estimated the cost of implementing the adaptation actions of the NDC target at USD 55 billion for 2021–2030, meaning USD 5.5 billion per year. For agriculture and food security area, USD 10 billion is estimated as investment required for 2021–2030. As stated in Somalia's NDC, Somalia, as an LDC in a fragile context, requires external financial support through multilateral and bilateral donors for successful implementation of the NDC.

427. The proposed GCF grant is appropriate to address the urgent needs of the country to cope with climate change. Decades of conflict have taken a toll on Somalia's agricultural sector, exacerbating the vulnerability of local populations to the impacts of climate change. Environmental degradation further compounds these challenges, undermining agricultural productivity and exacerbating food insecurity. The degradation of natural and built infrastructure that support climate coping mechanisms, must be reverted in order to continue to support local development. These investments, however, lie beyond the means of the Somalia government for the moment. In light of these challenges, the imperative for GCF grant financing to bolster climate-resilient agriculture emerges as a crucial solution to sustain livelihoods, enhance food security, and foster socio-economic stability and resilience.

8.4.1 Financing package details

428. The tables below the financing by component. See Annex 4 of FP for details.

Table 23: Financing by component

Component	Output	Indicative cost USD ($)	GCF financing		Co-financing		
			Amount USD ($)	Financial Instrument	Amount USD ($)	Financial Instrument	Name of Institutions
Component 1	Output 1.1	4,307,984	4,307,984	Grants			
	Output 1.2	30,127,943	30,127,943	Grants			
Component 2	Output 2.1	24,172,925	9,311,909	Grants	14,861,016	Grants	FAO
	Output 2.2	8,181,815	8,181,815	Grants			
	Output 2.3	9,544,024	9,544,024	Grants			
Component 3	Output 3.1	3,317,004	3,317,004	Grants			
	Output 3.2	2,755,379	2,755,379	Grants			
Monitoring & Evaluation	M&E	4,360,155	4,360,155	Grants			
Project Management Cost	PMC	5,812,700	5,479,487	Grants	333,213	Grants	FAO
Contingency		2,321,571	2,321,571	Grants			
Indicative total cost (USD)		94,901,497	79,707,268		15,194,229		

8.5 Eligibility Criteria

429. Participation in the project will be voluntary on the basis of a Free, Prior Informed Consent procedure that will be launched at the start of the project. A census of organized groups will also take place to ensure that all relevant stakeholders are participating in project activities. Participation will be limited to one member per household. General eligibility criteria will include:

- Must not be a part of Al Shabbab and commit to not supporting the group.
- Have access to land and/or livestock
- Testify to an absence of land conflict
- Commit to participating in project trainings

430. Additional criteria are explained below and in the Annex 23.

Activity	Sub-activity	Executing Entity (EE)			Funding source	Direct beneficiaries	Eligibility criteria
		FAO	GoS-MoECC	GoS-MoAI			
1.1.1 Strengthen the information base for climate-informed local land use planning	1.1.1.1	x			GCF	N/A	
	1.1.1.2	x			GCF		
1.1.2 Develop climate-informed inclusive landscape management plans	1.1.2.1	x			GCF	930	Must reside in the project areas
	1.1.2.2	x			GCF		
	1.1.2.3	x			GCF		
	1.1.2.4	x			GCF		
1.2.1 Conduct landscape restoration through local landscape management committees and community-based associations	1.2.1.1	x			GCF	41,800	Must reside in the project areas.
	1.2.1.2	x			GCF		
	1.2.1.3	x			GCF		
	1.2.1.4		x		GCF		
2.1.1 Strengthen water management capacity at State and local level	2.1.1.1	x			GCF	1,550	Must reside in project area and become a member in WUAC.
	2.1.1.2	x			GCF		
	2.1.1.3	x			GCF		
	2.1.1.4	x			GCF		
	2.1.1.5	x			GCF		
	2.1.1.6	x			GCF		
2.1.2 Increase access to water resources and climate smart irrigation infrastructure	2.1.2.1	x			FAO	861,000	Must reside in project area
	2.1.2.2	x			GCF		
	2.1.2.3	x			GCF		
2.2.1 Disseminate CRA practices to farmers	2.2.1.1	x			GCF	85,932	Must reside in a project area and be willing to join a FFS group. Have access to land.
	2.2.1.2	x			GCF		
	2.2.1.3	x			GCF		
	2.2.1.4			x	GCF		
2.2.2 Build the capacity of MoA at Local, State and Federal level to support communities in the adoption of CRA practices	2.2.2.1	x			GCF	N/A	
	2.2.2.2	x			GCF		
2.3.1 Improve access to climate resilient inputs for crop and livestock production	2.3.1.1			x	GCF	14,880	Must be a member of an existing cooperative/ associations/ groups or be able to join a cooperative/ associations/ groups. Have access to land and be a producing farmer or livestock producer.
	2.3.1.2	x			GCF		
	2.3.1.3			x	GCF		
	2.3.1.4			x	GCF		
	2.3.1.5			x	GCF		
	2.3.1.6	x			GCF		
	2.3.1.7	x			GCF		
	2.3.1.8	x			GCF		
	2.3.2.1	x			GCF	8,200	

2.3.2 Build the capacity of producer groups to develop sustainable climate-informed business plans	2.3.2.2	x			GCF		Must be a member of a farmer organization/group, cooperative, association or enterprise.
	2.3.2.3	x			GCF		
2.3.3 Increase MSME, cooperatives and farming group access to agricultural credit	2.3.3.1	x			GCF	13,020	Must be a member of a farmer organization/group, cooperative, association, FFS or enterprise
	2.3.3.2	x			GCF		
	2.3.3.3	x			GCF		
	2.3.3.4	x			GCF		
2.3.4 Increase all-season access to market for smallholder producers, cooperatives and farmer groups	2.3.4.1	x			GCF	113,832	Must reside in project area.
	2.3.4.2	x			GCF		
3.1.1 Update legal and institutional frameworks for sustainable landscape management	3.1.1.1	x			GCF	N/A	
	3.1.1.2		x		GCF		
	3.1.1.3	x			GCF		
	3.1.1.4		x		GCF		
	3.1.1.5		x		GCF		
3.1.2 Strengthen policy dialogue and coordination between sectoral ministries at State levels	3.1.2.1		x		GCF	N/A	
	3.1.2.2		x		GCF		
	3.1.2.3		x		GCF		
3.1.3 Strengthen the capacity of MoECC to manage, monitor and govern natural resources and implement nature-based solutions	3.1.3.1		x		GCF	N/A	
	3.1.3.2		x		GCF		
	3.1.3.3		x		GCF		
	3.1.3.4		x		GCF		
	3.1.3.5		x		GCF		
3.1.4 Build capacity for the monitoring, assessment, analysis and early warning related to the impacts of climate on food security, climate	3.1.4.1	x			GCF	N/A	
	3.1.4.2	x			GCF		
	3.1.4.3	x			GCF		
	3.1.4.4	x			GCF		
3.1.5 Build capacity of MoAI for climate informed water management infrastructure planning.	3.1.5.1			x	GCF	N/A	
	3.1.5.2			x	GCF		
	3.1.5.3			x	GCF		
3.2.1 Collect, disseminate and share relevant climate and land data to support decision making at all levels	3.2.1.1	x			GCF	949,799	Must be a resident of targeted areas.
	3.2.1.2		x		GCF		
	3.2.1.3		x		GCF		
	3.2.1.4		x		GCF		
	3.2.1.5	x			GCF		
	3.2.1.6		x		GCF		

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