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A Sectoral Analysis

Water+ in Somalia

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An accompanying report (of a suite of six reports) with

Economics of Water: Digging for Data—Towards Understanding Water as a Limiting or Enabling Factor for Socioeconomic Growth in Somalia

Contents

Abbreviations and Acronyms

ASAL	Arid and Semi-Arid Land
ENSO	El Niño Southern Oscillation
FDSNAU	Food Security and Nutrition Analysis Unit
FGS	Federal Government of Somalia
FMS	Federal Member States
GDP	Gross Domestic Product
ha	Hectare
IDP	Internally Displaced Person
mm	Millimeter
MoEWR	Ministry of Energy and Water Resources
MoLFR	Ministry of Livestock, Forestry and Range
MoPIED	Ministry of Planning, Investment, and Economic Development
MoWD	Ministry of Water Development
NDP	National Development Plan
NWRS	National Water Resource Development Strategy
LSDS	Livestock Sector Development Strategy
SSA	Sub-Saharan Africa
SWALIM	Somalia Water and Land Information Management (FAO)
UNICEF	United Nations Fund for Children
WALP	World Bank-funded Water for Agro-Pastoralist Livelihood Pilot in Somalia
WASH	Water, Sanitation and Hygiene
WHO	World Health Organization

Executive Summary

The benchmarking exercise[1] set out to review key comparators and determine how other countries with similar contexts have found a sustainable economic development trajectory.[2] External benchmarking was to be complemented by internal benchmarking comprising synthesis of available data on water access in Somalia and comparisons. Finally, noteworthy policies and investments to increase productivity or optimize benefits were to be recommended for consideration in the form of tangible examples to orient internal Bank strategies and support dialogue with government partners.

A 'light touch' review of select literature in relation to fragility, conflict, violence, and development as recommended by the World Bank, plus select additional sources points to the need to consider:

- Substantive issues that target both water insecurity and fragility, with consideration of gender and social inclusion from the outset.

- Process issues—the way that a particular policy or investment is introduced and supported, including consideration of leadership and ownership, how funds are channeled, participation and representation, and how to address grievances and inequalities and data-gaps.

- The wider context around water supply and water resources.

Due to the limited findings from countries with similar contexts that have found a sustainable development trajectory in the short- to medium-term as a whole, a lack of reliable quantitative data for Somalia, and a recognition of the importance of appreciating the Somali context including its history and sectoral interdependencies, the scope of the benchmarking exercise was widened into a sectoral analysis.

A key issue for benchmarking is the degree of granularity, or scale, to consider and what context to consider in order to make meaningful comparisons. The potential policies and investments that were identified through the sector analysis, together with those from other components of the 'Economics of Water: Digging for Data—Towards Understanding Water as a Limiting or Enabling Factor for Socioeconomic Growth in Somalia' analysis, provide a good starting point for future benchmarking in relation to the outcomes of specific policies and investments in similar contexts.

The sector analysis provides a rich, and yet, concise overview of water in Somalia in a broad sense, referred to as **Water+**. The analysis was primarily informed through a detailed review of recent publications by the Government of Somalia, the World Bank, and the Food and Agriculture Organization

[1] This report has been developed and written on the basis of a participatory process between the author and Chantal Richey (Senior Water and Sanitation Specialist). Ms Richey's constructive inputs, guidance, and direction were invaluable in shaping and finalizing this report.

[2] This technical report is one of a suite of six supporting documents along with the 'Economics of Water: Digging for Data—Towards Understanding Water as a Limiting or Enabling Factor for Socioeconomic Growth in Somalia' report, and is a background note for Chapter 5 of that report. The other five supporting documents comprise (a) three technical reports (Somalia: An Institutional Analysis Report; Somalia: Groundwater Assessment Technical Report; and Somalia: Surface Water and Riverine Assessment); (b) Somalia: Groundwater Quality Technical Note; and (c) a Summary Report. All the reports can be accessed at: the Ministry of Energy and Water Resources' website (https://moewr.gov.so) [the reports will be available in 2022 as the site is currently under development]; the World Bank's Water Global Practice website (https://www.worldbank.org/en/topic/water); as well as the World Bank's Somalia website (https://www.worldbank.org/en/country/somalia).

(FAO) on national development, agriculture, livestock, water resources, economic development, urbanization and living standards in Somalia. All these insightful and lengthy reports were published in the last four years and draw on a wealth of published and gray literature. This was also reviewed where relevant. Regional comparisons and insights from international literature have been subsequently drawn into the sectoral analysis.

Access to a basic drinking water source in Somalia is low, estimated by the World Health Organization (WHO) and United Nations Children's Fund (UNICEF) to be 52 percent nationally (82 percent urban; 28 percent rural). Figures for access to basic sanitation are lower at 38 percent nationally (61 percent urban; 20 percent rural). Inequalities between rural and urban areas are extensive, as well as between urban internally displaced persons (IDPs) and other households. In rural areas, water sources tend to be used for multiple purposes, including drinking, for domestic use, and to water livestock. In cities, piped networks, point source vendors at boreholes and dug wells, as well as truckers and animal and human-drawn carters deliver water supply services. Water services across the country are delivered by public, private, and international institutions, as well as by households themselves, with provision minimally regulated. Policies for the water exist but are not all fully implemented.

With an emphasis by aid and development agencies on delivering emergency WASH services over many years, Somalia needs to transition from short-term support to long-term development, notwithstanding the fact that emergency support or buffer capacity will be needed for the foreseeable future. Water demands in Somalia are likely to grow and, in fact, should grow in order to overcome poverty. There is also a need to reconcile demands for food production with environmental flows, and livestock with farming, as well as better connect rural and urban economies.

Starting with a long list of potential themes for consideration, from the initial 'light touch' literature review, the review of Somali literature and reflections by the study team, the sector analysis focused on three core themes:

- Rural economy I: Pastoralists and livestock.
- Rural economy II: Farmer, crops, and forests
- Transitions: Urbanization, water-related shocks, resilience, and climate change.

Somalia encompasses large areas suitable for livestock grazing, browsing, and fodder production; fertile alluvial soils for staple cereals, oil seeds, legumes, and horticulture crops; forests that provide prized gums and resins, as well as charcoal for cooking. Somalia's waters are home to a diverse range of valuable reef and pelagic marine species. Over the last 50 years, deforestation in Somalia has been significant and, with flood plain forests essentially gone, perhaps one of several factors contributing to the disruptions caused by flooding.

An estimated 26 percent of Somalis follow a nomadic way of life as pastoralists, with another 23 percent of the population living in rural areas. Livestock in Somalia are the major repository of individual and national wealth. Livestock is important for food, but also for the economy, currently contributing to an estimated 43 percent of the gross domestic product accounting for 75 percent of total exports and engaging an estimated 65 percent of Somalia's labor force in some way (MoPIED 2020). However, Somalia's pastoralism and livestock are constrained by strains on rangelands including land degradation, loss of communal grazing land, and expansion of enclosures. These are all underpinned by weaknesses in the traditional and formal governance of rangelands.

Disputes and conflicts occur between pastoralists and farmers as well as between pastoralists themselves. There are also concerns about gender and wealth inequalities in pastoralist households and communities. Diversification into economic activates such as charcoal burning may have boosted some incomes in the short term but have degraded rangelands further. Inadequate, distant, and costly, water supplies undermine animal health and survival, the delivery of high-quality animals to markets, and other aspects of the value chain of livestock and dairy production and processing.

If Somalia's livestock sector is to flourish, there is need to invest in its foundation, that is, rangeland governance and the rehabilitation of degraded rangelands alongside improving resilience by easing water shortages, assuring the availability of year-round livestock feed and improving mechanisms to deal with water-related shocks. There is also a need to ensure reliable water supplies for the entire livestock value chain. Boosting human and economic development through pastoralism and livestock in Somalia is challenged by complex interlinkages and potential trade-offs including:

- Investments in water infrastructure are essential to address vulnerability in the drylands but must be complemented by parallel investments designed to mitigate and adapt to the effects of climate change, restore healthier ecosystems and strengthen the capacity of local communities to sustainably and equitably manage their water assets and the natural resource base (including soils, pastureland and forests) that underpins their livelihoods. In short—investments in water infrastructure alone will not be enough.

- In the drive to revitalize and develop agriculture in Somalia, experience from other regions such as the Sahel shows that, if irrigation is developed alongside pastoralism, there is a need to guarantee that it does not deprive pastoralists of access to dry-season water and forage reserves. Further, irrigation should not aggravate vector-borne diseases of people or animals or exacerbate conflict. In other words—irrigation investments, policies or transformation need to consider pastoralism from the outset.

- In arid and semi-arid areas, water has a high value. The World Bank-funded Water for Agro-Pastoralist Livelihood Pilot (WALP) project in Somalia has witnessed sand dam water being abstracted by those running water tanker businesses, threatening local supply. The lesson—new water infrastructure investments must consider governance and management mechanisms, including potential conflicts, from the start.

Less than 5 percent of land in Somalia is considered suitable for cultivation, of which over 75 percent is suitable for rainfed agriculture, and the remaining 25 percent has potential for irrigation. Today, poverty and chronic malnutrition are prevalent among the Somali rural population, with small-scale farmers, the majority, trapped in a poverty cycle and lacking the capacity or resources to improve production. Further, legal systems and sociocultural norms undermine women's capacity and agency, as well as educational and economic opportunities.

Crop production and food exports have declined significantly since the early 1990s. However, while export crops counted for 20 percent of foreign exchange prior to the outbreak of civil war in the early 1990s, large scale flood control and irrigation infrastructure, alongside state-owned enterprises enabled this, and it is not clear the extent to which subsistence farmers benefited.

Rainfed agriculture is more widespread than irrigated agriculture, and there is scope for improving dryland water conservation practices, potentially boosting yields and increasing resilience. Most of Somalia's irrigation potential is in the areas alongside and between the two perennial rivers, the Jubba and the Shabelle. Irrigated agriculture is constrained by inconsistent surface water availability,

inefficient water use, salinization and water logging, as well as soil fertility management, low quality seeds, and inappropriate farming techniques.

Somalia's crop sector today is also challenged by inadequate water and transport infrastructure, persistent insecurity, weak regulatory and enabling institutions, and severe environmental degradation of rangelands and forested areas. Soil degradation is a major ongoing problem, and land tenure presents challenges. In the past, Somalia was also a major global exporter of raw gums from trees, and while harvesting continues, there are concerns about the sustainability of current practices.

Improving the agricultural practices of subsistence farmers and enhancement of commercial agriculture could boost agricultural production, support the integration of rural and urban economies, and reduce food import dependency. Given that failures of large-scale irrigation in Sub-Saharan Africa have been acknowledged for decades, supporting farmer-led irrigation in Somalia may prove to be the most viable way to boost farmer incomes and rural livelihoods. Agricultural improvements present opportunities for income generation, including for the youth, who represent 70 percent of Somalia's population. Ensuring year-round availability of livestock feed is an issue for pastoralists, agro-pastoralists, and farmers. Policies or investments into fodder production have potential to reap considerable rewards, although there is need to balance short terms gains with long term sustainability, and to consider the contentious issue of land enclosures vis-à-vis open grazing.

Enhancing human and economic development in Somalia through 'Water+' sector policies and investments in relation to crops and forests should consider the following interlinkages:

- To improve agriculture in Somalia, water supply and water management practices need to be combined with good agronomic practices. Given that healthy soils play an instrumental role in crop and livestock production, prevention of soil degradation and loss of soil organic matter need to be considered alongside water conservation. In order to realize impact, investments in water infrastructure alone are unlikely to significantly transform rainfed or irrigated agriculture.

- In some areas, land tenure disputes will need to be resolved before, or together with, planning for investments to improve water infrastructure.

- While crops are very important for Somalia, a constraint to the livestock sector is the uncontrolled expansion of enclosures on previously open rangeland, and so expansion of areas for crops and livestock needs need to be considered jointly.

- Even in places with favorable hydrologic conditions, such as areas within the Jubba and Shabelle rivers' drainage basins, institutional flaws and mismanagement can lead to water insecurity. Water governance is essential.

- To boost crop production in Somalia, the issues of (a) institutional and human capacity building; (b) infrastructure rehabilitation; (c) expansion of rainwater catchment and moisture conservation; and (d) rehabilitation of trunk and rural roads need to be pursued in parallel, rather than sequentially.

Somalia has had a high degree of variability in relation to weather and the natural environment for centuries, which is expected to be exacerbated in the future by climate change. Somalia's natural resources are subject to seasonal and year-on-year variations in rainfall in space and time. Somalia has hyper-arid as well as arid to semi-arid conditions, with only two areas receiving rainfall between 400–600 mm, and two perennial rivers. Most other surface water sources are seasonal, comprising ephemeral rivers and wadis.

Droughts and floods in Somalia are centuries-old phenomena but are expected to be exacerbated by climate change. Extensive land use change, including loss of forest cover, loss of floodplain forests, and land degradation has affected lives and livelihoods. While there are examples of environmental rehabilitation efforts, they are not taking place at the scale needed.

Groundwater is used widely, providing an estimated 80 percent of domestic water supplies but water tables are deep at 100–300 m and groundwater is often of poor quality, including high salinity in most parts of the country. Subsurface dams and wadis also provide important shallow groundwater supplies and may have further untapped potential. Better use of Somalia's groundwater resources presents an opportunity to improve resilience by relying on the buffering capacity offered by considerable storage reserve volumes. Water quality does need to be considered, particularly salinity, fluoride, and microbiological contamination.

While there is no consensus on whether the Horn of Africa will receive more, or less, rainfall in the future as a result of climate change, there are likely to be temperature increases, with knock-on effects on evapotranspiration. More variable and extreme rainfall on barren soils may also result in more erosion, while reductions in vegetation cover have grave implications for livestock herding, livelihoods, and the economy. Degraded land also releases carbon, providing yet another argument for investing in land and rangeland rehabilitation and management.

Somalia's population is growing and also urbanizing. Dealing with the ongoing variabilities, and ensuring water security for people, livestock, crops, and changing settlement patterns presents a formidable challenge. However, it is important to be mindful of the fact that the people of Somalia have continued to demonstrate outstanding adaptability, resilience, mutual support mechanisms, and entrepreneurship despite colonization, state collapse, foreign interference, and violent conflict. All of the above are very powerful assets.

The Somali cities of today are sites of great wealth and enduring poverty, with most urban neighborhoods defined by clans, and living in enclaves with apparently little interaction between them although cross-clan businesses across cities does take place. Over the last decades urban areas have grown, with the large cities close to drought-prone areas also receiving waves of IDPs that puts pressure on scarce land and water resources and presents challenges for integration. Alas, demographic data on Somali cities remains inadequate and not all city boundaries are clear, presenting challenges for infrastructure development planning.

The uniqueness of Somali cities is magnified by differences in their vulnerabilities, with different levels of poverty, violence, price volatility, market size, urban growth, and numbers of IDPs. Understanding these vulnerabilities and finding ways to address them through, for example, improving governance, building capacity, and developing infrastructure is important for the sustainable economic and human development of urban areas.

Water-related shocks in Somalia have contributed to poverty, displacement, biodiversity loss, and conflict. Whereas droughts pose a risk to agriculture, floods can cripple crop and livestock production. Variability and environmental shocks in Somalia manifest themselves through the movement, migration, and displacement of people, both as nomadic pastoralists, but also as IDPs. Traditionally, pastoralists moved themselves and their livestock to access year-round pastures and water sources. While this remains the case for some, migration to IDP settlements has become a complementary coping strategy, as has family splitting. Movement of rural people to IDP settlements tends to be a response to flood and drought events.

There are numerous potential policies and investments that could increase access to drinking, domestic and multiple-use water supplies, improve the lives of pastoralists and enhance livestock productivity, boost crop production, support ongoing urbanization, and build capabilities to deal with water-related shocks and resilience, as well as adapt to climate change in Somalia. Summarized and presented below are 16 policy and investment opportunities for 'Water+' that have emerged from this benchmarking study and sector analysis as having particular potential to support Somalia to find a sustainable development trajectory.

Domestic/Multiple-Use Water Supplies

(a) Develop water investment plans for each major city, as has already been undertaken by the World Bank for seven cities in Somaliland and Puntland.

(b) Analyze economic growth potential of, and inequalities in, cities and define key urban water infrastructure investment priorities, one per Federal Member State and Somaliland.

(c) Improve data collection on water access and use, linked to investments which reduce geographic inequalities and improve access to basic water supplies, emphasizing reducing the distance and time to collect water, and thus the vulnerability of women and children to violence.

(d) Make investments in new small water systems/expansion, including innovations (for example, sand dams) coupled with appropriate governance and management arrangements.

Pastoralists and Livestock

(a) Secure the rural economy through participatory rangeland and water management.

(b) Improve livestock watering facilities management and maintenance by community organizations, combined with conflict resolution efforts.

(c) Facilitate technical assistance/co-funding for private and community investments to improve water access for livestock resting areas, transit stops, and livestock value chains.

Farmers, Crops, and Forests

(a) Support integrated land and water management practices, including soil conservation and flood management.

(b) Support the promotion of water and soil conservation and water harvesting methods in drylands.

(c) Introduction of mechanisms to enable and support farmer-to-farmer communications and learning (for example, farmers' voice radio).

(d) Support further research into farmer-led irrigation development, in combination with consideration of pastoralism and flood management.

(e) Support further research into boosting year-round affordable good quality livestock feed.

Transitions: Urbanization, Water-Related Shocks, Resilience, and Climate Change

(a) Facilitate water supply infrastructure planning, development, and management catering for vulnerable urban contexts with hybrid governance (for example, transition management).

(b) Pilot locally-based Natural Resources Management and Water Resources Management, including soil rehabilitation.

(c) Research viable flood mitigation and drought resilience measures, including forest stewardship.

(d) Support research and development of climate-resilient water and sanitation technologies and management techniques.

Introduction

Somalia has been in transition since the delineation of African borders at the Berlin Conference of 1884–85.[3] The country was subject to colonialism and military engagement by foreign powers, followed by a spell of relative stability after independence in the early 1960's, after which the country suffered from political instability, state collapse, and internal conflict compounded by foreign intervention and water-related shocks.

Despite inordinate challenges, Somali society has proven to be resilient, has established hybrid governance forms, and has a very dynamic private sector, with robust flows of remittances from Somali's diaspora (World Bank 2020). An active state-building process is ongoing, and Somalia's National Development Plans (NDP) present a vision for the country that breaks out of cycles of recurrent natural disasters which displace people and hinder progress, and move towards recovery and long-term resilience.

Water security is central to catalyzing economic development, addressing poverty challenges, and improving living standards in Somalia. However, the understanding of the role of water for the economy, as well as Somalia's vulnerability to floods and drought, remains inadequate (World Bank and FAO 2018). This is the backdrop to the 'Economics of Water: Digging for Data—Towards Understanding Water as a Limiting or Enabling Factor for Socioeconomic Growth in Somalia' report.

As part of this study, an external benchmarking exercise set out to review key comparators and determine how other countries with similar contexts have found a sustainable economic development trajectory. This was to be complemented by internal benchmarking—synthesizing available data on water access in Somalia and undertaking comparisons. Finally, noteworthy policies and investments to increase productivity or optimize benefits were to be recommended for consideration. These were to be presented as tangible examples that can orient internal Bank strategies and support dialogue with government partners.

The benchmarking exercise commenced with a 'light touch' review of select literature in relation to fragility, conflict, violence, and development. The review found limited findings with respect to countries with similar contexts on a sustainable development trajectory in the short- to medium-term as a whole and a lack of reliable quantitative data for Somalia. In addition, the following statement in the World Bank and FAO (2018) report entitled 'SOMALIA: Rebuilding Resilient and Sustainable Agriculture' stood out as particularly important:

"*Interlinkages between climate variability and climate change, environmental degradation and natural resource depletion, conflict, food insecurity, and poverty are more pronounced in Somalia than in almost any other country. Though broadly documented and scrutinized, these dynamics are little understood.*"

Noting the above, and recognizing the need to appreciate the Somali context, including history and interconnections between water and other sectors, the scope of the benchmarking exercise was widened into a sectoral analysis.

[3] In Berlin, the land on which the Somali people lived was divided into five territories—initially French, British, and Italian Somalia, plus the Ogaden region in Ethiopia and the Northern Frontier District of British-ruled Kenya.

This has provided a rich, and yet concise, overview of water in Somalia in a broad sense, referred to as 'Water+'. The sectoral analysis was primarily informed through a detailed review of recent publications by the Government of Somalia, the World Bank, and the Food and Agriculture Organization (FAO) on national development, agriculture, livestock, water resources, economic development, urbanization, and living standards in Somalia. All these insightful and lengthy reports were published in the last four years and draw on a wealth of published and gray literature. This was also reviewed where relevant. Regional comparisons and insights from the international literature were subsequently drawn into the sectoral analysis

Starting with a long list of potential themes for consideration, from the initial 'light touch' review, the review of Somali literature and reflections with the study team resulted in the decision to focus on three core themes:

- Rural economy I: Pastoralists and livestock.
- Rural economy II: Farmer, crops and forests.
- Transitions: Urbanization, water-related shocks, resilience, and climate change.

Through in-depth analysis of the aforementioned reports and literature, the salient issues with respect to 'Water+' for the above three themes are synthesized and presented in Chapter 3, Chapter 4, and Chapter 5 of this report. Quantitative and qualitative data that relates and compares Somalia to the wider context and trends in the region or more widely is included where relevant. Chapter 3, Chapter 4, and Chapter 5 each conclude with recommended water sector investments or policies which could contribute positively towards human and economic development. Tangible examples and stories from within Somalia and elsewhere that can help to orient investment strategies and support dialogue with partners have been drawn into Chapter 6 of the main 'Economics of Water: Digging for Data' report. This report is structured as follows:

- Chapter 1 summarizes the key points from the 'light touch' literature review and internal benchmarking exercise.
- Chapter 2 provides an overview of key definitions, set in a regional and global context.
- Chapter 3 examines the historical and ongoing situation with respect to pastoralists and livestock, focusing on water-related issues.
- Chapter 4 sets out the role that crops and forests have played in the past and today, and reflects on the interlinkages with the water sector.
- Chapter 5 discusses the challenges and opportunities of the ongoing changes and uncertainties, with a focus on urbanization, water-related shocks, and resilience.

Appendix 1 provides the data behind the maps on access to water for people and livestock. Appendix 2 provides collated information about city populations. Appendix 3 summarizes available data on groundwater quality. Appendix 4 provides detailed justification and examples of other settings in which the recommended policies and investments have demonstrated impact.

1 Benchmarking

1.1 External Benchmarking

1.1.1 Insights from Comparative Countries

The initial, 'light touch' literature review was undertaken against the backdrop of the overarching questions of the 'Economics of Water: Digging for Data' study on:

- **Question 1:** How much are water resources' availability and quality of access to water services limiting factors for human and economic development in Somalia?
- **Question 2:** What are the socioeconomic impacts of underinvestment as per consumptive water uses (with emphasis on water services for rural and urban areas and water for livestock and agriculture)?
- **Question 3:** How could water be better harnessed in the future?

The review explored how other countries with similar contexts have found a sustainable economic development trajectory.

Sadoff et al. (2017) find that water security is more difficult to achieve in fragile contexts due to weak institutions and information systems, strained human and financial resources, and degraded infrastructure. The result is failure to provide services, protect from water-related disasters, and other multiple failures. In order to improve water security in fragile contexts, Sadoff et al. (2017) emphasize the importance of investing more in the data, information, and institutions that manage infrastructure and, foremost, improving knowledge and institutional capacity.

While adverse rainfall events (for example, floods and droughts) do have negative economic effects, some policies and investments to protect against rainfall changes have created moral-hazard problems (for example, more groundwater access leading to farming more water-intensive crops) (Damania 2020). Further, "*Solutions to manage the capricious effects of water scarcity and vulnerability have remained elusive despite vast investments in infrastructure and significant research*" (Damania 2020). This is echoed by Sadoff et al. (2017), who present several examples of what has gone wrong but very few positive cases. This highlights the importance of learning from trajectories that have not led to sustainable economic development, but also presents a challenge for the external benchmarking exercise as initially envisaged.

A case in point is dams, which are extremely important for hydropower and food production but can put pressure on communities in the form of physical displacement and income loss (Eberle 2020). The first systematic study of conflict and dams finds strong and robust evidence for an increase in conflict in regions with new dams and adds that while "*dams in average increase local violence, it does not necessarily imply that all dams are harmful"* (Eberle 2020). Context matters, and a lack of political competition may result in dams that are poorly planned, and fail to account for the economic preferences of the communities that are directly affected, with conflict and violence a potential outcome (Eberle 2020).

State and peace-building efforts through the development of vital services are no panacea. Based on a study in Zimbabwe, WSP et al. (2014) provide recommendations on how water and sanitation infrastructure projects could also maximize state and peace-building dividends. It is important, however, to caveat this with subsequent findings from Mcloughlin (2015), who argues that "*Received wisdom*

holds that the provision of vital public services necessarily improves the legitimacy of a fragile or conflict-affected state. In practice, however, the relationship between a state's performance in delivering services and its degree of legitimacy is nonlinear. Specifically, this relationship is conditioned by expectations of what the state should provide, subjective assessments of impartiality and distributive justice, the relational aspects of provision, how easy it is to attribute (credit or blame) performance to the state, and the characteristics of the service."

There is surprisingly little evidence on the role of water in the economy, its influence on growth and impact on the structure of economic activity and employment with evidence of irrigation infrastructure to buffer against rainfall shocks ambiguous (Damania 2020). In fact, social safety nets may be a necessary adjunct to water policies that address rainfall variability (Damania 2020). However, "a*t spatially disaggregated scales variations in water availability, proxied through changes in rainfall, have significant effects on economic growth*" (Damania 2020).

Even though a country may be well-endowed with water, this does not necessarily translate to it being water secure,[4] and water use may not be the most economic. Pakistan is a case in point, which is well endowed with water as a nation, but its high population means that per capita availability is relatively low (Young et al. 2019). Water use is heavily dominated by agriculture, but the four major crops (wheat, rice, sugarcane, and cotton), which use nearly 80 percent of all water, generate less than 5 percent of gross domestic product (GDP) (Young et al. 2019). Further, the economic costs from poor water and sanitation and floods are conservatively estimated at 4 percent of GDP, as well as the suffering and death caused by waterborne diseases. Young et al. (2019) acknowledge that there is no simple solution or intervention to address water quality in Pakistan.

In contrast, the Middle East and North Africa is the most water scarce region in the world, with over 60 percent of the population living in areas with high or very high surface water stress (World Bank 2017a). While water scarcity challenges in the region are centuries old, the challenge is being compounded by climate change, droughts and floods, and water management in the context of fragility, conflict, and violence among others (World Bank 2017a). In many countries, population growth and increasing water demands coupled with poor governance have overwhelmed infrastructure investments, resulting in unsustainable withdrawals and degraded ecosystems and aquifers (World Bank 2017a).

Given that failures of large-scale irrigation in Sub-Saharan Africa (SSA) have been acknowledged for decades, supporting farmer-led irrigation in Somalia may prove to be the most viable way to boost farmer incomes and rural livelihoods (Higginbottom et al. 2021). Many small-scale farmers in SSA are developing small-scale irrigation equipment—including buckets, watering cans and treadle pumps—which tend to have lower unit costs and better performance than larger systems managed by government agencies. Precision agriculture—comprising information and communications technology tools, including global positioning system (or GPS), satellites, sensors, and aerial images that provide farmers with site-specific information—allows farmers to enhance irrigation efficiency while minimizing impacts on the environment (FAO 2020a).

When markets are sparse, as they are in many rural areas dominated by subsistence production, variations in market prices of crops tend to be wider than in regions where markets are more fully developed. Farm-level fertilizer prices in Africa are among the highest in the world (Bationo et al. 2012). One metric ton of urea costs about US$90 in Europe, US$500 in Western Kenya, and US$700 in

[4] 'Water security' is defined as "the availability of an acceptable quantity and quality of water for health, livelihoods, ecosystems and production, coupled with an acceptable level of water-related risks to people, environments and economics" (Grey and Sadoff 2007).

Malawi. The high prices are due to a lack of subsidies, high transaction costs, poor infrastructure, poor market development, inadequate access to foreign exchange and credit facilities, transportation costs, and lack of training to promote and utilize fertilizers. It costs about US$15, US$30 and US$100 to move 1 ton of fertilizer 1,000 km in the United States, India, and SSA, respectively (Bationo et al. 2012; FAO 2015). Overall, the economics of fertilizer use are often not sufficiently positive, especially under rainfed conditions—farmers are cash-poor and so cannot buy expensive inputs, and farmers are highly averse to making cash outlays in unpredictable climatic conditions and with uncertain commercial returns (FAO 2015).

Given the lack of positive trajectories from other countries, this study should consider productive benefits as well as potential destructive impacts of investments in water, and cross-sectoral linkages. The literature review points to the need for consideration of (a) substantive issues that target both water insecurity and fragility, with consideration of gender and social inclusion from the outset; (b) process issues—the way that a particular policy or investment is introduced and supported, including consideration of leadership and ownership; how funds are channeled; participation and representation; how to address grievances, inequalities, and data gaps; and (c) the wider context around water supply and water resources.

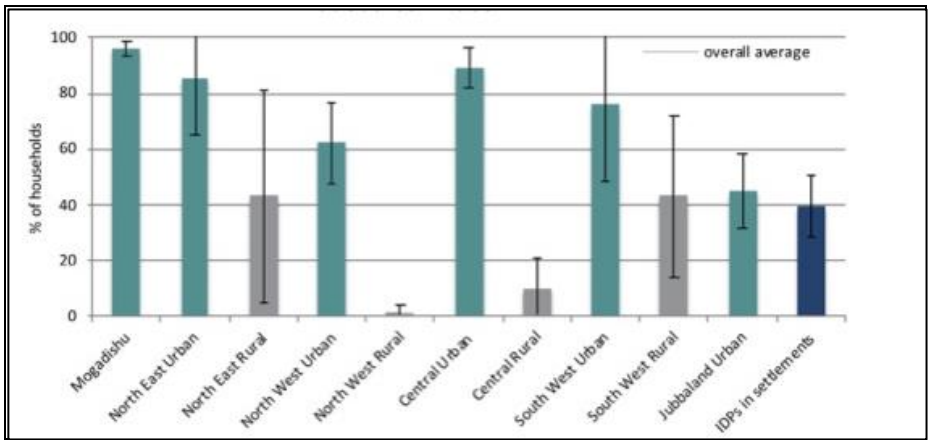
1.2 Internal Benchmarking

1.2.1 Water and Sanitation Access

The Joint Monitoring Programme (JMP) of the World Health Organization (WHO) and UNICEF estimates that only 52 percent of the Somali population has access to a basic water supply, corresponding to 28 percent in rural and 83 percent in urban areas, while it is estimated that, on average, 38 percent of the population has access to basic sanitation facilities (20 percent rural and 61 percent urban), with 28 percent defecating in the open (WHO and UNICEF 2019). These estimates are in sharp contract with the Water, Sanitation and Hygiene (WASH) goal to "*Ensure provision of safe, affordable, equitable, quality and sustainable management of water, hygiene and sanitation for all*" (MoEWR 2021). WASH in schools and in primary health care facilities has been part of many programs, but there are few examples of sustainable services or in sustained behavior change; and policies and plans for such places are lacking (MoEWR 2021).

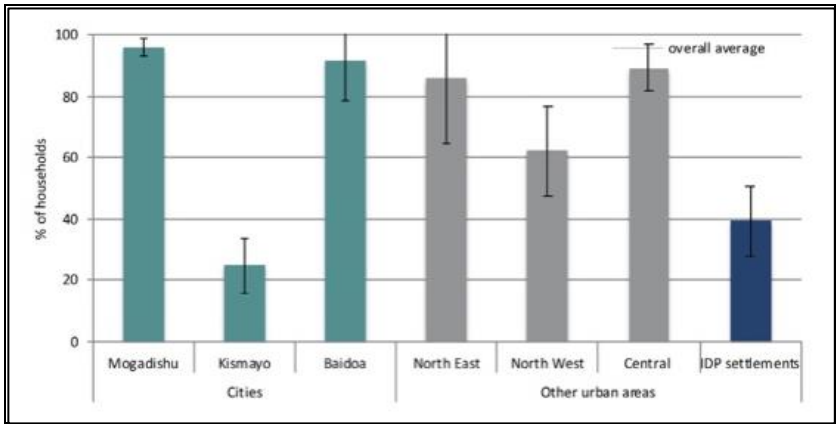
Inequities with respect to water and sanitation access between rural and urban areas, between towns themselves and between urban IDPs and other households are considerable, with rural and IDP settlement populations lagging behind in all cases (Figures 1, 2, and 3). The JMP notes that Somalia is the only country in the world where the gap between rural and urban access to a basic drinking water supply is more than 50 percentage points (WHO and UNICEF 2019). Women that travel to access water supplies situated away from the residences can risk their personal safety, with gender-based violence high in rural and nomadic areas in the country (MoEWR 2021).

Figure 1. Access to Water



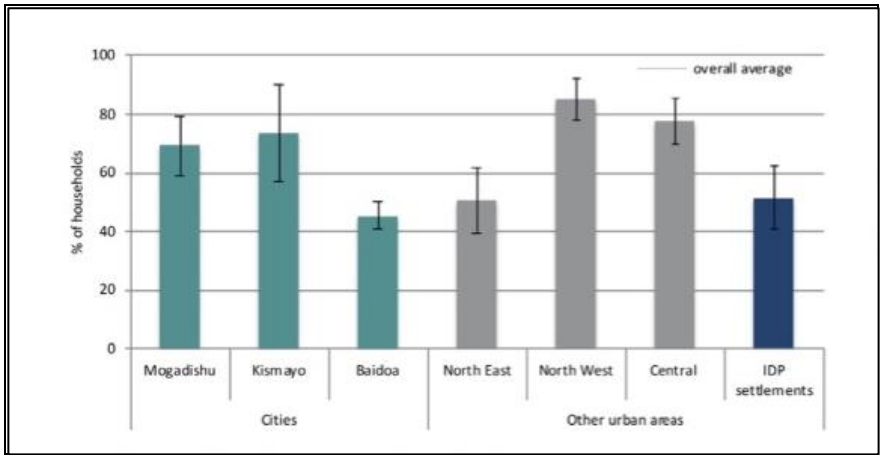
Source: World Bank (2019a).

Figure 2. Access to Piped Water in the House



Source: World Bank (2019a).

Figure 3. Access to Improved Sanitation

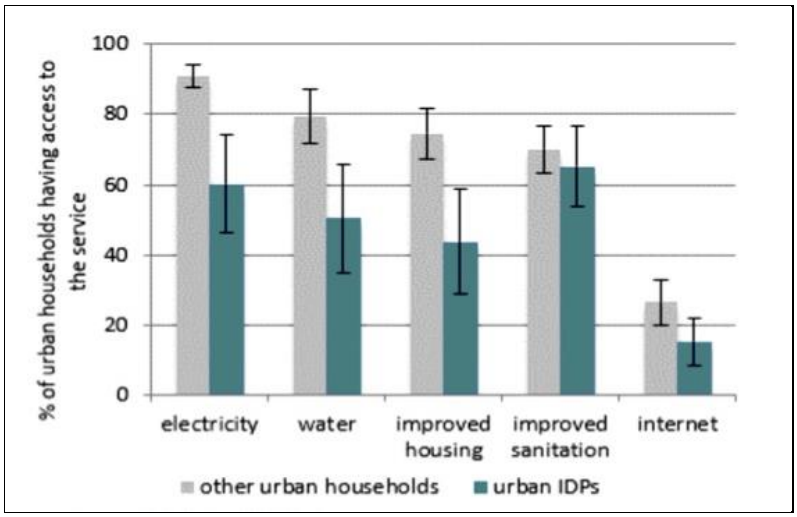


Source: World Bank (2019a).

Inequalities with respect to water services between IDPs and other households in urban areas are similar to those of improved housing, and urban IDPs lag behind major access to services (Figure 4). Access to services and improved housing is highest in cities in Puntland (North East urban) and

Somaliland (North West urban). World Bank (2020) attributes the different service levels to the varying strength of the private sector and other non-state actors, local governance and security, consumer purchasing power, social structures, segregation aid flows, and IDP status, among others. Differences between select cities are discussed further in Section 5.1.5.

Figure 4. Urban IDPs' Access to Services



Source: World Bank (2019a).

For years, the Somali WASH sector focus has been on delivering emergency WASH services, in which the international community has played an instrumental role. The WASH Cluster brings together and coordinates over 180 local and international nongovernmental organizations, government departments, and United Nations' agencies that undertake actions and provide WASH expertise (MoEWR 2021).

However, as a new Somalia emerges, there is a need to find ways of moving from emergency short-term interventions to long-term programmatic development, notwithstanding that some emergency support will continue to be needed in the foreseeable future, given that people are likely to continue to move in response to droughts and floods until alternative coping mechanisms are established. However, the root causes for inadequate WASH need to be addressed, and approaches followed which can deliver improved services in the long-term. Government agencies have key roles to play in this regard.

1.2.2 Water Supplies in Cities

Piped networks, point source vendors at boreholes and dug wells, as well as truckers and animal and human-drawn carters, deliver water supply services in cities (World Bank 2020). It has been estimated that piped water at the home is available for 75 percent of urban households across the country, but that there are considerable differences between cities[5] (World Bank 2020). However, given that it is also estimated that only 82 percent of the urban population has access to a basic water supply, and considering the (limited) data on household connections for select cities (Appendix 1, Table A1.1), the 75 percent estimation piped supplies seems on the high side. Reliable data is lacking, and not well compiled. Appendix 1 consolidates information on water supplies in cities from a range of data sources.

[5] In the case of Kismayo, the equivalent figure is 25 percent (World Bank 2020).

It has been estimated that about 60 percent of existing water supply infrastructure assets requires rehabilitation, expansion or replacement in both urban and rural areas to meet demands (Federal Government of Somalia 2017).

Across Somalia, the private sector fills the void of a lack of public leadership in providing WASH services. Many of the urban water companies are today owned by a local investor who operates with local businesspeople as shareholders (MoEWR 2021). Noting that there is very limited published information in the public domain about the operations of private water supply businesses, Chapter 3 of the 'Economics of Water: Digging for Data' report (Institutional Analysis) groups the private sector into three categories:

(a) Quasi water utilities which are relatively sophisticated private businesses that operate large borewells and supply piped water connections to large parts of many primary and secondary cities.

(b) Small scale providers—a fragmented network, ranging from small businesses to individual entrepreneurs who serve smaller sections of urban and peri-urban areas.

(c) Private entities which provide water services in territories under the control of Al-Shabaab.

1.2.3 Water Supply in Rural Areas

Table 1 provides an overview of the different types of water sources in rural areas. The 2014 population survey classified nine types of water points used by nomadic communities: dug wells, boreholes, springs, berkads (man-made traditional water basins), dams, mixed-type water points, hilos (riverbanks), wars (natural reservoir), and others. Given the prevalence of livestock throughout the country, essentially, these are practically all multiple-use water supplies. Deep boreholes are not considered a cost-effective solution for watering livestock and for increasing crop productivity and suffer from high salinity (MoLFR 2019). "*In the inter-riverine areas of the Bay and Bakool regions, rainfall is harvested for livestock watering by an extensive network of large and shared reservoirs using earth dams and cemented cisterns (berkads), which were originally constructed and maintained by the MoLFR* (World Bank and FAO 2018).

Table 1. Types of Water Supplies in Rural Somalia

Type	Description and General Distribution	Observations	Number Mapped[a]
Surface Water			
Berkads	Berkads are cemented cisterns. One new berkad was constructed under the World Bank WALP project in northern Somalia (World Bank, 2019a).	*Berkads often become silted during the dry seasons and need regular desilting"* (World Bank and FAO 2018).	387
Wadis	In areas other than the Jubba and Shabelle valleys, wadis are ephemeral, with water flowing for very short periods during the seasonal rains. Following these rains, water infiltrates into shallow aquifers that last for a few months of the year. There may be wells situated along the banks of the wadis.	The shallow aquifers last for a few months of the year.	–
Check dams	Check dams have been constructed across the wadis in some parts of Somaliland to raise the water level in the shallow wells along the wadis. The three- to four-meter deep subsurface dams, built of concrete and/or bricks with cement, are used to store surface water and help recharge groundwater (World Bank and FAO 2018).	Many of these sources retain water for a short duration and do not provide year-round water supplies (World Bank and FAO 2018). Evapotranspiration from surface water is high.	–
Reservoirs (earth dams)	Water reservoirs are found behind earth dams in depressions.	Evapotranspiration from surface water is high.	–
Small-scale dams	One dam constructed under the WALP project in Somaliland and Puntland (World Bank 2019b).		–
Hafir dams	These are artificial excavations in which surface water flows during the rainy season and then is stored and used during the dry season.		565

Type	Description and General Distribution	Observations	Number Mapped[a]
Groundwater			
Sand dams or subsurface dams	Groundwater dams are structures that intercept or obstruct the natural flow of groundwater and provide storage for water underground. They can improve the adaptive capacity of dry lands by helping sustain vegetation biomass during drought periods (Ryan and Elsner 2016). In 2017, sand dams and subsurface dams were introduced into Somaliland and Puntland through WALP and later the Biyoole[6] project. Seven sand dams were constructed under WALP.	Have been shown to provide a return on investment.[7] In some areas, uncontrolled withdrawals by water truckers may deplete the reservoir and rob local communities of the resource.	
Boreholes	Boreholes provide water for people and livestock, and are less vulnerable to short-term fluctuations in rainfall than berkads, open dams, shallow hand-dug wells, and springs.	Boreholes are associated with environmental degradation.	1,979
Shallow wells/dug wells	A dug or shallow well is excavated by hand, allowing access to groundwater. They are at least 1 meter wide and generally not very deep (15 to 20 meters).	Dug wells are also relied upon by urban populations.	2,871
Springs	Exist in some parts of the Golis Mountain range along the Gulf of Aden (World Bank and FAO 2018).		437

Note:
[a] As mapped and recorded in the database managed by SWALIM (December 2020).

While land degradation is widespread across the country, it is especially the case near water holes and wells (World Bank and FAO 2018). Heightened pressures on pasture during droughts can cause long-term damage to the surrounding rangeland, creating so-called **'sacrifice zones'** (MoLFR 2019).

[6] Water for Agro-Pastoralist Livelihood Pilot (WALP), and Water for Agro-Pastoral Productivity and Resilience, or Biyoole, project.

[7] A cost-benefit analysis that considered building and maintenance costs of the one berkad and seven sand dams only, found that the benefit people would gain by not having to buy water from water truckers would provide a return that is nearly five times the initial investment. However, rates of return varied between the dams ranging from US$1 to US$10 for every dollar invested.

On February 4, 2021, a total of 6,427 water sources had been mapped and registered in the Somalia Water Resources Information Management System (SWALIM) of which 4,962 (77 percent) were classified as functional. Nonfunctionality is a result of weak water supply management models, high operational and maintenance costs, lack of supply chain of spare parts, and technical limitation of service providers (MoEWR 2021).

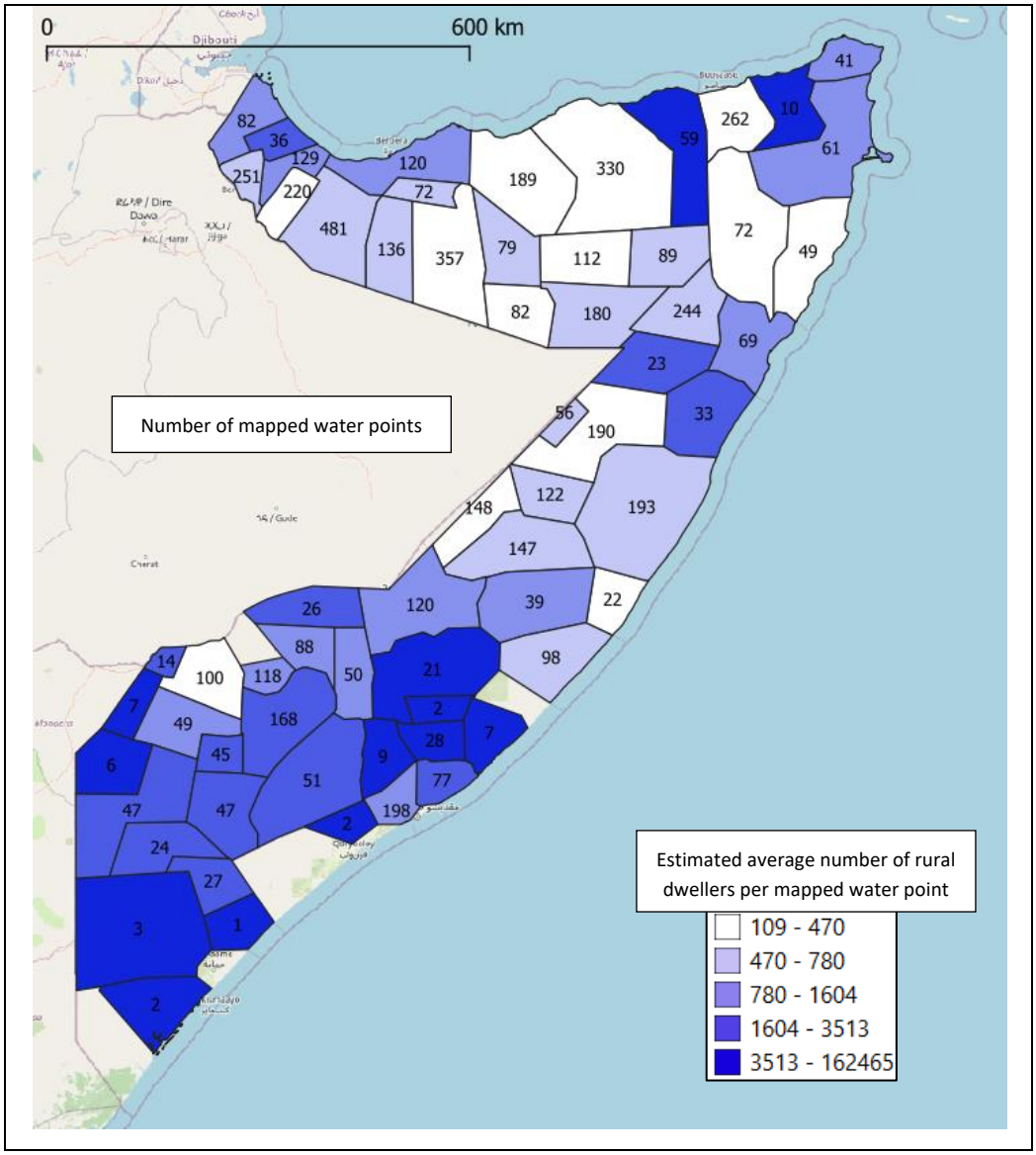
The low functionality rates of water points highlight the importance of operation and maintenance. World Bank (2019c) points to the need for training and exposure of communities and government staff on operation and management, as well as hydrological and geophysical studies to support the design and development of policies, guidelines, and strategies for water harvesting, well as improved information management systems.

Figure 5 provides insights into what has been documented about water point distribution in Somalia. It shows the number of people per mapped water point in each district, and is color coded in quintiles. The data suggest that in some districts over 3,500 people rely on one water source. Given that this is not realistic in practice, the map actually provides insights into where water point data is likely to be lacking, or severely lacking (upper two quintiles). It illustrates the paucity of information available in the SWALIM database for much of the south of the country, as well as select districts in the north.

If future investments are to target geographic inequalities with respect to water access in the country, more reliable data are required. Further studies would also be useful to unpack whether there is crowding at select water points in districts with low or moderate number of people per water source (that is, the upper two quintiles). The need for improved information management systems is echoed in the World Bank (2019c) WALP Project endline report.

Given that unless there is treatment of drinking water, boreholes are likely to be the only source that can provide safe water supplies, it is worth examining borehole distribution in the country. Figure 6 shows the average number of mapped boreholes and average people per mapped borehole at district level. As with Figure 5, it provides insights into the extent of water point mapping, but given that people can use alternatives, the map also sheds light on which districts people are likely to not have access to a safe drinking water supply (lower three quintiles).

Figure 5. Estimated Average Number of Rural Dwellers Per Mapped Water Point and Mapped Water Points in Somalia's Districts[8]

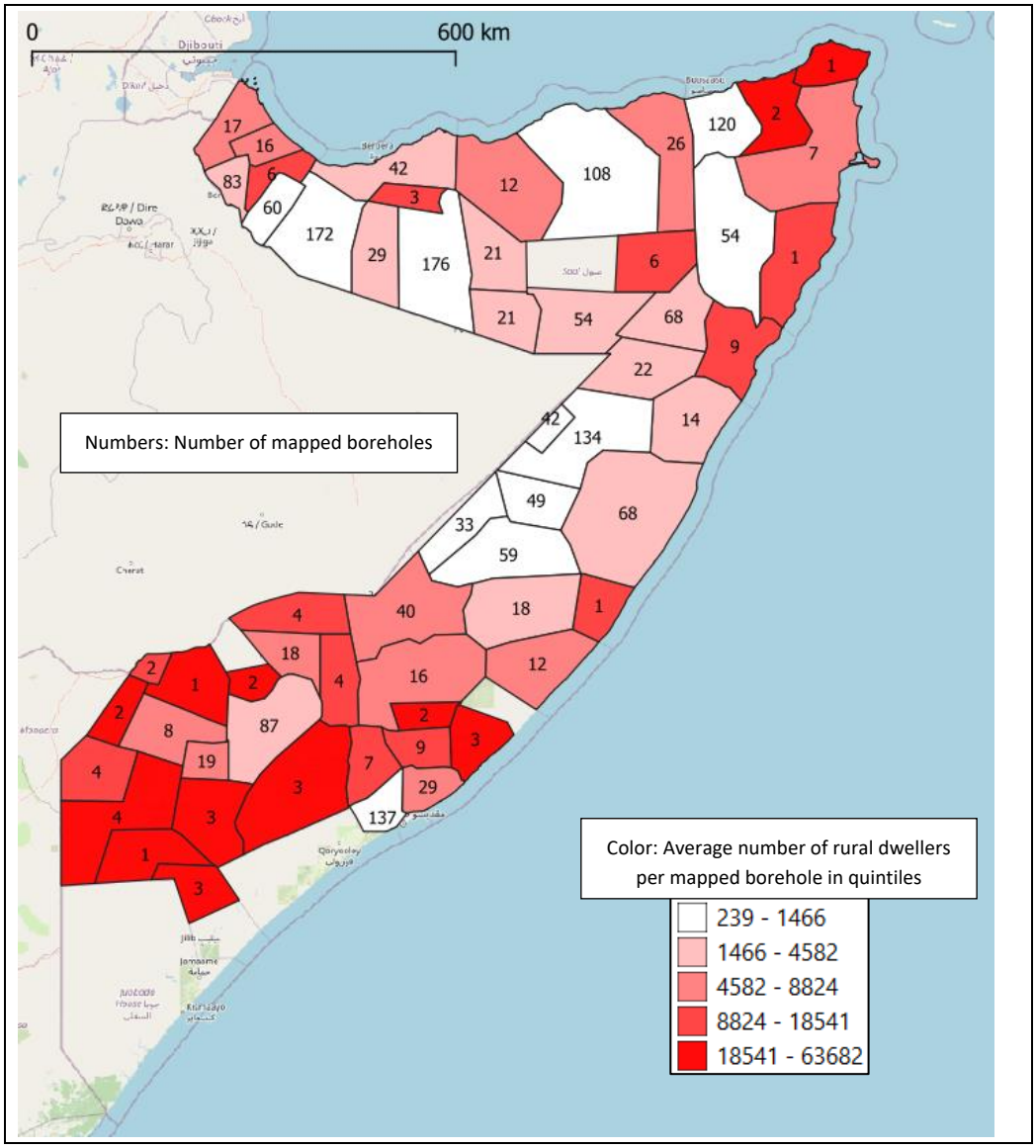


Disclaimer: The actual number of water points is probably much higher in many districts.

In both cases, the fact that there is considerable movement of people (and livestock) needs to be born in mind. If this is taken into account, there may be even more pressure on few water supplies. Further research to shed light on the choices that people make with respect to their water supplies, as well as water treatment practices would be beneficial going forward.

[8] Classes are based on quartile boundaries. Population is derived from UNDP 2014 survey and projected to 2020 based on a 1.79-percent growth rate (World Bank 2020). Waterpoints are from the SWALIM Live database (December 2020).

Figure 6. Mapped Boreholes (Numbers) and Rural Population Per Mapped Borehole (Color Classes) in Somalia's Districts[9]



Note: Average number of people per mapped water source at district level.
Disclaimer: The actual number of boreholes is probably much higher in many districts as not all are mapped.

1.2.4 Gender

In pastoral families, men and boys tend to be responsible for activities related to camels and cattle (for example, buying, owning, grazing, milking, slaughtering, and selling). Women and girls are responsible for most of these activities related to goats, sheep, and household poultry as well as for the sale and processing of most livestock products. Women control at least 80 percent of milk production and virtually all milk wholesale collection and retail trade. Men and women are jointly responsible for

[9] Classes are based on quartile boundaries. Population is derived from UNDP 2014 survey and projected to 2020 based on a 1.79-percent growth rate (World Bank 2020). Boreholes are from the SWALIM Live database (December 2020).

sheep and goats' trade and export, with men typically handling the major livestock trade for export (MoLFR 2019).

Within Somali society, multiple legal systems and sociocultural norms undermine women's capacity and agency (World Bank and FAO 2018). Crop-related responsibilities are shared between men and women, and women provide 60 percent of labor in subsistence farming. However, weak land tenure and limited access to extension services has constrained women's productivity. For example, before the civil war, in the Jubba valley, only 14 percent of women owned farms, and only 28 percent owned any livestock, with women-owned farms generally less productive and least secure, rainfall-dependent dryland plots (NRC, UN-HABITAT, and UNHCR 2008).

Gender roles have been shifting, with an increase in women's engagement in a range of income generating activities as well as in political representation.

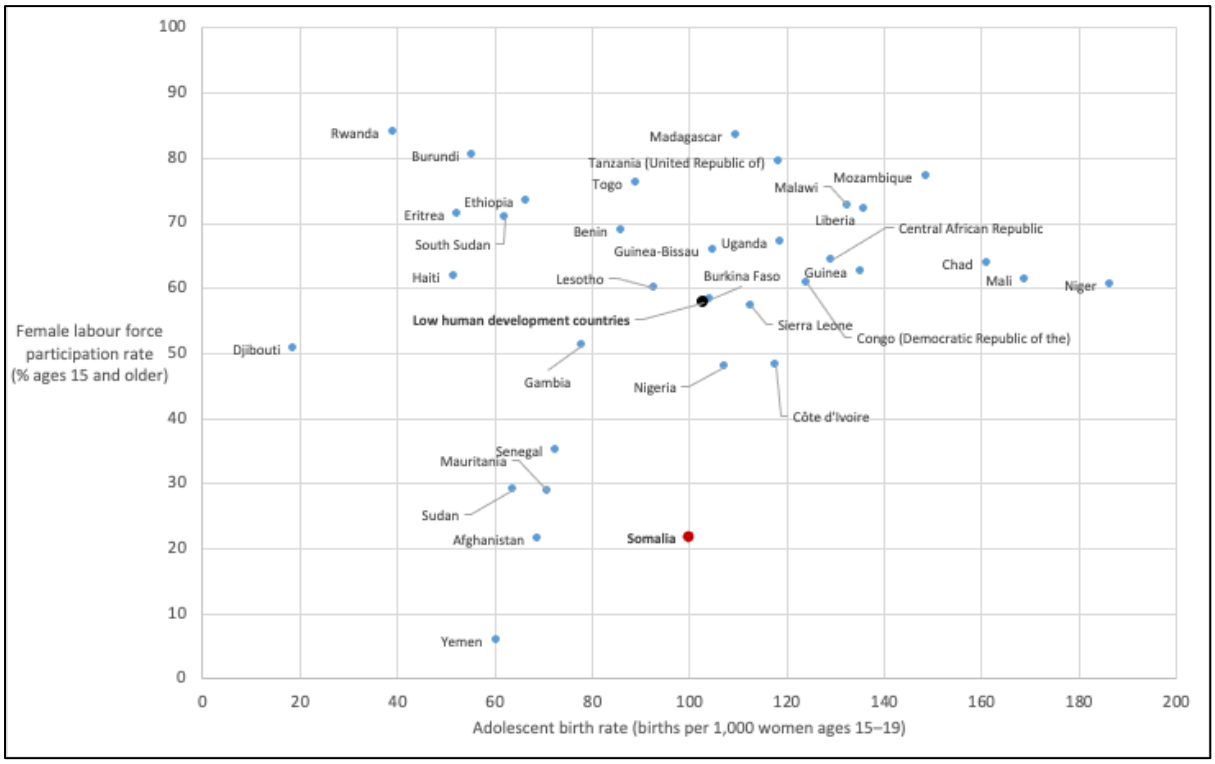
The Gender Inequality Index combines data on reproductive health, empowerment and economic status to measure gender inequalities (HDR 2021). Somalia is one of six out of 195 countries or territories that has not been ranked. The Index lacks data on female secondary education. This echoes the general lack of data on primary education including WASH for Somalia in relation to other countries (Our World in Data 2021).

At a rate of 100 adolescent birth rates per 1,000, the figure for Somalia is close to the mean value for countries classified as having low human development (102.8). However, Somali female labor force participation at 21.8 percent is the third lowest, after Yemen and Afghanistan (Figure 7), whereas Somali male labor force participation is 73.6 percent. A study by McKinsey (2015) found that fully bridging the gender gap in Sub-Saharan Africa could increase 2025 GDP by 27 percent, while bringing it up to the best in the region could raise it by 12 percent. Thus, finding ways of bringing more women into Somalia's labor market is key to growing the economy. According to the MoLFR (2019), there has been an increase in women's engagement in a range of income-generating activates. A key issue, therefore, is how to build on this momentum, in which enhancing female skills and education has a role to play.

All over the world, women's rights and access to opportunities are restricted by such discriminatory social institutions, in other words, formal and informal laws, social norms and practices (Ferant and Kolev 2016). Within Somali society, multiple legal systems and sociocultural norms undermine women's capacity and agency (World Bank and FAO 2018). The MoEWR (2021) states that, in Somalia, perceived gender roles take root early in life and are strengthened by unequal access to education.

The political representation of women in Somalia, at least as measured by their share of seats in parliament at 24.6 percent, is similar to the mean value for countries classified as having low human development of 22.2 percent. However, whilst some laws strive to address gender inequality, many are not passed, not implemented or not enforced or lack what is needed to fully promote the inclusion of women in Somalia (MoEWR 2021). In addition, women are excluded from positions of authority within Xeer, Somalia's customary law. The MoLFR (2019) points to inadequate awareness among politicians, officials, and local elders on the need for gender mainstreaming.

Figure 7. Comparison of Adolescent Birth Rates with Female Labor Force Participation

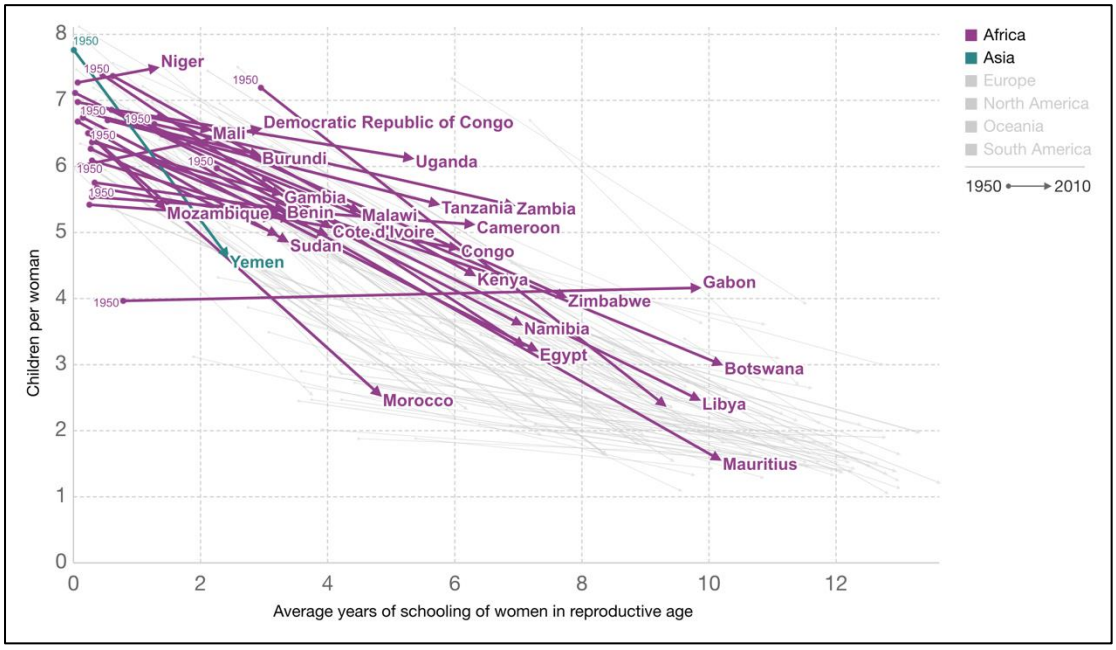


Source: HDR, (2021).

At community level, while one or two spots are reserved for women in village water committees, customary law and cultural norms undermined women's input into management and decision making. As seen in other countries, when the inclusion of women is low, their concerns are not usually taken into account (Khandker et al. 2020), missing out important issues for women such as locating where a source should be constructed. Research in other countries shows that the active participation of women in local water supply management can support mobilizing finance and fee collection and enhance sustainability (Lundqvist 1999; van Wijk-Sijbesma 1998) while if they participate in water user associations it can increase their social standing (Khandker et al. 2020).

Across most of the countries of the world, there is a correlation between the average years of schooling the children per women (Figure 8). It has also been shown the educational attainment of girls has a significant effect on fertility decline, particularly through their early teens, that is, 'lower secondary schooling (Liu and Raftery 2020). Compared with most of the world, birth rates in Somalia over the 70 years since 1950 have remained very high and are currently second only to Niger (Figure 9). While there is a lack of data on the proportion of females with secondary education (noted above), the MoLFR (2019) acknowledges that there is limited technical knowledge and skills as well as limited access to technical higher education by women.

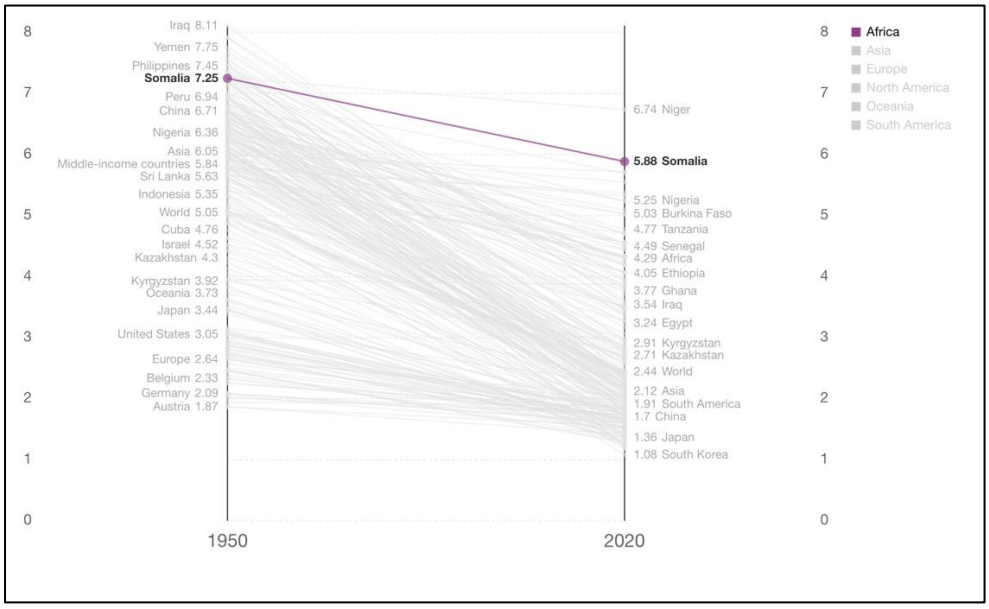
Figure 8. Women's Educational Attainment vs. Number of Children Per Women for Africa and Yemen



Note: Shown on the x-axis is the average number of the years of schooling of women in the reproductive age (15 to 49 years). On the y-axis is shown the 'total fertility rate'—the number of live births per woman in reproductive age.

Source: Our World in Data (2017).

Figure 9. Total Fertility Rate (1950 to 2020)



Source: Our World in Data (2017).

In conclusion, improving access to education for girls, keeping them in school, and bringing them into secondary school education can enhance their opportunities to join the labor market and contribute to economic development, but is also likely to have an impact on Somali fertility rates. The water sector has an extremely important role to play to keep girls in school, by ensuring that suitable WASH facilities

are available, and that menstrual hygiene management is catered for. Given the paucity of information on education including WASH in schools in Somalia, as reflected in international comparisons, as starting point is the collection of this data.

In many countries, women play a critical role in providing water for the family. An analysis in 2015 found that in 53 out 73 countries, in over 50 percent of households using water sources located off-premises, the responsibility to collect water fell on women. A survey in Somaliland found that approximately 60 percent of households relied on adult women to collect water (UNICEF 2011). Women that travel to access water supplies situated away from the residences can risk their personal safety, with gender-based violence high in rural and nomadic areas in the country (MoEWR 2021). Expanding access to improved water sources and, in particular, ensuring that sources are located close to the home will reduce the time that women need to spend on water collection, freeing up their time for other activities and reduce their vulnerably to violence.

1.3 Recommendations

Policies and investments that could improve domestic/multiple-use water supplies in Somalia which take the context into consideration are:

- Developing water investment plans for each major city, as has already been undertaken by the World Bank for seven cities in Somaliland and Puntland.
- Analyzing economic growth potential of, and inequalities in, cities, and defining key urban water infrastructure investment priorities, one per Federal Member State and Somaliland.
- Improving data collection on water access and use, linked to investments which reduce geographic inequalities and improving access to basic water supplies, emphasizing the reduction of the distance and time to collect water, and thus the vulnerability of women and children to violence.
- Making investments in new small water systems/expansion, including innovations (for example, sand dams), coupled with appropriate governance and management arrangements.

2 Definitions—with Global and Regional Perspectives

These definitions are intended to render this report fully accessible for readers with different backgrounds.

Climate change refers to a change in the state of the climate that can be identified (for example, by using statistical tests) by changes in the mean and/or the variability of its properties and which persists for an extended period, typically decades or longer (IPCC 2021).

A **drought** occurs when rains fall below a long-term precipitation average in a given place (FAO 2019). Droughts can have an impact on the susceptibility of soils to erosion (FAO 2015). During a drought, degraded rangelands show a much stronger decline in productivity than nondegraded rangelands (FAO 2015).

A **flood** is the inundation of land surface, and is caused by seasonal accumulation of rainwater, river discharge or tidal phenomenon (FAO n.d.-a). Periodic floods transport massive amounts of sediment and nutrients within catchments (FAO 2015)

A **forest** refers to land with a tree canopy cover of more than 10 percent and an area of more than 0.5 ha. Forests are determined both by the presence of trees and the absence of other predominant land uses (FAO n.d.-b).

Forests, deforestation, and reforestation: The highest annual deforestation rates in the world are in Sub-Saharan Africa (SSA), a result of overexploitation of forest resources and conversion of forested land for agriculture. The highland forests of the Horn of Africa are among those particularly affected (FAO 2007; Hansen et al. 2013). Deforestation is driven by (a) demand for agricultural land; (b) use of wood for fuel, charcoal production, and construction; (c) large-scale timber logging; and (d) population movements and resettlement schemes in forested areas. Cropped land in the SSA has increased by about 40 million ha over the 30 years from 1975–2005, most of it at the expense of forests and woodlands, and further expansion of cropland would be at the expense of forests or rangeland (FAO 2015b).

Internally displaced persons (IDPs) are persons or groups of persons who have been forced or obliged to flee or to leave their homes or places of habitual residence,[10] who have not crossed an internationally recognized state border (UNCHR 2021).

Mangroves are assemblages of salt-tolerant trees and shrubs that grow in the intertidal regions of tropical and subtropical coastlines. They grow luxuriantly in places where freshwater mixes with seawater and where sediment comprises accumulated deposits of mud (FAO n.d.-d).

Pastoralism means that animals are herded some of the time, rather than being constantly penned or left by themselves (Mundy 2020). Pastoralism creates livelihoods in highly variable environments, with mobility harnessing variability in space and time for livestock productivity, dealing with pests and

[10] In particular, as a result of or in order to avoid the effects of armed conflict, situations of generalized violence, violations of human rights or natural or human-made disasters.

diseases and avoiding conflicts (Krätli 2019; Bayer 2020). Pastoralists raise livestock[11] or semi-domesticated animals on rangelands, and can be ranchers, nomads, and transhumant herders (IYRP 2019). They produce food in the world's harshest environments (FAO 2020f) and are fundamental to global food production, support value chains and farming systems, generate tax revenue and foreign exchange, and provide environmental services (Krätli 2019; Manzano et al. in press).

As a cultural identity, ethnic pastoralists are people who come from ethnic groups that "*traditionally practiced pastoralism but do not themselves derive their livelihoods from grazing livestock, but still regard themselves as pastoralists*" (Bayer 2020).

Rangelands are lands on which indigenous vegetation is predominantly grasses, grass-like plants, forbs[12] or shrubs, and which are used as a natural ecosystem for raising grazing livestock and wildlife (IYRP 2019). By definition, rangelands may have poor water supply, poor soil quality, extreme temperatures, steep slopes, and remoteness (Jenet et al. 2016). High grazing pressures lead to changes in species composition, which may reduce drought resilience (Hein and De Ridder 2006).

Rainfed and irrigated agriculture: Generally, crop production is either rainfed or irrigated (Box 1) "*Rainfed production dominates agriculture, covering about 80 percent of total cropland and accounting for more than half of the world's food production*" (FAO 2020e). "*Irrigated agriculture occupies about 20 percent of total cropland but generates more than 40 percent of total production in terms of value*" (FAO 2020a). Irrigated areas are more productive than rainfed agriculture due to higher and more stable yields, more intensive cropping and the cultivation of high-value crops (FAO 2020a). Globally, about 10 percent (128 million hectares) of rainfed cropland experiences high to very high drought frequency, and over 60 percent of irrigated cropland is under high water stress (FAO 2020a; FAO 2020e). There has been a focus of attention on irrigation, with limited investment or innovation in rainfed areas (FAO 2020e).

Box 1. Rainfed and Irrigated Agriculture, and Water

Increased yields in rainfed agriculture can be achieved through (a) water harvesting—collecting or harvesting more water and infiltrating it into the root zone; and (b) soil and water conserving techniques that increase plant uptake capacity and/or reduce root-zone evaporation and drainage losses (FAO 2020e). Increased use of fertilizer and improved seeds, alongside improved crop management practices, can also contribute (FAO 2020e).

The three main irrigation methods are surface or gravity irrigation; sprinkler or spray irrigation; and drip or microirrigation. Irrigation enables control of water volumes and timings that is impossible in rainfed farming, but irrigated agriculture is contributing to, and also affected by, pressure on freshwater resources. Given that over 60 percent of irrigated cropland is under high water stress, there is a need to improve water productivity by increasing crop yields and/or reducing evapotranspiration, including increasing water-use efficiency, as well as ensuring that withdrawals are sustainable (FAO 2020a).

Water harvesting can negatively affect water-related ecosystems, impacting on those who depend on them (FAO 2020e). Investments in irrigation can affect water availability downstream, including

[11] Livestock varies with context, and can include cows, buffalos, yaks, llamas, sheep, camels, goats, reindeer, horses or donkeys.

[12] A forb is a herbaceous flowering plant that is not a graminoid (grass, sedge or rush).

inland fisheries (FAO 2020a). Holistic approaches are needed to mitigate negative environmental impacts of improving rainfed and irrigated agriculture (FAO 2020a). Investment decisions should be informed by detailed water accounting and auditing[13] to assess available water resources and their use and ensure good governance (FAO 2020e).

Soil, land, and degradation: Healthy soils are essential to secure food and fiber production, with their ecosystem services integral to the carbon and water cycles. Soil degradation[14] is the decline in soil quality caused by improper use by humans, usually for agricultural, pastoral, industrial or urban purposes. The most critical threats to soils and their related ecosystem in the SSA are soil erosion, loss of soil organic matter, and soil nutrient depletion (UNEP 2013), as well as the loss of soil biodiversity. Soil degradation (Box 2) is a root cause of declining agricultural productivity in the SSA, increasing food insecurity, negatively impacting economies, and affecting the welfare of rural households that depend on agriculture (Lal 1990; UNEP 1982; FAO 1999).

More than 20 percent of the agricultural land and pasture in the SSA has been irreversibly degraded, mainly by soil erosion (UNSO/SEED/BDP 1999). Land degradation also leads to a release of carbon into the atmosphere[15] through oxidation of soil organic matter (FAO 2015). There is need for interventions to arrest and reverse soil degradation in the SSA: "*Rehabilitation of degraded land and conservation of those not yet degraded is the most desirable step for every country in the region*"[16] (FAO 2015).

Box 2. A Brief Explanation of Soil Degradation and Loss of Soil Organic Matter

The most widespread causes of soil degradation are water erosion, followed by wind erosion, chemical degradation (nutrient loss and salinization), and physical degradation. Overgrazing, agricultural activities, deforestation, and overexploitation can all result in soil degradation (Oldeman, Hakkeling, and Sombroek 1991). Loss of vegetative cover and decline in soil organic matter causes soil degradation.

Soil organic matter stabilizes soil and prevents physical, chemical, and biological deterioration and maintains a balance between soils and growing plants (FAO 2015). A decrease of organic matter in topsoil can also dramatically affect the water holding capacity of soil, alter its structure stability and compactness, nutrient storage and supply, and affect biological components (Sombroek, Nachtergaele and Hebe, 1993).

[13] Water accounting involves the systematic study of the hydrological cycle and the status and trends in water supply, demand, accessibility, and use. Water auditing places these data in the broader context of governance, institutions, public and private expenditure, legislation, and the wider political economy (FAO 2020f). Together, information from water accounting and water auditing can be used in stakeholder dialogue and consensus-building, and to inform changes in governance (FAO 2020f).

[14] Soil degradation encompasses physical, chemical, and biological deterioration and may be exacerbated by climate change.

[15] "*…it has been suggested that this process could be reversed and that the soil could be used to capture and store carbon*" (FAO 2015).

[16] This requires that the "*characteristics of the soil resources are well defined and quantified and soil monitoring systems established*" (FAO 2015).

Monoculture cereal production, intensive tillage, short to no fallow and reduction or absence of crop rotation systems are the main causes of soil organic matter decline, with long-term effects of these practices now experienced across Sub-Saharan Africa (FAO 2015).[17]

Socioeconomic pressures to increase production and incomes incentivize farmers to reduce the length of fallow periods, cultivate continuously, overgraze fields, or remove biomass for fuel, animal fodder and building materials, not only results in the reduction of soil organic matter, water holding capacity and nutrients but also increases vulnerability to erosion (Lal 2004).

Urban can be referred to in terms of labels such as “major cities”, “municipalities” or “administrative centers”, or using a quantitative threshold (for example, populations over 200 people (Iceland) and 10,000 people (Italy and Benin) (Danert and Flowers 2012).

Water security is the availability of an acceptable quantity and quality of water for health, livelihoods, ecosystems, and production, coupled with an acceptable level of water-related risks to people, environments, and economies (MoEWR 2021).

Wetlands are areas with free water at or on the surface for at least the major part of the growing season. The water is sufficiently shallow to allow the growth of a wetland crop or of natural vegetation rooted in the soil (FAO n.d.-c).

Water demand: Growing demand is creating competition between sectors and individuals as well as exacerbating inequalities and threatening water-related ecosystems and their services (FAO 2020f). Globally, almost three-quarters of freshwater withdrawals are for irrigation, livestock, and aquaculture. There is an urgent need to reconcile water for food production with environmental flows (FAO 2020f). Further, surface water, groundwater, and soil moisture are critically linked and cannot be compartmentalized (FAO 2020f).

[17] “*The SSA experience is not unique. Across the globe, the carbon balance of terrestrial ecosystems is being changed markedly by … human activities. Land use change was responsible for 20 percent of global anthropogenic CO_2 emissions during the 1990s (IPCC, 2007)*” (FAO, 2015).

3 Rural Economy I: Pastoralists and Livestock

3.1 Rangelands

More than 80 percent of Somalia's land mass comprises arid and semi-arid lands (ASALs), which are prone to extreme weather conditions, including periods of extended drought, highly erratic rainfall, and strong winds (UNPFA 2016). In 2014, 53 percent of Somalia was classified as rangeland (SWALIM 2014, in MoLFR 2019).

Many interconnected factors strain rangelands, including competition over land and water resources for agricultural production (MoLFR 2019). Strains on rangelands and water, particularly in northern, central, and Southern Somalia are attributed to a large livestock population compared to historical levels. However, by the mid-1980s, it was estimated that as much as half of Somalia's northern rangelands were already degraded (World Bank 1987). Somalia has also witnessed increasing desertification, which the World Bank (2017b) attributes to recurring low rainfall and deforestation for charcoal production. Vulnerable livestock keepers resort to charcoal production to meet their needs, causing further degradation of rangelands (MoLFR 2019).

The livestock sector is constrained by "*Lack of access to good quality pasture, due to land degradation and reduction of productive land, which is in turn the result of deforestation, soil erosion, invasion of unpalatable plant species, spread of private enclosures, and increasingly frequent recurrence of natural shocks such as drought and floods*" (MoLFR 2019).

Improving natural rangelands resources is critical to sustaining the production and productivity of livestock. World Bank and FAO (2018) state that traditional and formal rangeland governance has broken down and become scattered, with different clan-based groups taking responsibility for managing rangelands under their control. Effective rangeland management is the bedrock for the future of pastoralism and the livestock sector in Somalia. Going forward, there is also a need to clarify land tenure arrangements; reach consensus over policies and their implementation with local communities; improve communities' capacity to manage their natural resources sustainably and support rangeland rehabilitation intensified soil and water conservation, reforestation and afforestation, and reseeding.

Somaliland and Puntland are engaged in initiatives to address widespread communal rangelands degradation, including investments at grassroots levels in establishing and upgrading community-managed rangelands reserves. However, the impact and sustainability of these initiatives needs to be assessed to inform strategies for upscaling.

3.2 Mobility, Nomadism, and Agro-Pastoralism

In many parts of the world, mobility has been largely regarded as a sign of *lack* of progress rather than a practice that is actually *well-adapted* to marginal environments. Mobility allows pastoralists to thrive. Pastoralism is underrecognized and undervalued (Johnsen et al. 2019), and largely misunderstood, with pastoralists traditionally suffering from marginalization and exclusion from dialogue (FAO 2020b, Axweso 2011). Pastoralists have been deeply affected by the fact that sedentary societies, with poor understanding of their livelihood systems, have imposed alien social and governance schemes including attempts to sedentarism, as well as putting up hurdles to mobility or access to public

services (FAO 2020b). As with other marginalized groups, the voices of pastoralists have been insufficiently heard at all levels.[18]

Home of an agro-pastoral family, in Jariban District, Puntland. *(Photo courtesy: Chantal Richey)*

Low rainfall in Somalia makes much of the country suitable for nomadic herding only (Kolmannskog 2009; UNCCC 2013). Broadly speaking, nomadic pastoralism takes place primarily in the arid zones, with agro-pastoralism in the semi-arid zones and irrigated crop cultivation in the humid zones (MoLFR 2019). In addition, "*on much of Somali's Indian Ocean coastline, inshore fishing ceases entirely during the months of the strongest southwest monsoon winds, when many coastal communities return to pastoralism*" (MoPIED 2020).

Pure pastoralists are mostly nomadic, poor, and are found throughout all rural areas of Somalia (MoPIED 2020). They live predominantly in the arid rangelands of northern and central Somalia and along the borders with Ethiopia and Kenya in the south.

Agro-pastoralists depend on both settled crop production and livestock-rearing, whereas most riverine crop growers keep no livestock (MoPIED, 2020). In 2014, it was estimated that almost 26 percent of the Somali population of 12.3 million followed a nomadic way of life,[19] with another 22.8 percent living in rural[20] areas, and an estimated 9 percent residing in IDP settlements, displaced by conflict and natural disasters[21] (UNPFA 2014).

Traditionally, Somali pastoralists have followed seasonal patterns in search of pastures and water for their animals (IOM 2014), involving caravans of nomadic communities moving across regions and districts with their animals. Traditional and once well-respected natural resource management included high mobility on grazing areas, including communal drought-time grazing reserves. Pastoralists enjoyed and enforced their right to graze in their traditional areas of influence, but rangeland pastures were never privately owned. In the case of a localized drought emergency, livestock were customarily allowed to move to better pastures, even if they were controlled by others. Such customary courtesies, reciprocated by clans in different areas, were an important coping mechanism for livestock to survive

[18] To recognize how rangelands and pastoralists contribute to culture, economy, and environmental health, the FAO has endorsed a proposal for 2026 to be the International Year of Rangelands and Pastoralists.

[19] The nomadic population is essentially a rural population but treated in a separate subgroup because of its size and uniqueness (UNPFA 2014).

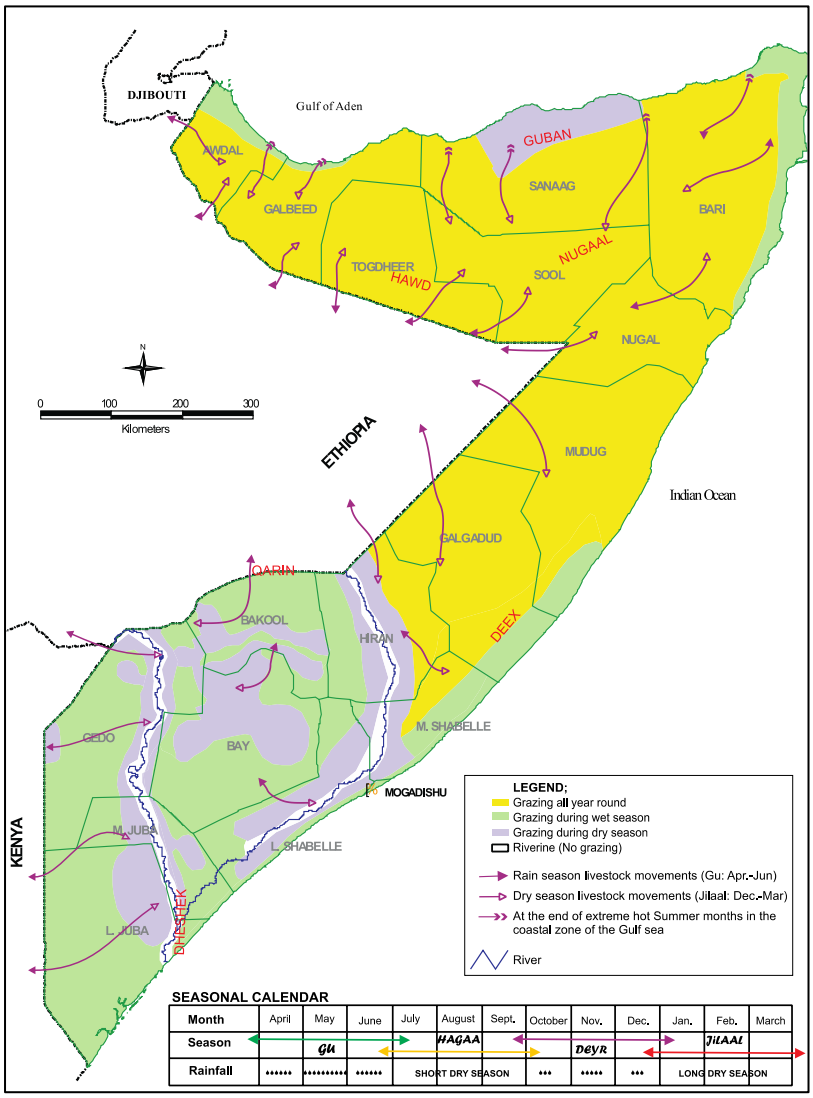
[20] Note that in Somalia, urban areas include all administrative districts and regional headquarters regardless of population size and availability of basic common amenities associated with urban areas in other countries.

[21] As of July 2020, it was estimated that there were 560,000 (in Puntland), 590,000 (in Somaliland), and 1.5 million (in South Central Somalia) displaced persons (UNHCR 2020).

even extended but localized periods of drought; only on rare occasions did such movements result in clan warfare (World Bank 2018). The Golis Mountains, other hilly areas, and riverine woodlands are examples that allow pastoralists to manage risk during the dry season and periods of drought (IUCN 2006).

As indicated in Figure 10, during seasons of drought, pastoralist families move to the less-affected areas in search of greener pastures for their livestock (UNCCC 2013), with some pastoralists crossing national borders in and out of Kenya and Ethiopia. These practices appear to be changing, threatening the optimization of climate variability that has been central to pastoralism for generations and potentially placing rangelands under more stress (Box 3).

Figure 10. Seasonal Migration of Livestock



Source: FSNAU (n.d.).

Box 3. Optimization of Climate Variability by Pastoralists in Somalia under Threat

"*In low rainfall areas (below 400 mm), rangelands are dominated by annual grasses and herbs, which "bloom" after rains and provide critical wet-season grazing for livestock. As rainfall is unevenly distributed spatially and temporally, pastoralists move to make optimal use of the range, which can be very productive until the grasses and herbs set seed and die. At that point, herds move to dry-season grazing areas, where perennial grasses grow in areas that get more than 400 mm of rain a year, most of them open wood and bush lands. Allowing grasses and herbs to set seed and not overgrazing them beyond their regenerative ability are critical to the sustainability of such ecosystems*" (World Bank and FAO 2018).

Unfortunately, *"… loss of rangeland has played havoc with traditional pastoral movements between dry and wet season grazing areas, putting pastoralism under increasing stress [and] … communal grazing land has been lost to private enclosures, and private berkads have been constructed*" (World Bank 2017b).

In northern and central Somalia, "*pastoral mobility is now practiced on increasingly degraded rangelands that are extremely sensitive to drought. Permanent grasses on once-safe dry season grazing areas are often replaced by seasonal (annual) grasses also affected by seasonal droughts*" (World Bank and FAO 2018).

Nomadic lifestyles differ—in 2014, 92.8 percent of the nomadic population moved predominantly within the same district, with over a third staying in the place where they usually live during the rainy season for four to six months per year, and almost 40 percent remaining in the same place for seven to 12 months (UNPFA, 2016).

Nomadic communities are now also using water trucks to provide water for their animals (UNFPA 2016). *"In recent years, livestock survival during annual or seasonal severe droughts has become dependent on very costly and often unaffordable water transported by privately owned water tankers"* while widespread degradation has been found, especially near water holes and wells (World Bank and FAO 2018).

The uncontrolled expansion of enclosures on previously open rangeland is also causing strain. In some parts of northern Somalia, *"some rangeland areas are being increasingly enclosed illegally, against the traditional practices, in order to grow fodder"* (MoLFR 2019). This issue has become increasingly contentious, especially in Somaliland, where it is being described by authorities and elders as a new and very serious source of conflict and insecurity (World Bank and FAO 2018).

3.3 People

3.3.1 Poverty, Wealth, Vulnerability and Marginalization

Internally displaced persons (IDPs) and the rural population (agro-pastoralists and nomads) have the highest rates of monetary poverty in Somalia. The 9th National Development Plan (NDP) states that rural Somalis are consistently among the most vulnerable groups in the country. Rural agro-pastoralist and IDP settlements experience a significantly higher incidence of food consumption poverty (close to 60 percent in both cases), compared to the national average (World Bank 2019a).

In 2018, pure pastoralists suffered from a poverty incidence at 71.6 percent (World Bank 2019a). IDPs and agro-pastoral populations have lower literacy rates (57 percent and 45 percent respectively),

while nomadic pastoralists have the lowest literacy rate (16 percent). Pastoralist households are least well served by health centers or clinics. A 100 percent of households among the nomadic pastoralist population and 92 percent or rural agro-pastoralists experience poverty of two or more deprivations.

Poverty is prevalent in the pastoral/agro-pastoral, highland perennial, and forest-based farming systems which constitute one-third of the total SSA production systems (FAO and World Bank 2001), and thus this problem is by no means unique to Somalia.

All nomadic households own some type of livestock, and nomadic households own a larger number of livestock than nonnomadic households. However, a primary reliance on livestock for livelihood does increase vulnerability to water and environment-related shocks. "*For pastoralists, loss of animals is closely related to destitution and marginalization from community life"* (MoLFR 2019).

When shocks occur, an absence of provisions for safeguarding pastoral capital stock, or any alternatives such as insurance, results in economic insecurity and deprivation, and increases the risk of wider violence and social breakdown. Further, political and socioeconomic marginalization of pastoralist communities and policies that neglect or undermine traditional governance and arbitration mechanisms have, over time, weakened resource management and conflict resolution capacities among rural communities (MoLFR, 2019).

Exclusion is a major problem for pastoralists, not only in Somalia. "*Formal financial institutions in many … countries mostly exclude pastoralists from their services due to pastoralists' inability to pledge collateral, and livestock insurance is not available at all. Furthermore, traditionally women in pastoral and agro-pastoral communities have faced even greater barriers than men in accessing finance*" (MoLFR, 2019).

Remittances provide a crucial safety net for many Somalis, but there is variation in their frequency and who receives them, with rural-based and pastoralist households making up the largest category of households that receive remittances on an occasional basis rather than regularly. Further, those "*who do not benefit from remittances are disproportionately found in the south, where there is a larger rural population, and where structurally marginalized and ethnic-minority populations are more numerous"*[22] (Majid et aI. 2018).

Wealthier households in pastoral areas of the Horn of Africa increasingly own larger number of animals to the detriment of poorer households, and are also more actively engaged in livestock commercialization. Promoting commercialization can contribute to gradual distribution of livestock from poorer to wealthier households, which, over time, can make it more difficult for poor pastoralists to build herds (Catley 2017). A pro-poor approach to pastoral development is thus necessary, which goes beyond promoting only livestock commercialization and considers preventing avoidable losses and better drought management, enabling poor herders to rebuild and expand their herds (MoLFR 2019).

[22] Populations in the south, and ethnic-minority populations, in particular, may be suitable for targeted investments to address inequalities.

3.3.2 Cooperation, Disputes, and Conflicts

Traditionally, communities have collectively used and shared rangelands and forests. Grazing disputes, leading to fighting between neighboring pastoral clans, have become more common throughout Somalia, including at the Ethiopia and Kenya borders. "*A study in three pastoral districts of Gedo region (Dollow, Luuq, and BeletHawa) documents the rise in communal conflicts, including livestock thefts and violent clashes between clans, as a result of intensified competition over the use of shared resources, such as water, pasture lands, and humanitarian aid*" (FAO 2016).

In general, clashes involving rival clan militias that start from communal disputes remain the single most common form of armed conflicts in Somalia, comprising about 35–40 percent of total security occurrence per month (MoLFR 2019). These conflicts are often resolved by local clan elders and religious leaders, with local district or regional authorities intervening only in the case of major interclan fighting (World Bank and FAO 2018). Mediation by elders and religious leaders is very important (World Bank and FAO 2018).

Conflict over access to natural resources occurs in Somalia and undermines human and economic development. "*Localized conflicts between farmers and herders, and between different pastoralist groups, frequently revolve around issues of contested land use, grazing rights, and insecure access to water and pasture… Expansion … of private enclosures on traditionally open communal rangelands, especially along livestock migration routes, … jeopardizes the mobility of pastoralist communities, … weakening their capacity to cope with adverse climate conditions. Existing tensions and conflict risks are amplified during extended dry periods, when pastoralist livelihoods become particularly precarious*" (World Bank 2019b). There is no simple solution, but natural resource conflict is an issue of immense strategic importance for the country.

According to a study commissioned by the United Nations in Somalia, in Al-Shabaab-controlled areas, harsh rule has affected rural, including pastoral, communities by threatening lives, confiscating assets, performing abductions, forcing marriages, and instilling a culture of fear and mistrust as well as undermining community participation in peace initiatives (UNSOM n.d.).

3.3.3 Economics, Employment, and Development Priorities

In contrast to the crop sector, where production has fallen to an estimated half of its pre-war peak, the livestock sector in Somalia has experienced growth, including impressive export growth right through to the mid-2010s. Not all livestock exported from Somalia originates in the country, as livestock from Ethiopia and Kenya also transit through the country, but official figures on cross-border trade are unreliable (World Bank and FAO 2018). Somalia is also an importer of live animals and livestock products on a very small scale (MoPIED 2020).

The livestock sector has proved to be resilient, despite social unrest and recurrent droughts (MoLFR 2019). Substantial investments into infrastructure and service quality improvements by the diaspora, foreign private companies, and donor-funded programs have all contributed to this growth, although performance dropped after 2016 due to the 2016/17 drought and a livestock import ban from overseas (MoLFR 2019).[23] Disruptions in exports effects on the food security of pastoral households as they rely

[23] "*Livestock exports have been periodically interrupted by bans imposed by importing countries, mainly on the grounds of livestock disease*" (FAO et al. 2004), including a livestock import ban by Saudi Arabia in 2020 due to COVID-19 (Yussuf 2020).

on animal sales to access food markets and also use the cash to buy imported foodstuffs (MoLFR 2019).

Contribution of livestock to Somalia's gross domestic product (GDP) is speculative, due the lack of reliable and consistent estimates for production, farmgate prices, and input use (MoLFR 2019). In 2017, the livestock sector was estimated to account for 43 percent of GDP, with livestock exports accounting for 75 percent of total exports (MoPIED 2020). In addition to the more formal northern trading routes through the ports of Berbera and Bosaso, there is also formal and informal southern cross-border trade, as well as along the length of the entire country. This trade is largely unrecorded but believed to be substantial (MoLFR 2019).

It is estimated that about 46 percent of employed persons work in agriculture, with about 25 percent in agro-pastoral activities, 9 percent in nomadic herding, 4 percent in fishing, and 7 percent in other rural activities (ILO 2015). Private sector employment includes livestock product marketing (ILO 2015). The vast majority of Somalia's population depends on livestock and its products for employment, as well as food and nutrition security (MoPIED 2020). *"Job-creation, especially for youth, is fundamental to sustainable poverty reduction, vulnerability mitigation, and conflict avoidance"* in Somalia (MoLFR 2019). FAO (2013) estimates that more than 65 percent of the Somali population engages in some way in the livestock sector. Development of this sector has potential to create more jobs.

The Livestock Sector Development Strategy (LSDS) considers failure to develop the country's livestock sector as a major constraint to economic growth and recovery (MoLFR 2019). The development and growth of the sector is constrained by degradation and deforestation of rangelands, shortage of feed and fodder, water shortages, poor breeding, weak veterinary services, animal diseases, and institutional capacity constraints (MoPIED 2020). Somalia's LSDS sets out to:

- Strengthen climate resilience and increase incomes from livestock products.
- Enhance nutrition and food security via an expanded supply of high-quality and hygienic animal proteins.
- Fuel stronger economic growth in livestock production and expanded value-adding processing.

Three of the six operational goals of the LSDS are related specifically to water:

- Preserve animal resources—rehabilitation of rangelands, increasing resilience to climate change by easing chronic water shortages.
- Hygienic livestock products.
- Increased processing of livestock (MoLFR 2019).

The NDP9 emphasizes the need for diversification within agriculture, livestock, and fisheries (MoPIED 2020).

3.4 Livestock

3.4.1 Livestock Development

Information on the sector's structure and economic performance is limited, with insufficient knowledge and data on animal populations, offtake rates, incidence of diseases, and domestic consumption, among others. Bearing in mind that figures may be unreliable, the 2018 livestock population was estimated to be 56 million heads, compared to 40 million in the 1980s (MoLFR 2019). Trade bans, effectively reducing offtakes, may have contributed to this increase (MoLFR 2019). Appendix 1 provides estimates of livestock populations for each region.

"*While well adapted to the harsh geographical and climatic environment, Somali sheep and goats (shoats), camels and cattle are characterized by poor weights and milk yields, largely as a result of young animals with larger frames and body weights being selected for slaughter or live export rather than breeding*" (MoPIED 2020). There is potential to improve the quality and resilience of Somali livestock, and its offtake, without increases in the animal population, which is important given the limited carrying capacity of the degraded rangelands and broader environmental challenges (MoPIED 2020). "*In early 2017, at the peak of the drought, milk yields were cut by more than half for camels and up to two-thirds for cows and goats*" (World Bank and FAO 2018). In the future, data on milk yields (Table 2) could provide useful information for benchmarking livestock productivity.

Livestock in Somalia are the major repository of individual and national wealth (MoLFR 2019). According to FAO (2021) data, Somalia has the second largest camel population in the world after Chad (Table 3).

Table 2. Milk Productivity Per Animal (Liters Per Day)

Animal	Somalia[24]			Ethiopia[25]		
	Wet Season	Dry Season	Seasonal Drop	Wet Season	Dry Season	Seasonal Drop
Cow	4.1	2.4	40%			
Camel	3	2.1	30%	8.6	5.8	33%

For the past decade, most external assistance for the livestock sector was in Somaliland and Puntland with only one recognized project covering South Somalia (MoPIED 2020). Project-based approaches emphasized animal health or market linkages, and did not tend to address environmental issues such as degradation and deterioration of pastures and rangelands (MoPIED 2020). Similarly, few projects (and none in South Somalia) focused on rehabilitating watering facilities or fostering commercial feed supplies and markets.[26] The aggregation of a large number of livestock in common grazing areas, watering points, markets and along trading routes, as well as shared grazing on rangelands with wildlife, also contribute to a high likelihood of disease transmission.[27] Good practices from other countries with similarly high populations could contribute to learning in Somalia.

[24] USAID (2017).

[25] Wako (2015).

[26] This presents a potential investment opportunity.

[27] Rift Valley Fever is enzootic throughout Sub-Saharan Africa and Madagascar and reached the Arabian Peninsula in 2000. Permanent irrigation in the western coastal zones of Yemen and Saudi Arabia will contribute to the risk of the disease becoming endemic in these areas (FAO et al. 2004).

Table 3. Top 12 Countries in Terms of 2019 Estimated Camel Population

Country	2015	2019
Chad	6,413,521	8,276,416
Somalia	7,214,325	7,243,792
Sudan	4,809,000	4,895,000
Kenya	3,059,840	4,721,900
Niger	1,742,548	1,834,943
Mauritania	1,418,000	1,500,973
Ethiopia	1,228,023	1,281,468
Mali	998,558	1,241,093
Pakistan	1,035,000	1,090,000
Saudi Arabia	476,398	492,853
Mongolia	367,994	472,379
United Arab Emirates	430,372	461,788

Source: FAO (2021).[28]

In addition to pastoralism and agro-pastoralism, smaller peri-urban dairy farming exists, relying on purchased supplements and grain and crop by-products as fodder (MoLFR 2019). *"Commercial livestock-rearing operations with dairy animals (mostly camels) have been on the rise in peri-urban settings, ranging from small to very large (3,500 animals for a camel dairy farm in Benadir), supplying nearby urban markets with fresh raw milk*" (MoLFR 2019). However, the potential negative environmental impacts of intensive zero-grazing or semi-intensified milk production systems need to be better understood, with strategies developed to mitigate impacts. According to USAID (2017), a high concentration of dairy animals (about 12,000 to 15,000), kept on what have effectively become permanent pastures is causing gradual environmental degradation in the area. Poultry and honey production are small, but provide alternative and/or complementary sources of livelihood to some (smaller) population groups, with poultry keeping widespread among poor households (MoLFR 2019).

3.4.2 Livestock Value Chains

Most livestock exports from Somalia are of live animals, with only very limited exports of meat and hides and skins (MoLFR 2019). The poultry and beekeeping sectors are primarily backyard with commercial intensive limited to the main urban centers. Figures 11, 13, and 14 set out the value chains for live animals and meat, dairy, and hides and skins, respectively. These already provide employment opportunities, including for women and youth [29]but this could be enhanced further, particularly by adding value to, and processing livestock inputs and outputs (MoLFR 2019). An increase in processing, storage, and consumption of readily available by-productsof meat production, such as offal, would also provide additional cheap sources of protein for domestic consumers (MoLFR 2019). Improved hygiene and a lack of cooling of camel milk, provides an example of how significant losses in market value could be reduced (Younan, Gure, and Schulze 2013).

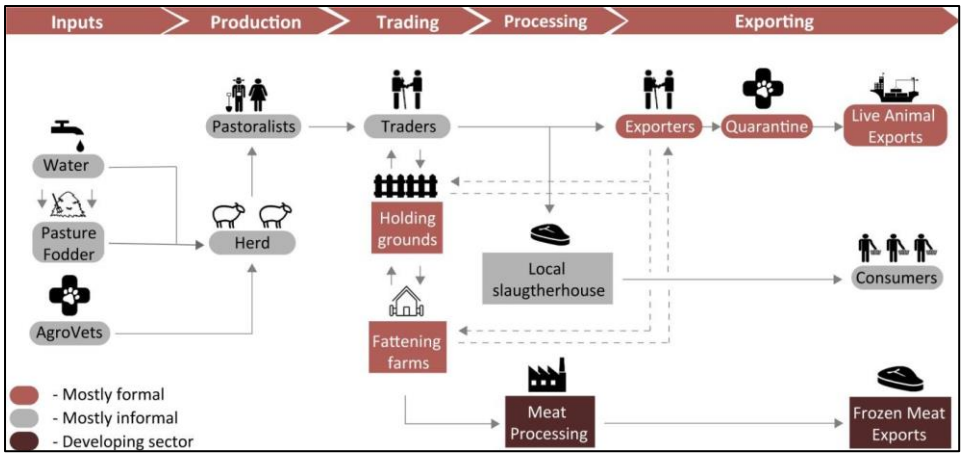
[28] Query—Live Animals—on January 20, 2021.

[29] As small- and large-scale traders, brokers, as well as trekkers, feedlot operators, lorry drivers, loaders and ancillary services.

Live Animals and Meat

Currently, pastoralists sell their animals at primary town markets to local butchers operating in local slaughterhouses/slabs or to wholesale traders, who bring them to larger urban markets for resale. Informal slaughtering of shoats by individuals in their backyards and larger animals by private butchers in poorly designed, open, unhygienic slaughter facilities lacking drainage systems is the norm (MoLFR 2019). Enforcement of sanitary regulations and/or meat inspection services does not take place (MoLFR 2019).

Figure 11. Live Animal Exports and Meat Value Chain in Somalia



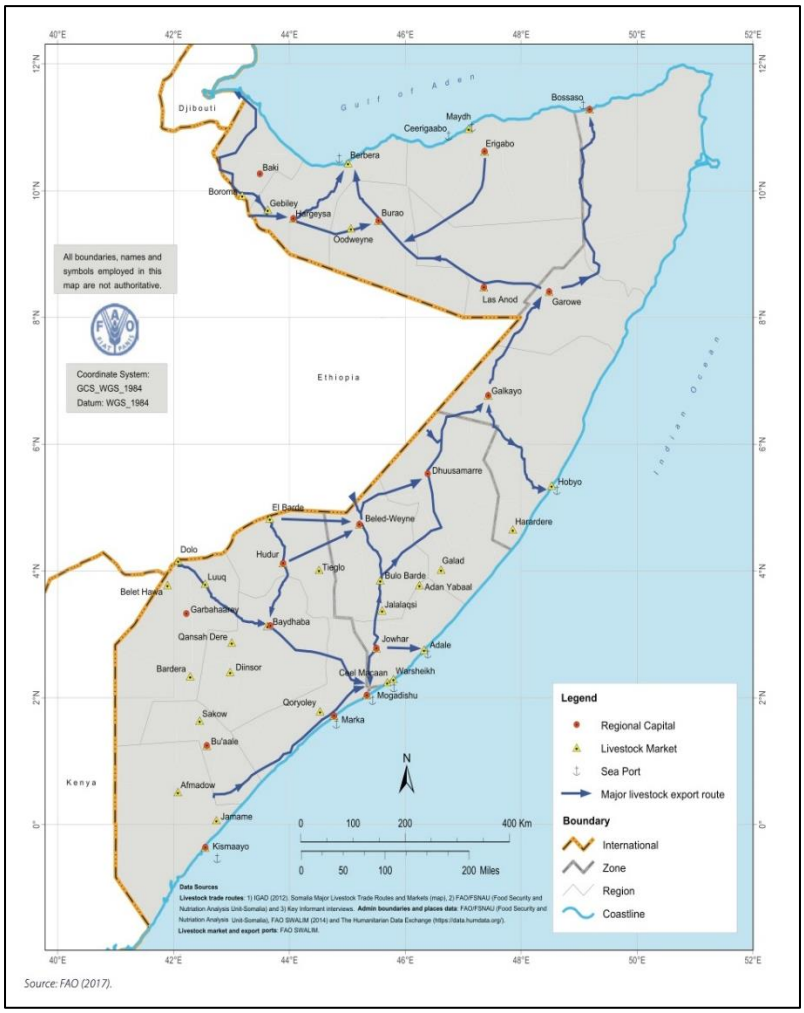
Source: MoLFR (2019).

There are also animal welfare issues, primarily due to inadequate facilities and services in rural areas and along transit routes (Figure 12) in the form of sanitation, nutrition, water, and veterinary care. There is also a lack of adequate facilities for animals to rest and recuperate, before export or domestic trade in large urban centers (MoLFR 2019).

Chilled meat export over the last two decades has largely failed, with exporters facing stiff competition on weight, sanitary standards, and price from exporters in other developed or emerging economies (MoLFR 2019). Currently, commercial meat processing is limited to small quantities exported by one company in Mogadishu,[30] plus two companies in Hargeisa and Galkayo that serve local markets (MoLFR 2019). Slaughterhouse effluent from the Mogadishu plant is brought to a large purpose-built reservoir far from the slaughterhouse; the Hargeisa factory has a livestock holding ground (MoLFR 2019). The LSDS calls for further analysis of meat exports prospects including quality perceptions, competitiveness, and food safety issues of Somali meat, vis-à-vis other countries such as Pakistan (MoLFR 2019).

[30] Export of whole beef chilled carcasses by air in cool crates; frozen carcasses sea in refrigerated containers.

Figure 12. Main Livestock Trade Routes in Somalia



Source: World Bank and FAO (2017).

Dairy

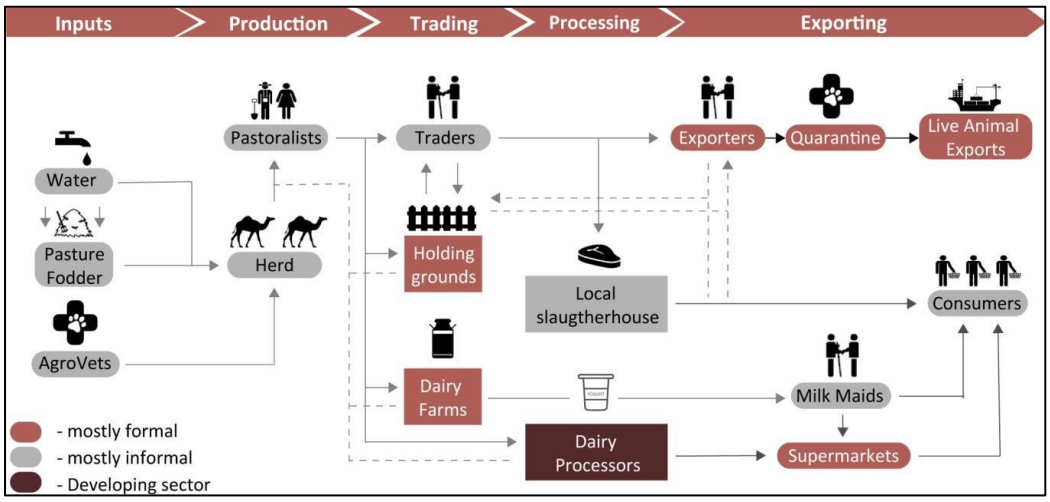
Dairy imports, of which 90 percent are for long-life processed milk and milk powder, may be a missed opportunity for import substitution (MoLFR 2019). Although some studies question the demand for processed milk,[31] there are also views that demand is growing and that there is scope for a viable commercial dairy industry.

"*Pastoral dairy production is one of the most valuable goods for both rural and urban populations …[for]… household consumption and commercialization [and a] key source of income and employment generation for women and youth"* (MoLFR 2019). Alas, *"over-dependence on degraded pastures leaves the agro-pastoral and pastoral milk producers struggling to maintain current low milk production levels"* (MoLFR 2019) as shown by comparing Somalia's and Ethiopia's milk yields (Table 2). Further, the high entry costs for the peri-urban dairy business prevent pastoral herders from entering. Businesses tend

[31] The dairy trade is informal and, according to Oxfam (2018) and FAO (2019), consumers prefer to buy unpackaged fresh milk and are unwilling or unable to pay the extra costs of formal processing and packaging, making their purchase decisions largely on price. Value addition for milk may not generate returns as the market for processed milk products is a small niche segment, and most buyers are unwilling or unable to pay for processing.

to be in the hands of city businessmen owning other ventures. The dairy subsector thus does not seem to benefit lower socioeconomic and poverty profile groups, including pastoralists (MoLFR 2019).

Figure 13. Milk Value Chain in Somalia



Source: MoLFR (2019).

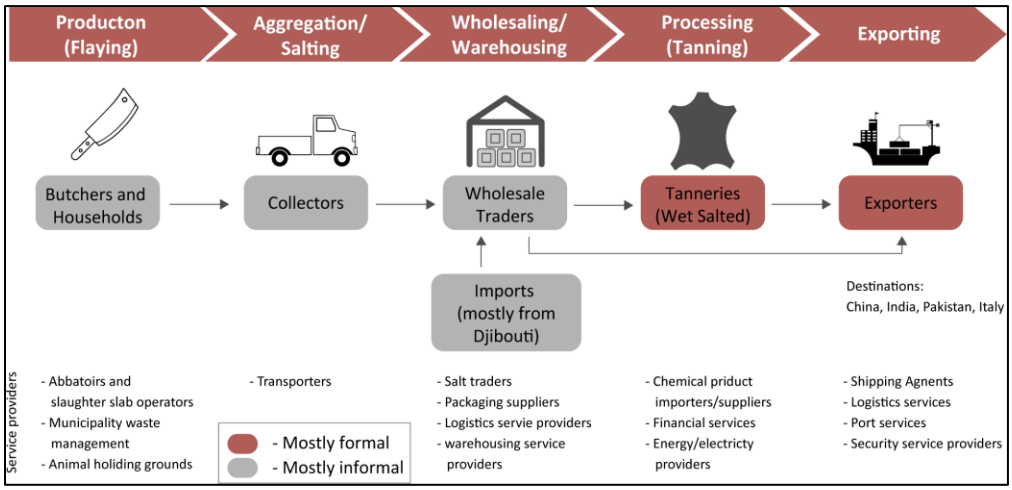
Hides and Skins

Export earnings from hides and skins have dropped considerably over the past 15 years, with a collapse of trade and processing in the 1990s (MoLFR 2019). A few traders pick up skins from villages and hides from slaughterhouses, but processing is minimal and limited to sun-drying and salting, rather than through the wet blue stage (MoLFR 2019). Notably, a tanning factory in Hargeisa was shut down in 2014, after six years of operations, following accusations of the dumping of dangerous chemicals into the environment, polluting soil and water sources, and accompanying health complaints from residents, as well as workers (MoLFR 2019; *The Guardian* 2013). This highlights the importance of waste management for tanneries, as well as the need for safe working practices.

Domestic (rough) leather handicrafts by artisans are negligible, and largely confined to sandals and stools (MoLFR 2019). Ongoing exports, while limited, suggest potential to revive international demand.

Hides' and skins' quality is affected by the health of animals, their grazing environment (thorny bushes damage the skin), the flaying skills of butchers and storage practices of the traders (MoLFR 2019). Droughts negatively impact the industry as production of healthy and quality animals is reduced, yielding hides and skins of inferior quality (MoLFR 2019). The subsector is characterized by low prices, as low as US$0.30 per hide or skin (MoLFR 2019).

Figure 14. Hides and Skins Value Chain Mapping



Source: MoLFR (2019).

Poultry and Beekeeping

Somali poultry production comprises:

- Free-range production at village level.
- Semi-intensive or backyard in most regional and small towns.
- Commercial intensive—largely limited to main urban centers (Mogadishu/Hargeisa) but on the rise, mainly to supply eggs to nearby towns (MoLFR 2019).

Government support to the poultry sector over the last half-decade has been limited, as it was not considered a priority subsector. Water access is one of challenges faced by both semi-intensive and commercial poultry farms (MoLFR 2019). Almost all chicken and eggs sold on a commercial scale are imported, which takes place without any quality control or health certification (MoLFR 2019). In large urban markets, domestic poultry cannot compete on price with frozen chicken imports, although there is a niche market where local consumers prefer indigenous breeds and more naturally-fed chicken meat (MoLFR 2019).

Honey, which is believed to possess medicinal properties, is in high demand locally (MoLFR 2019). Evidence of beekeeping is anecdotal, and is primarily a small-scale side business, especially concentrated in "the beekeeping belt" of Bay and Bokool regions of South West state, employing traditional hives and harvesting methods (MoLFR 2019). However, beekeeping improvements introduced by the Food and Agriculture Organization (FAO) have demonstrated socioeconomic benefits, especially to women (FAO 2015).

3.5 Water Sources and Wastewater

Reliable water supplies are important for livestock watering, to support fodder production (see Section 4.5) and transit stations. Irregular and inadequately harvested rainfall, and inadequate, or costly water supplies undermine animal health and survival, the delivery of high-quality animals to markets and other aspects of the value chain of livestock and dairy production and processing (MoLFR 2019). As noted in Section 3.2, *"In recent years, livestock survival during annual or seasonal severe droughts has become dependent on very costly and often unaffordable water transported by privately owned*

water tankers" (World Bank and FAO 2018). Functioning, reliable water supplies, waste management, and wastewater treatment are all essential for slaughterhouses, meat markets, and tanneries.

Livestock watering in Arabsiyo village, Somaliland. *(Photo courtesy: Chantal Richey)*

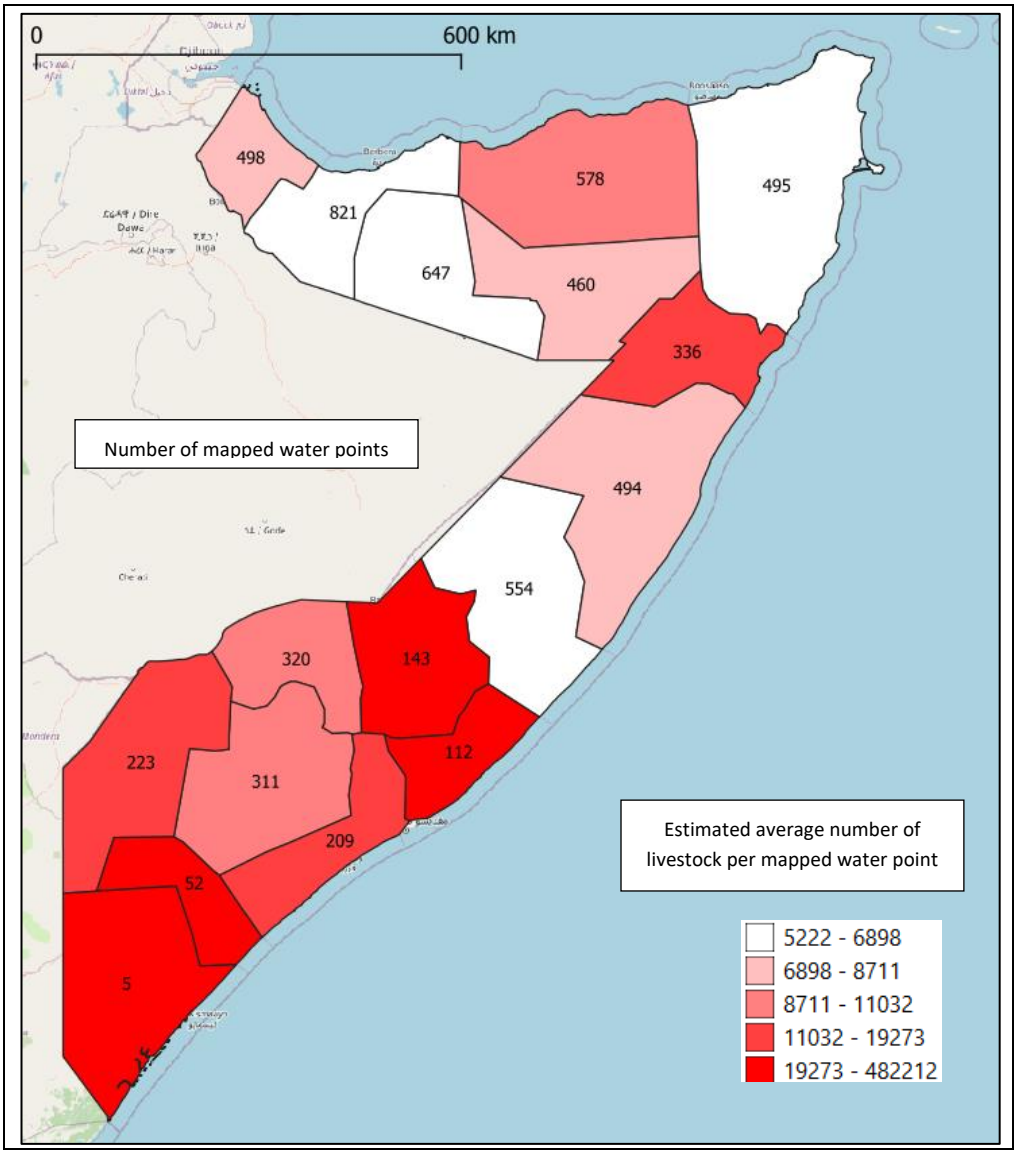
Low-cost solutions that enhance rural communities' access to water across Somalia's dry lands include the deployment of small-scale water harvesting and storage technologies (Table 1, Chapter 1). In the case of nomadic households, the frequency of collection of water for livestock depends on the type of livestock they own, with camels needing water less often than goats and sheep, although herds are often mixed. Of the total 6,427 water sources in the SWALIM database (February 4, 2021), over 1,400 (by camels), 860 (by cattle), and 1,570 (by shoats) were reported to be used.[32] However, not every water supply technology may be suitable for every location and *"more information is needed to determine which water harvesting technology is best suited for the various types of Somali terrain"* (World Bank 2019c).

Figure 15 shows the number of mapped water points and estimates the number of average livestock per mapped water point for each of Somalia's regions. With the exception of two regions, in each region between 112 and 821 water points have been mapped. The very low numbers in Lower and Middle Jubba suggest major gaps in the data. However, even the lowest quintile, which starts at just over 5,000 livestock per water point, suggests a high livestock demand on water sources.

A key takeaway message from Figure 15 is that it is likely that many more water sources are in use in the country but have not been mapped. This further highlights the strategic importance of comprehensively mapping water supplies across the country, or at least in select areas before investing in new infrastructure.

[32] 'Shoats' means sheep and goats (Kafele 2019).

Figure 15. Mapped Water Points (Numbers) and Number of Livestock (Goat, Sheep, Cattle and Camels) Per Water Point in Somalia Regions[33]



Disclaimer: The actual number of water points is probably much higher in many districts.

3.6 Recommendations

The LSDS notes that narrow project designs, a piecemeal approach, and a limited focus on hand-over and management of assets by past projects supported by external assistance has, in some cases, undermined the sustainability of outcomes that were initially positive. Moreover, focusing interventions solely on some segments of the supply chain has resulted in poor or limited upstream and downstream linkages (MoLFR 2019).

The National Water Resources Strategy, supports this sentiment, that is, *"it is important to consider water security, not in the present myopic sense of availability of enough water to satisfy … needs …*

[33] Classes are based on quartile boundaries. Livestock is derived from UNDP 2014 survey and projected to 2020, based on a 1.79-percent growth rate (World Bank 2020). Waterpoints are from the SWALIM Live database (December 2020).

but rather water as a cross-cutting issue which can act as a catalyst for economic development while addressing poverty challenges, improving the standards of living of Somalis, and ensuring a clean aquatic environment" (MoEWR 2021). It caveats this by pointing out that even where hydrologic conditions may be favorable institutional flaws and mismanagement can lead to water insecurity (MoEWR 2021).

Numerous diverse and challenging problems, as well as the intertwined nature of the livestock sector with rangelands management, and crop production means that while there are potential numerous water sector investments, there is also a danger that a focus which is too narrow, or does not consider customs, culture, conflict, gender and inequalities, or allow for meaningful participation will not be impactful in the long term. In fact, well-meaning investments may even result in negative outcomes, and lead to loss of livelihoods or exacerbate conflict. Efforts to support pastoralists and boost the Somali livestock sector need to consider the following:

- Water investments are essential to address acute vulnerability among dryland communities but they are insufficient on their own, and need to be complemented by parallel investments designed to restore a healthier ecosystem and strengthen the capacity of local communities to sustainably and equitably manage their water assets and the natural resource base (that is, soils, pastureland, and forests), which all underpin their livelihoods (World Bank 2019a).

- Noting the drive to revitalize and develop agriculture in Somalia, experience from other countries shows that if irrigation is to be developed alongside pastoralism, it is important to guarantee that irrigation does not deprive pastoralists of access to dry-season water and forage reserves, and there is also need to ensure that irrigation does not aggravate vector-borne diseases of people or animals or exacerbate conflict (Ickowicz et al. 2012).

- The experiences from the WALP project, of sand dam water being abstracted by water tankers, thus threatening local supply, illustrate the high value of water, and challenge in governing its use from newly constructed infrastructure.

Appendix 4 provides details of potential policies or investments that are well-documented and have resulted in improvements in the human and economic development of pastoralists, livestock and/or the rangeland environments that underpin their existence. The three top investments for pastoralists and livestock are:

- Securing the rural economy through participatory rangeland and water management.

- Improving livestock watering facilities' management and maintenance by community organizations, combined with conflict resolution efforts.

- Facilitating technical assistance/co-funding for private and community investments to improve water access for livestock resting areas, transit stops, and livestock value chains.

4 Rural Economy II: Farmers, Crops, and Forests

Somalia encompasses arable land and areas conducive to agriculture, with large areas suitable for livestock grazing, browsing, and fodder production; fertile alluvial soils for staple cereals, oil seeds, legumes, and horticulture crops; forests that provide prized gums and resins, as well as charcoal for cooking and waters, with a diverse range of valuable reef and pelagic marine species (World Bank and FAO 2018).

Alas, Somalia's livestock and crop sectors have been challenged by "*deteriorating water and transport infrastructure, persistent insecurity, weak regulatory and enabling institutions, and severe environmental degradation of … rangelands and forested areas"* (World Bank and FA 2018). Furthermore, agriculture and livestock are acutely vulnerable to extreme weather events and climate change, while coastal fishing remains artisanal, with legal and illegal harvesting by foreign commercial vessels (World Bank and FAO 2018).

This chapter provides global and regional perspectives on water demand, forests, soil and agriculture. For Somalia, in particular, it draws out key issues and interconnections, concluding with potential water-related investment opportunities that relate to water which could support agricultural development

4.1 People

4.1.1 Employment

About 49 percent of the Somali population live in rural areas, and 46 percent of employed people work in agriculture—25 percent in crop cultivation, 9 percent in herding, 4 percent in fishing, and 7 percent in related activities (World Bank and FAO 2018). Recurrent water shortages in Somalia have contributed to the movement of millions of people from their homelands while conflicts over water can break out as local supplies diminish (World Bank and FAO 2018).

With an estimated 70 percent of Somalia's population under 30 years of age, one of the highest rates of unemployment in the world and very low levels of education, improvements to agriculture presents an opportunity for employment and income generation (World Bank and FAO 2018). Prior to the civil war, almost all of Somalia's agro-processing industry was either government-owned or heavily controlled by the government, with few fully developed or well managed (World Bank and FAO 2018). Today's emphasis on the private sector and small-scale farmers provides a very different vision for the country.

4.1.2 Poverty

Pastoral, farming, and fishing communities all suffer from high rates of chronic malnutrition,[34] with micronutrient deficiencies widespread (World Bank and FAO 2018). *"The increased availability, affordability, and consumption of diverse, safe, and healthy foods … would improve nutrition directly and increase the resilience of poor households indirectly"* (World Bank and FAO 2018).

In fact, *"most small-scale farmers are trapped in a poverty cycle, without the capacity or resources to increase production and modernize their farming practices"* (World Bank and FAO 2018). UNDP

[34] "*Root causes of poor nutrition include poverty, food insecurity, gender inequity, high population growth, and limited access to water, sanitation, and health services, as well as lingering civil conflict in many rural areas in Southern Somalia and more frequent, severe, and protracted droughts*" (World Bank and FAO 2018).

(2012) found that multidimensional poverty incidence within this group is 95 percent. This poverty trap, combined with two consecutive years of below-average rainfall, contributed to an estimated 38 percent of the Somalia's population requiring humanitarian assistance in 2016 (World Bank and FAO 2018).

4.2 Land Use and Livelihoods Zones

Somalia has an area of 637,657 km² (63.8 million hectares) comprising rangeland, forest, and land suitable for agriculture. Almost two-thirds of cultivable land is in the fertile areas along and between the Jubba and Shabelle rivers; the remaining third comprises a smaller cultivated rainfed area in the northwestern regions and some oasis and coastal cultivated areas in the northeast (World Bank and FAO 2018). The majority of land with potential for irrigation is within the alluvial plains of the Jubba and Shabelle rivers (MoEWR 2021). Table 4 presents available data, but it should be noted that Basnyat (2009) is concerned that the reliability of data on irrigated areas is not reliable.[35]

Table 4. Estimates for Somali Land Use

Type	Proportion	Area (hectares)
Forest cover (before 1980)	62%[e]	
Forest cover (2020)	9.5%[a]	
Suitable for cultivation (rainfed or irrigated)	<5%[a]	~3 million[b]
Cultivable land suitable for rainfed agriculture/under dryland conditions	>75% of < 5%[d]	2.3 million[b]
Suitable land for irrigation		0.7 million[b]
Estimated total irrigates area before the civil war		222,950[d]
Pre-war spate irrigation in the Jubba-Shabelle basin		150,000[c]
Pre-war full control irrigation in the Jubba-Shabelle basin		50,000[c]
Irrigation potential in the Shabelle and Jubba basins if pre-war infrastructure was brought back into operation		265,000[c]
Estimated area currently irrigated		115,000[b]

References: [a]**MoLFR (2019);** [b]MoEWR (2021); [c]Basnyat (20090; [d]World Bank and FAO (2018); and [e]Openshow (1982).

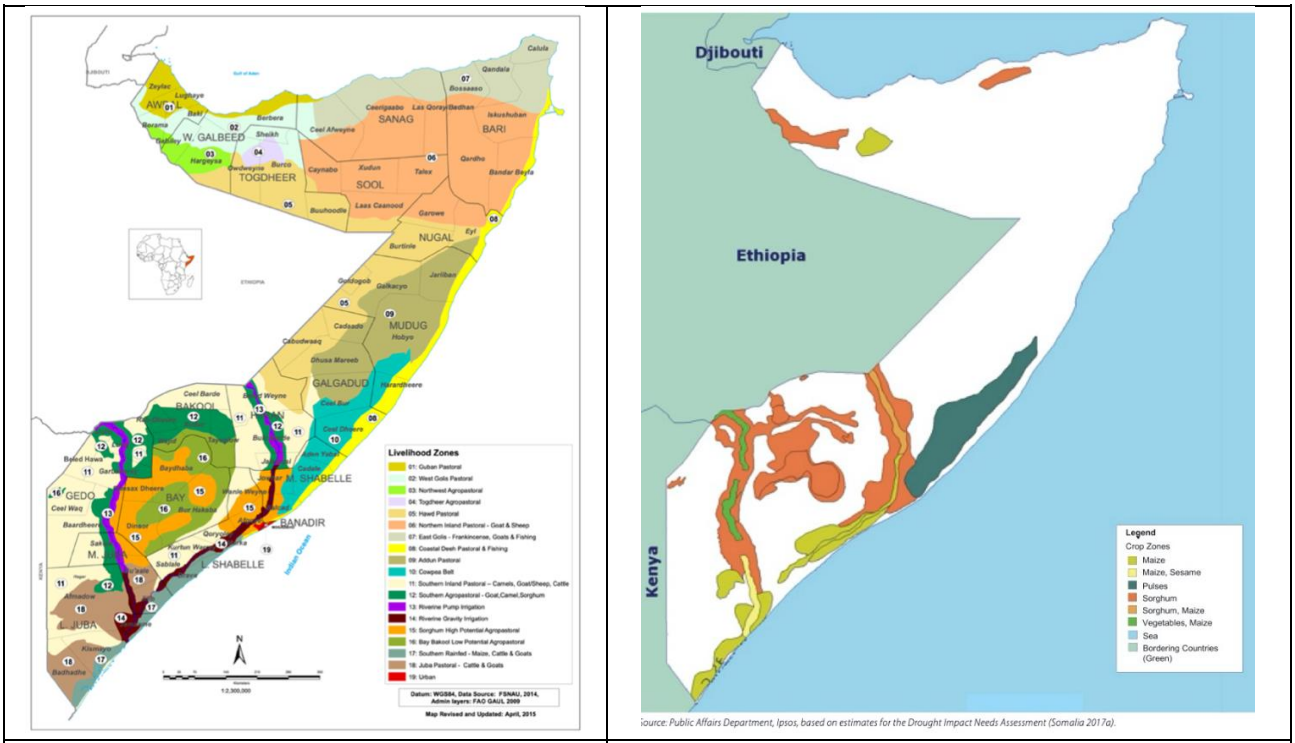
Somalia's livelihood zones and crop growing zones at the national scale are presented in Figure 16. Agro-pastoralists are located in the inter-riverine regions (Bay, Bakool, Western Hiran, and Eastern Gedo), as well as some areas in the northwest and southwest.

Although pastoral areas are found throughout the country, pastoralists are predominantly in the arid rangelands of northern and central Somalia and along the borders with Ethiopia and Kenya in the south.

[35] "*A study by Henry (1979) estimated an irrigated area of 38,685 ha in 1979 and a potential of 65,000 ha in Shabelle flood plains. Similarly, committed irrigated area was estimated as 73,210 ha and total potential was estimated as 221,500 ha in the Jubba riverine areas*" (Basnyat 2009).

Figure 17 also shows specific livelihoods zones such as the cowpea belt in central Somalia and the long coastal Deeh pastoral and fishing zone.

Figure 16. Livelihoods and Crop Growing Zones in Somalia



(a) Livelihoods zones (FSNAU and FNEW 2015).

(b) Crop growing zones (reproduced in World Bank and FAO 2018).

4.3 Forests and Trees

Trees provide resources for browsing, firewood, and construction materials for housing. The acacia tree is the main type of vegetation on Somalia's open savannah and bushlands. The juniper forest in the Golis Mountains remain a center of biodiversity and endemic species. Somalia's forests also provide frankincense,[36] myrrh,[37] and gum arabic[38] for both export and local markets (World Bank and FAO 2018). Somalia also has wild fruit trees that produce important medicinal products, are tolerant to water stress, and which are valued both locally and internationally[39] (UNEP 2005; IUCN 2006), as well as trees that produce henna[40] and tamarind (World Bank and FAO 2018).

Somalia's forest cover has declined from 62 percent of land area before 1980 to 9.5 percent today (MoLFR 2019). "*By the late 1980's, virtually all of Somalia's floodplain forests had been cleared for irrigated agricultural production"* (World Bank and FAO 2018). Deforestation has been exacerbated by the move towards private enclosures for livestock grazing and semi-permanent family shelters, which is still gathering speed (World Bank and FAO 2018). Large-scale deforestation of rangelands has been primarily attributed to massive and unsustainable cutting of acacia trees for charcoal exports (World

[36] Boswelia species in the northeast.

[37] Commiphora in the southwest and northeast.

[38] Some acacia species.

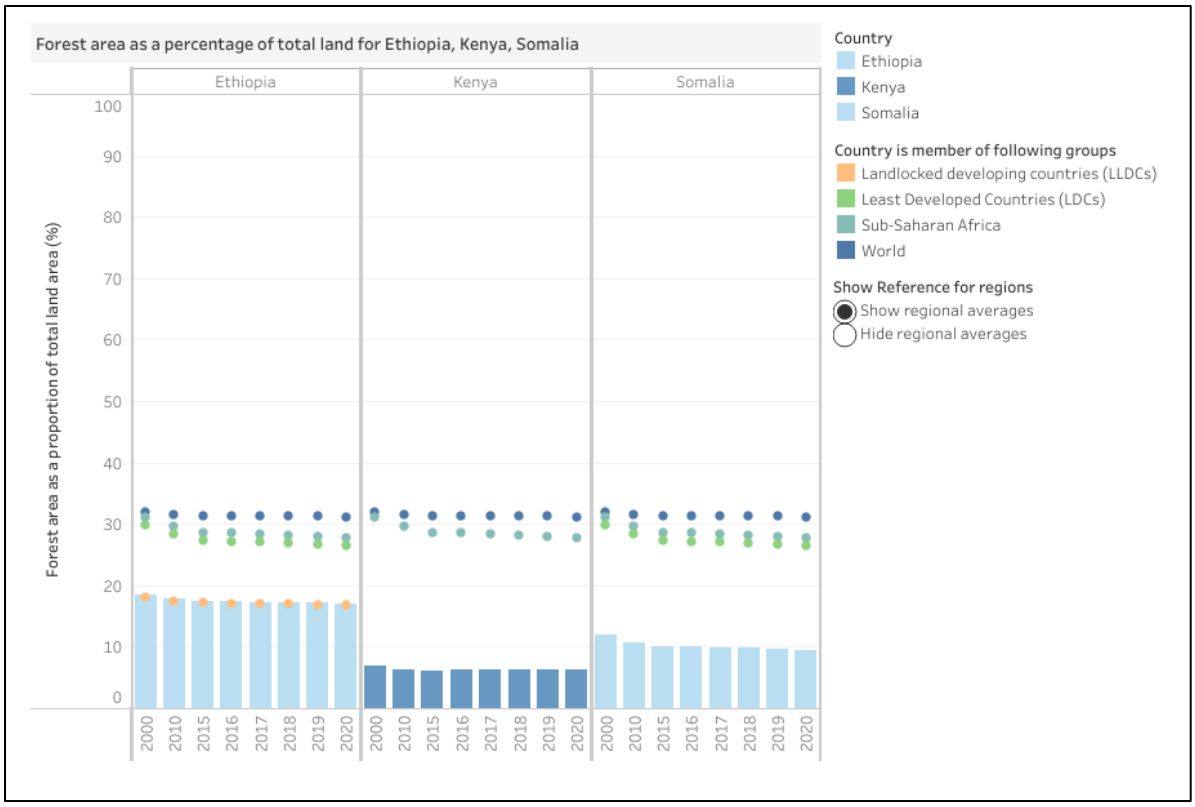
[39] Including Zizysphusmauritiana, Boscia coriacea, Cordia sinensis, Balanites spp., and Dobera glabra.

[40] Lawsoniainermis.

Bank and FAO 2018). However, there is also considerable demand for charcoal in Somalia's urban centers.

Forestry cover in Somalia is very low for region, is lower than Ethiopia, but higher than Kenya (Figure 17). There are also concerns about overexploitation and poor harvesting practices of frankincense and myrrh, which maximize short-term earnings and neglect the long-term health needs of the trees including illegal harvesting (World Bank and FAO 2018).

Figure 17. Forest Area as a Percentage of Total Land for Ethiopia, Kenya, Somalia



Source: FAO (2021).

4.4 Crops and Food

4.4.1 Farm and Crop Types

Most cropping in Somalia is relatively small scale[41] subsistence farming, accounting for 80 percent of total crop output and 70 percent of marketed agricultural produce. Dryland crops comprise sorghum, cowpea, and, to a lesser extent, maize and sesame, as well as khat and millet in the northwest. Irrigated farms grow maize, sesame, other food crops, groundnut, rice, and other fruits and vegetables (Word Bank and FAO 2018; Basnyat 2009). Fruits and vegetables grown include banana, grapefruit and lime, watermelon, papaya, dates, tomatoes, and onions.

An estimated 70 percent of the country's cereal production is from Jubba-Shabelle basin and 60 percent of the country's maize is produced in the Lower Shabelle region, primarily by small-holder farms (Basnyat 2009). The volume of cereal production in Somalia has declined by almost 60 percent from

[41] In the southern regions, farmers have an average of 0.2 to 0.3 acres of land.

its 1989 peak while the population has more than doubled (World Bank and FAO 2018). Somalia produces less than half of as much food as it did before the civil war[42] and cultivated area under irrigation is about half the over 220,000 hectares that it was beforehand (World Bank and FAO 2018).

4.4.2 Exports and Imports

"According to pre-war statistics, crop production accounted for just over 20 percent of foreign exchange" (Basnyat 2009) but is now extremely limited. Banana used to be a major export crop in the past. In the late 1980s, Somalia was the world's largest producer and exporter of frankincense and myrrh (World Bank and FAO 2018) and Somalia's fourth-largest source of foreign exchange earnings was the export value of raw gums. Alas, current estimates of export volumes are unreliable, rendering meaningful comparisons very difficult.

Currently, sesame is Somalia's second-largest export (after livestock), with dry lemon the only sizable export among vegetables and fruits. Charcoal exports to the Arabian Peninsula have fallen significantly[43] but still take place (World Bank and FAO 2018).

The imports to Somalia are much higher than exports. Whereas agricultural imports averaged at about US$82 million in the late 1980s, they reached almost US$1.5 billion in 2015, a rise in a factor of 18. This is being driven by increased food demand, caused by population growth and urbanization, and reductions in domestic crop production. Although quantitative evidence is lacking, qualitative studies and anecdotal evidence strongly suggest that Somalia is also a major re-exporter of items including sugar and pasta to neighboring countries, where they are otherwise subject to high tariffs (World Bank and FAO 2018).

By quantity, 65 percent of imported food consists of oil palm, macaroni, wheat flour, milled rice, and sugar (MEWR n.d.). Local cereal production meets only 22 percent of per capita cereal needs or about 40–50 percent in the best seasons (World Bank and FAO 2018). The remainder is imported, paid for by foreign exchange from remittances, exports and donor aid inflows.[44] Somalia faces a shortage in cereal production, which should not be conflated with food production.

4.4.3 Food

Food consumption is broader than cereals, with domestic milk and meat, as well as locally produced vegetables playing a very important role, particularly in rural areas of Somalia. On average, annual per capita consumption is 330 liters of milk and 22 kilograms of meat (ICPALD 2016). While domestic cereal and crop production has remained fairly constant over the last 60 years (MoEWR n.d.), the increase in Somalia's population over 70 years has been eight-fold, from just over 2 million in 1950 to 16 million by 2020. Somalia's population is projected to be 27.6 million by 2040 (Figure 18).

[42] The Somali civil war started in 1988 in the northwestern region (today's Somaliland), reaching Mogadishu in late December 1990 and engulfing the southern part of the country. The civil war resulted in major weakness—or, in the case of Southern Somalia, the total absence— of government institutions until the early 2010s (World Bank and FAO 2018).

[43] Charcoal exports peaked at US$56 million in 2011, up from zero before the civil war and as late as the mid-1990s. Exports have dropped since the federal and state governments started enforcing the export bans adopted in 2012, alongside import bans by importing countries in the Gulf, introduction of gas stoves, and growing environmental awareness (World Bank and FAO 2018).

[44] Very approximate annual estimates—remittances: between US$1.3 and 2 billion; exports US$500 million and donor funding US$30 million.

Enhancing food security for Somalia for now, and into the future, requires significant improvements to agricultural productivity (livestock and crops) alongside improvements to in-country value-chains and further better linking the rural and the urban economies. Both blue water (that is, surface and groundwater) and green water (stored in soils and plants) are central to improving crop production. Nevertheless, even with improvements, remittances are likely to continue to contribute towards cereal imports and food consumption in Somalia for some time in the future.

Given the volume of rice exports into Somalia (estimated) at over 453 million tons of milled rice at a value of over US$200 million in 2019 by FAO (2021), further development or rice production may have potential for import substitution. Growing and processing rice in Somalia is not new. High-yielding varieties of rice introduced into Somalia in the pre-war period contributed to an increase in the area under rice cultivation from zero to a peak of 6,500 hectares in 1989 (Box 4).

Box 4. The Mogambo Rice Project and Rehabilitation Efforts

"*The Mogambo Rice Project (1982–86) covered 2,052 hectares of paddy rice fields and 163 hectares of sprinkler-irrigated land planted with cotton (Sir McDonald and Partners Ltd. 1982). Associated farms benefited from irrigation and drainage canals. High-yielding varieties of rice were introduced into Somalia in the pre-war period contributed to an increase in the area under rice cultivation from zero to a peak of 6,500 hectares in 1989. The civil war began right after the first phase of the project was completed, with the plant looted. The project never produced the 10,000 tons of rice a year planned. Because the irrigation infrastructure and upstream flood control embankments were not maintained, the farmland is also no longer cultivated*.

"FAO implemented rehabilitation project in the Middle Shabelle region which seems to have only stemmed the trend of declining rice production, but which did strengthen the Jowhar Rice Growers' Association. High-yielding varieties of rice are still in use and make rice growing profitable in the region. By the early/mid-2010s (predrought) rice was being grown on only about 750–1,500 hectares, however, a small fraction of the area under rice cultivation in the prewar years."

Source: World Bank and FAO (2018).

The extent to which rice farming, particularly the reintroduction of large-scale rice farming, is an option for Somalia is worth further investigation. New rice varieties that grow in brackish water have been piloted, with nascent success, in India and may be appropriate for cultivation in the Jubba and Shabelle coastal floodplains.[45]

4.5 Improving Crop Productivity

4.5.1 Causes of Decline and Constraints

The underlying causes of Somalia's agricultural decline are numerous and complex (Box 5). Expert consensus is that if constraints (see also Boxes 6 and 7) were fully addressed, average yields could increase by a factor of four to six for maize and three for sorghum (World Bank and FAO 2018). Water

[45] (a) Indian Council of Agricultural Research and Central Coastal Agricultural Research Institute (Goa) develop new salt tolerant rice varieties: https://ccari.res.in/Karwar1018.html; (b) CSR23: a new salt-tolerant rice variety for India: https://www.researchgate.net/publication/250278469_CSR23_a_new_salt-tolerant_rice_variety_for_India.

supply and water management feature considerably in the above constraint for both dryland and irrigated agriculture, as discussed in the 'Water and Crops' section below.

Box 5. Underlying Causes of Somalia's Agricultural Decline

- Armed militias with little farming skills and experience occupying prime farmland in the Lower Shabelle region.
- Contested political (and taxation) control over much of the riverine and inter-riverine areas between Al-Shabaab and the national army.[46]
- Ministries' provision of agricultural services in Southern Somalia is limited, fragmented, and inefficient, due to lack of skilled staff and funding, coupled with poor road access.
- Landholders who left their farms in Southern Somalia during the civil war are unable to reclaim their land, due to insecurity, weaknesses in traditional arbitration, and the absence of modern judicial institutions.

Source: World Bank and FAO (2018).

Soil degradation

Somalia is a country with severely eroded areas (UNSO/SEED/BDP 1999). Severe deforestation and soil erosion threaten growth prospects and the viability not only of Somalia's traditional nomadic pastoralism (discussed in Section 3.1), but also of rainfed crop cultivation.

Enclosure and conflict

The expansion of private enclosures on traditionally open rangelands, especially along livestock migration and transport corridors and urban centers, have exacerbated tensions and conflict. Even in the more secure northern regions, neither government nor community institutions appear capable of dealing with such disputes (World Bank and FAO 2018).

Land tenure

Historically, land tenure arrangements for most cultivated and nearly all pastoral land was customary. State leasehold tenure based on statutory law was widespread until independence in 1960, particularly in riverine areas. In 1975, legislation passed control of tenure rights from traditional authorities to the government, and landholders were allowed to register[47] under a 50-year lease from the state (World Bank and FAO 2018). State farms, cooperatives, and large private plantations were established in the 1970s (World Bank and FAO 2018). These policies concentrated land ownership and gave those that were wealthier and better connected an advantage in acquiring leasehold titles.

In the south, where most farmed land is privately owned, there are land disputes. However, recommendations and decisions by traditional and religious leaders are usually accepted by parties in conflict. There are ongoing cases of landowners from prime farms in the Lower Shabelle who left for safety, whose land remains occupied and who are still unable to reclaim their land. Traditional mediation attempts have not yet led to resolution, especially in the Lower Shabelle. Here, "*local clans are involved*

[46] The continuing insecurity makes access to farms and market outlets risky, costly, and unprofitable. Such conditions also make interventions by aid agencies extremely challenging.

[47] Permitted Registration was no more than 30 hectares of irrigated, and no more than 60 hectares of nonirrigated land.

in a bitter land dispute with a clan from central Somalia" (World Bank and FAO 2018). In northern regions, where the civil war did not disrupt landholding, there are very few disputes over farmland.

4.5.2 Water and Crops

Three areas where water sector investments could significantly impact are with respect to rainfed or dryland crops, irrigated agriculture, and fodder.

Rainfed or dryland agriculture

Rainfed agriculture in Somalia relies mostly on groundwater, rainfall harvesting, and moisture retention (World Bank and FAO 2018). In Somaliland, soil bunding was used by sorghum farmers to conserve moisture and prevent erosion and there is a project to improve this (World Bank and FAO 2018). While deteriorated rainwater harvesting infrastructure and weak capacity have contributed to reducing the area under rainfed agriculture, there are also other constraints (Box 6) which need to be considered to improve the status quo.

Box 6. Main Constraints to Rainfed Farming Systems

- Lower and more erratic rainfall than in the past, resulting in more frequent and intense cycles of droughts and floods.
- Deteriorated water harvesting and storage infrastructure.
- Poor soil management, resulting in very low moisture retention and inadequate internal drainage.
- Very low-input farming techniques.

Source: World Bank and FAO (2018).

The adoption of water-saving technologies and management tools requires an understanding of farmer constraints, alongside provision of information through extension services and appropriate incentive systems, including financial support and credit (FAO 2020a). Cultivating drought-tolerant crop varieties is also important. *"In water-scarce areas, crop and nutrient selection is also needed, including diversification into higher-value and less-water-demanding crops. An important integrated crop-management option is conservation agriculture, which enhances efficient water and nutrient use"* (FAO 2020a).

Irrigated agriculture

Small-scale irrigation is prolific in peri–urban, coastal areas, and dry riverbed areas:

- Irrigation of cut-and-carry livestock feeding, involves mechanical and solar-powered pumps abstracting groundwater from boreholes and dry riverbeds (MoLFR 2019).
- *"Following seasonal rains, water infiltrates into shallow aquifers that last for only a few months of the year. Around these shallow aquifers, there is a small but growing horticultural production base selling vegetables to urban areas and improving rural incomes"* (MoLFR 2019).

While irrigation infrastructure in Somaliland and Puntland has always been limited, there has been development of date palm plantations, including improved infrastructure through small canals providing water from shallow wells or water springs to small-scale farmers (World Bank and FAO 2018).

*"The alluvial plains of the …. the Shebelle and Jubba Rivers, have been and could once again be the breadbasket of Somalia thanks to their sizable potential for irrigation development" (*Basnyat 2009). While there is a large area of land suitable for irrigation in the riverine areas, water availability is a constraint (Basnyat 2009), which may worsen in the future, depending on upstream investments in Ethiopia. A detailed analysis of this is beyond the scope of this report.[48]

Large-scale flood control and irrigation schemes in Somalia existed in the past and included gravity, pumped, and flood-recession irrigation as follows:

- From the 1920s to late 1980s, infrastructure (barrages,[49] weirs, canals, and other) as well as pumped irrigation systems were constructed in the middle and lower reaches of the Jubba and Shabelle rivers, with Italian, Somali Government, Chinese, Abu Dhabi, Saudi Arabia, and Democratic People's Republic of Korea funding (World Bank and FAO 2018).

- These irrigation works were primarily associated with state-owned farms with associated agro-processing factories but in some cases also supplied water to agro-pastoral and farming communities and small-scale farmers (World Bank and FAO 2018). Crops grown commercially included sugarcane, rice, banana, citrus, and other fruit crops (Basnyat 2009).

- In Southern Somalia, the vast majority of this infrastructure is no longer functioning.[50]

- In the northern regions, infrastructure has been largely rehabilitated, and in some cases expanded, but remains inadequate (World Bank and FAO 2018).

Given that the days of large-scale state-owned irrigations are unlikely to return, there is need to fully consider the extent to which rehabilitation this large-scale infrastructure is economically viable, and whether there is potential for select investments in infrastructure that could boost farmer-led irrigation. Given the flooding scenarios likely for the future, there is also a need to examine what is environmentally prudent.

There are other, interlinked constraints to irrigation, of which some are related to water (Box 7). Attempts to rehabilitate broken barrages and clogged irrigation canals have been undertaken, with mixed results (World Bank and FAO 2018). Maintenance of infrastructure for flood control and irrigation is problematic, and has been attributed in part to an absence of nomadic community organizations (World Bank and FAO 2018).

Box 7. Constraints to Irrigated Farming

- **Diminished and inconsistent surface water availability**—a result of the dilapidated irrigation and flood control infrastructure in Southern Somalia.

[48] This is discussed in detail in the main report, 'Economics of Water: Digging for Data', in Chapter 3.

[49] "*There were altogether ten barrages (one in Jubba and nine in Shabelle) that were constructed to regulate flows to the canals supplying irrigation water to these irrigation schemes*" (Basnyat 2009).

[50] Prior to the collapse of the government, the Somali Ministry of Agriculture estimated that 112,950 hectares were under controlled irrigation and 110,000 hectares were under flood-recession irrigation. The area under controlled irrigation is estimated to have reduced by 42.5 percent to about 65,000 hectares along the Shabelle River and 15,000 along the Jubba river. Flood recession cultivation is estimated to have shrunk by 58 percent to 24,200 hectares and 21,600 hectares along the Jubba and Shabelle rivers, respectively.

- **Inefficient water use, increased salinization, and water logging**—caused by lack of water use planning and regulation.
- Poor soil fertility management, as inputs such as manure, fertilizer, and pesticides are either used in a suboptimal way or not used at all.
- Low-quality seeds and the retail availability of only a few seed varieties.
- Limited and unreliable mechanized equipment (most farmers use handheld tools to till the land).
- Badly deteriorated roads—increasing the time and costs of transporting crops to markets and undermining incentives to expand horticulture crops.
- Inappropriate farming techniques—a result of lack of extension and research services.

Note: Water issues are marked in bold.

Source: World Bank and FAO (2018).

Another very important point is that if irrigation is to be (re)developed alongside pastoralism, it is needed to guarantee that it does not deprive pastoralists of access to dry-season water and forage reserves, aggravate vector-borne diseases of people or animals[51] or exacerbate conflict (Ickowicz et al. 2012). Along parts of the Shabelle and Jubba rivers, irrigation is invariably linked to flood control (discussed in Chapter 5).

Going forward, there are several linked questions for irrigation:

- Are there projects which are appropriate for effective large-scale, or small-scale flood control? If so, how can capacity and long-term investment be assured to ensure maintenance? What are the implications for existing land and water users in the area?
- What are the short, medium and long-term benefits of small-scale or farmer-led irrigation versus larger-scale commercial irrigation for the economy, but also for equality?
- How can water for livestock and irrigation demands be reconciled to foster a win-win scenario for farmers, pastoralists and agro-pastoralists?
- What measures need to be undertaken to prevent further soil degradation and improve soil organic matter?

Fodder

Year-round affordable good quality livestock feed can improve animal quality and reduce the pressure of a large animal population on increasingly scarce natural resources. Fodder specifically is very important for a number of reasons (Box 8). In Somalia, fodder demand and prices peak when livestock exports soar before and during the main Islamic celebrations and during the two regular dry seasons every year, with a documented example of a seven-fold increase of price in one area and a

[51] Such as Rift Valley Fever, which was instrumental in the 2000–2009 livestock export ban by Saudi Arabia.

150 percent increase in another (MoLFR 2019). "*At peak demand periods, grains, other fresh crops, and even emergency relief food for people are also sold as livestock feed*" (World Bank and FAO 2018).

Box 8. The Importance of Fodder

Fodder is important because:

- The availability of fodder offers a coping strategy during dry seasons and even prolonged droughts (MoLFR 2019).
- High and growing demand for quality fodder for livestock along trading routes, in market centers, and at terminal ports (MoLFR 2019).
- High and growing market demand for fodder at rest stops along major trekking routes, given that most animals destined for export are trucked large distances from the main livestock markets to the export ports (MoLFR 2019).
- "*Increased demand for and availability of quality fodder in the riverine areas around Dollow … support[s] … breeding and lactating animals, for increased milk yields and for consumption by the local communities, [and] an opportunity for women to engage in the marketing of fodder as an alternative source of income*" (MoLFR 2019).

In Somalia, livestock feed remains characterized by traditional low-input grazing and browsing, that are subject to seasonal shortages of pasture, with very limited commercial fodder available (Box 9). Storage practices of hay production from native grasses are also poor, leading to a rapid drop in nutritive value.[52] "*Most available commercial fodder is from humanitarian emergency stocks or imported from Oman, with the subsector vulnerable to supply or price shocks outside of its control and at risk of being oligopolistic*" (MoLFR 2019). Competition among fodder importing companies remains very limited (MoLFR 2019). The 2016–2017 major prolonged droughts stoked the interest in the production, commercialization, and storage of improved feed and fodder, but production and marketing remain limited and inadequate, and quantitative information on production, availability, inputs, and stakeholders involved is lacking (MoLFR 2019).

Box 9. Current Fodder Production Practices in Somalia

Current fodder production practices are mainly:

- Medium to high integration in agro-pastoral and settled mixed farming.[53]
- High integration in the flood plain areas where fodder can be grown.

[52] "The biomass currently used as fodder are mostly crop residues such as stalks that is mainly made up of maize and sorghum straws, that are generally of low nutritional value" but there are sources available at higher prices, with a private seed company in Mogadishu producing quality seeds for animal fodder and human consumption (MoLFR 2019).

[53] A study undertaken of Ethiopia, Kenya, and Somalia (Nyangaga et al. 2009) found that agro-pastoralists use part of their crops, mostly residues,[53] to feed their livestock. The rest is sold to peri-urban livestock keepers in and around towns as well as pastoral communities living further away from the rivers when they move closer to their farms during the dry season.

- Seasonal fodder production in some rainfed areas (including illegal enclosures).
- Irrigation-grown, along the riverine areas and within flooded areas in the plains.
- Cut and carry livestock feeding in coastal areas and dry riverbeds based on groundwater extraction (MoLFR 2019).

Given that feed and water scarcity drive pastoral destitution, as the natural resource base in the rangelands is shrinking[54] fast feed resources should be considered not just as an emergency response to drought, but in a broader development perspective. In order to institutionalize feed security, the country needs to be aware of its needs, resource availability, gaps, and how the gaps can be filled within the country, the region or beyond.

A livestock feed strategy needs to build on an assessment of the national feed inventory, including measuring actual and potential feed sources and the national feed balance (MoLFR 2019). Inadequate water access is one of several constraints to the production of quality fodder.[55] Development opportunities include suitable land and water in some states (for example, South West and Jubbaland), as well as Somaliland and Puntland where seasonal rivers flow in abundance but drain into the sea without their waters being utilized, and by harnessing water catchment facilities on the rangelands requiring rehabilitation (MoLFR 2019).

4.6 Recommendations

Although, in the longer term, agricultural development requires a comprehensive sector development strategy alongside institutional support, resolution of land tenure issues, and private sector engagement, "*at least a start toward rehabilitating dilapidated flood control*" and irrigation infrastructure is considered important for agricultural production in Somalia (World Bank and FAO 2018). However, issues of (a) institutional and human capacity building, (b) infrastructure rehabilitation; (c) expansion of rainwater catchment and moisture conservation and (d) rehabilitation of trunk and rural roads need to be "*pursued in parallel, rather than sequentially*" in order to yield gains and be sustainable[56] (World Bank and FAO 2018).

Boosting human and economic development through water sector investments in crops and forests relates requires consideration of the following:

- In order to improve agriculture in Somalia, water supply and water management practices cannot be taken in isolation, and need to be combined with good agronomic practices.

[54] See Chapter 3: Rural Economy I: Pastoralists and Livestock.

[55] Feed underdevelopment has been compounded by the breakdown of government institutions and traditional management institutions, as well as by degradation, deforestation, and continuous overgrazing resulting in major soil erosion, desertification, and reduction in edible biomass. Other constraints and gaps are insecurity and difficult access to some parts of the southcentral rangelands, the uncontrolled expansion of enclosures on previously open rangeland, low levels of technical knowledge on fodder production and storage, poor access to fodder seeds and other production inputs, absence or inadequate water, storage, and transport infrastructure, and unsettled land tenure issues in Southern Somalia.

[56] A case in point is the lack of annual maintenance and repairs that undermined the functioning of irrigation infrastructure in the past, while lack of rehabilitation of main and rural roads has meant increased and severe isolation of farms during rainy periods and increased and substantial crop wastage and quality deterioration during transport to markets.

- While crops are very important for Somalia, a constraint to the livestock sector is the uncontrolled expansion of enclosures on previously open rangeland (MoLFR 2019), and so expansion of land for crops and land requirements for livestock need to be considered jointly.

- Even in places with favorable hydrologic conditions, such as areas within the Jubba and Shabelle rivers' drainage basins, institutional flaws and mismanagement must be considered, to avoid water insecurity (MoEWR 2021).

- In some areas, such as lower Shabelle, some land tenure disputes need to be resolved before, or with planning for investments that improve water infrastructure for flood control and irrigation.

FAO (2020a) advocates for the promoting of digital extension tools to help disseminate knowledge of innovative water management tools. This, alongside other remote extension and outreach mechanisms, is an aspect which cuts across all development for crops and forests, and is applicable more broadly.

Five investments which could improve the crop productivity and the well-being of agro-pastoralists and farmers in Somalia are:

- Supporting integrated land and water management practices, including soil conservation and flood management.

- Supporting the promotion of water and soil conservation and water harvesting methods in drylands.

- Introducing mechanisms to enable and support farmer-to-farmer communications and learning (for example, farmers' voice radio).

- Supporting further research into farmer-led irrigation development, in combination with consideration of pastoralism and flood management.

- Supporting further research into boosting year-round affordable good quality livestock feed.

Appendix 4 provides more information about policies investments which have led to improvements in similar climatic and socioeconomic contexts elsewhere, are all well-documented, and have potential for positive results in Somalia.

5 Transitions: Urbanization, Water-Related Shocks, Resilience, and Climate Change

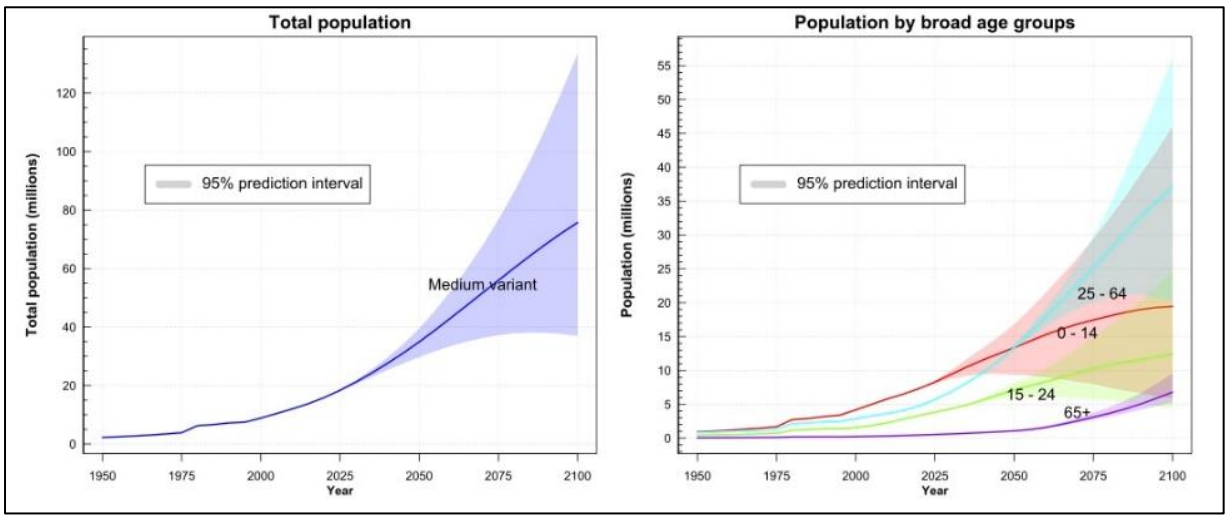
This chapter focuses on four interconnected transitions currently taking place in Somalia—urbanization, water-related shocks, resilience, and climate change.

5.1 Urbanization and Cities

5.1.1 Growing Populations

Somalia's population had increased from just over 2 million in 1950 to an estimated 16 million by 2020. Annual population growth is estimated to be 2.9 percent (UNDESA 2019). Figure 18 shows that the population could reach over 35 million by 2050. Future population growth will determine the population by the end of this century as clearly illustrated in Figure 18. More than 70 percent of Somalia's population is under the age of 30, illustrating the importance of youth in the development of the country (World Bank 2020).

Figure 18. Population Estimates for Somalia[57]



Source: UNDESA (2019).

Somalia has also witnessed significant outward migration. UNDP (2009) estimated that at least 1 million Somalis, equivalent to 14 percent, were living as diaspora overseas. The 2014 Population Estimation Survey estimates a much lower number, at 190,745 households, representing 2.1 percent of the population (UNFPA 2016).

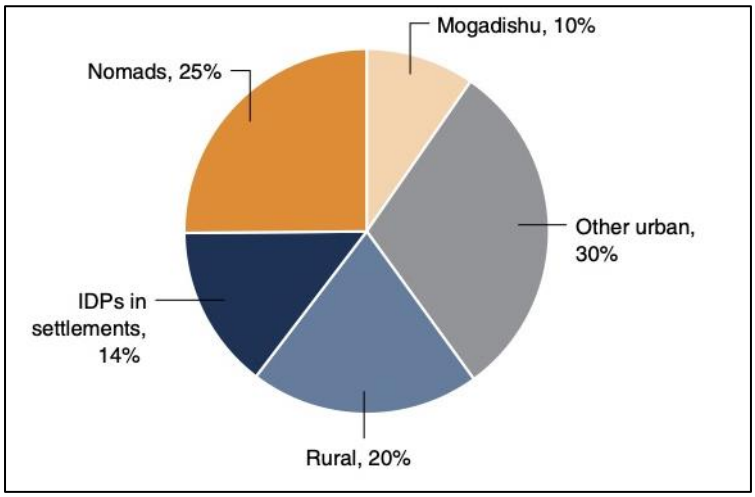
The educational attainment of girls has a significant effect on fertility decline, particularly through their early teens, that is, 'lower secondary' schooling (Liu and Raftery 2020). Investing significantly in girl's education, including WASH in schools and menstrual hygiene management, could significantly influence Somalia's future population size.

[57] Medium-variant projections for 2020–2100 are shown as thin colored lines, and uncertainty is shown in lighter shades for 95 percent prediction intervals.

5.1.2 Overall Urban Population

In1990, it was estimated that about 30 percent of Somalia's population lived in urban areas, which in 25 years had risen to an estimated 51 percent (UNFPA 2014). Somalia's urbanization growth rate and urbanization are similar to those of Sub-Saharan Africa as a whole (World Bank 2020). Wave 2 of the Somali High Frequency Survey estimates that currently, 45 percent of Somali's live in rural areas; 40 percent in urban areas, and another 14 percent in IDP settlements (Figure 19). Assuming that 75 percent of Somalia's estimated 2.6 million internally displaced persons (IDPs) live in urban centers means that one out of four urban residents are IDPs.

Figure 19. Somali Households by Type of Population in 2017–2018

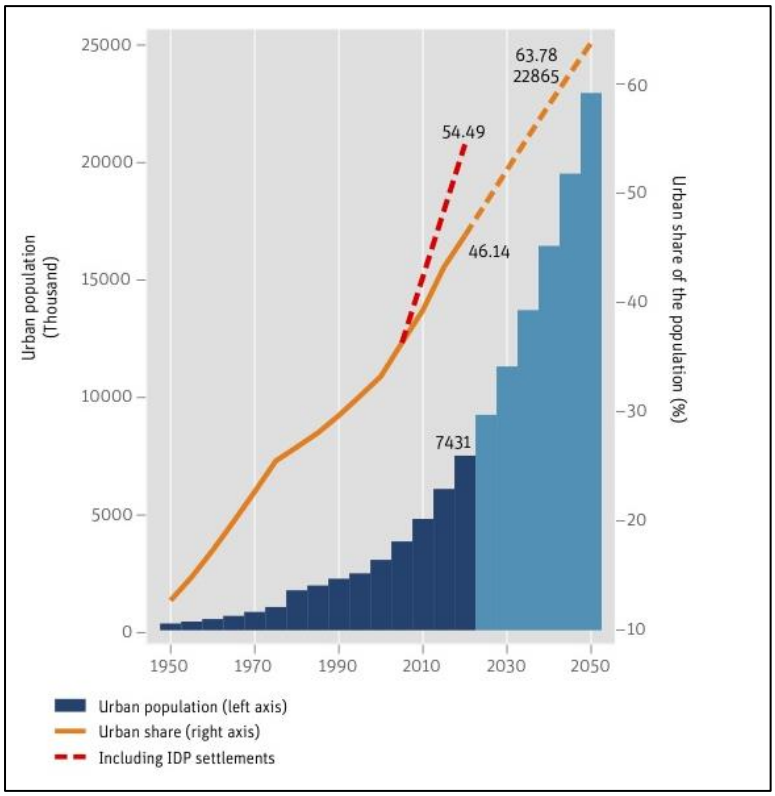


Source: World Bank (2019a).

Figure 20 illustrates changes in urbanization. Urbanization is predicted to continue in the future, with an estimated urbanization growth rate of 4.3 percent[58] per year. Protracted crises and recurrent droughts, in particular, have contributed to population displacements within the country towards urban centers and nearby camps (World Bank and FAO 2018).

[58] Note that data is insufficient to estimate urban natural population growth in Somalia but there is reason to believe that it is similar to the national population growth rate (World Bank 2020).

Figure 20. Urbanization in Somalia



Source: World Bank (2020).

World Bank (2020) considers that, if it is managed well, urbanization can help Somalia to develop faster and further, as evidenced by research which shows that every 1 percent increase in urbanization sees a 4 percent increase in per capita GDP, alongside the economies of scale that can be achieved in terms of service delivery. However, "*failure to meet the needs of growing urban populations threatens to undermine Somalia's modest successes and wider stability*" as discussed below.

5.1.3 Urban History

Up to the early to mid-20th century, Somali society was primarily rural, with a few coastal, city trading hubs, including Mogadishu, Brava, Merka, and Zeila that linked trade from the Indian Ocean to the interior. The advent of European colonialism witnessed a growing importance of urban areas, which remained modest in size up to the middle of the 20th century. Rapid urbanization and investment in urban infrastructure commenced after independence, but was concentrated in the capital, Mogadishu. Following the 1977–78 war with Ethiopia, service delivery in cities, including Mogadishu, essentially collapsed (World Bank 2020).

The 1970 and most of the 1980s witnessed a growing sense of nationalism and decline in clan identity and loyalties among urban Somalis, and increasing cosmopolitism[59] in some of the country's growing cities. However, the "*besieged Barre regime resorted to manipulation of identity politics, relying on a small coalition of clans and marginalizing the rest*", setting the stage for a civil war from 1988–1992 (World Bank 2020). This war, which was waged by clan-based militias, resulted in violence

[59] In political theory, cosmopolitism is "*the belief that all people are entitled to equal respect and consideration, no matter what their citizenship status or other affiliations happen to be*" (Britannia 2021).

towards rival clans in the main cities of Somalia, and led to people fleeing to their clan home regions. Looting and destruction was widespread, including the pilfering of underground water pipes (World Bank 2020). Most cities had become the domain of a single clan by 1991, after which internal divisions within clans promoted more warfare, leading to city divisions,[60] or expulsions of those who lost.[61] Meanwhile, some cities were occupied by an outside clan, leading to tensions between armed setters and local populations.[62] Land grabbing was ubiquitous in all of the above settings and some cities are still plagued by property disputes (World Bank 2020).

Unfortunately, this history of distrust, coupled with repeated displacements, presents a major obstacle to the normalization of political and social relations in Somalia; conflict over land in urban areas with increasing land values remains a very contentious issue (World Bank 2020).

5.1.4 Cities Today

Figure 21 shows the location of Somalia's major cities, with a full list of cities in Appendix 2. Today, Somalia's cities "*are the sites of both the greatest wealth and the most enduring poverty and vulnerability; of impressive and inclusive cosmopolitism and entrenched clannism; of the highest levels of security and the most destructive acts of political violence…*" (World Bank 2020).

Currently, for the most part, urban neighborhoods tend to be defined by clan (World Bank 2020). Urban kin concentration provides social safety nets for members, but social mistrust is evident, and interclan interaction opportunities are limited. While genealogical alliances or clans play an important role in Somalia, clan affiliation is not considered to be the root cause of resource conflicts, but rather a tool to obtain the resources necessary for sustaining life and human security (World Bank and FAO 2018).

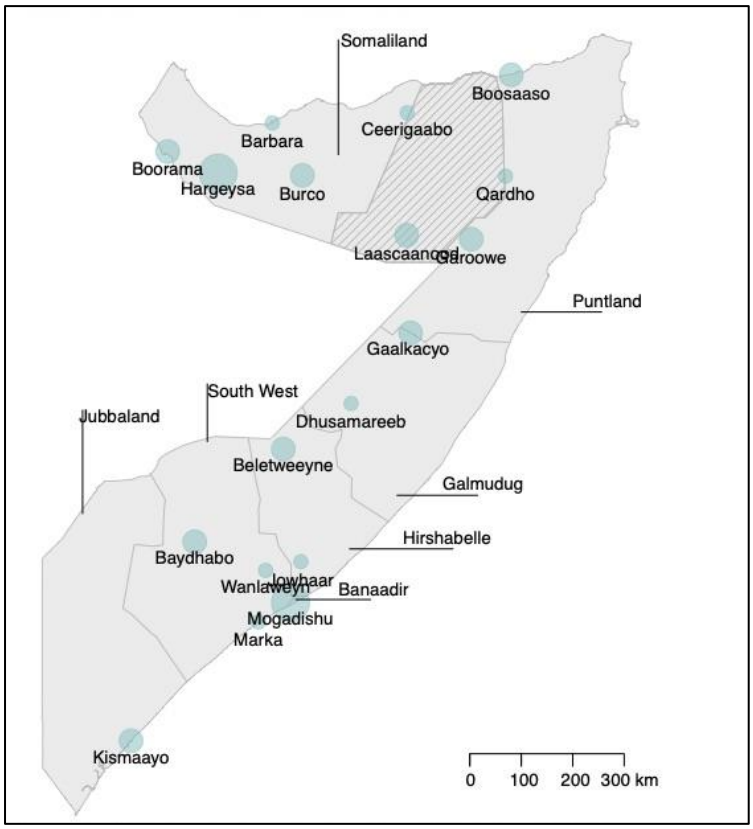
City development and service delivery has been skewed to particular clan enclaves with, for example, one clan providing water in different parts of Mogadishu, with some cross-clan shareholding for additional security. There are also many cross-clan business partnerships across cities, which create mutually beneficial situations (World Bank 2020). Governance, and in particular the hybrid governance of Somali's cities, is discussed in more detail in Chapter 3 in the 'Economics of Water: Digging for Data' report.

[60] That is, Mogadishu, Hargeisa, Galkayo, Beledweyne, and Luuq.

[61] Kismayo.

[62] That is, Baidoa, Merka, Jilib, and Bardhere.

Figure 21. Somalia's Main Cities[63]



Source: World Bank(2020).

Demographic data on Somalia's cities is inadequate, and there is also a lack of clarity with respect to city boundaries (World Bank 2020). Somalia's transition and change relates very much to its city populations. They are not only growing steadily, but have, over the last decades received sudden waves of IDPs from within the country as well as from neighboring Ethiopia. Notably, rapid increases in urbanization puts pressure on scarce land and water resources, which leads to environmental stress (MoEWR 2021). As noted in Section 5.1.3, when conflict breaks out, cities can also witness people fleeing.

Large cities which are close to drought-prone areas, or in regions with other climatic hazards, are most likely to receive IDPs. Understanding such trends may help preparedness for the future. Early-warning tools, such as those by the Food Security and Nutrition Analysis Unit (FSNAU) indicating displacement pressures, have an important role to play. However, in the longer term, broader measures may be required to enable additional services to be rapidly deployed when required. Displacement and IDPs is discussed further in Section 5.5.2.

5.1.5 City Populations

The last published population census was in 1975 and the most recent population survey was undertaken in 2014 (UNFPA 2014). However, given subsequent displacements, projecting urban populations for specific cities is a challenge. World Bank (2020) presents 2015 estimates for 12 cities

[63] The selected cities are those for which there was more than population data, either referred to in the literature, background work or city-level poverty analysis. The size of the circles reflects relative size of cities. Dashed area is contested between Puntland and Somaliland.

from a range of sources (Table 5). Appendix 2 draws together diverse sources of population data, for 46 cities, but provides an indication of orders of magnitude of a dynamic situation, rather than up-to-date stable and reliable figures.

Table 5. Population and City Areas Vary from One Source to Another (2015)

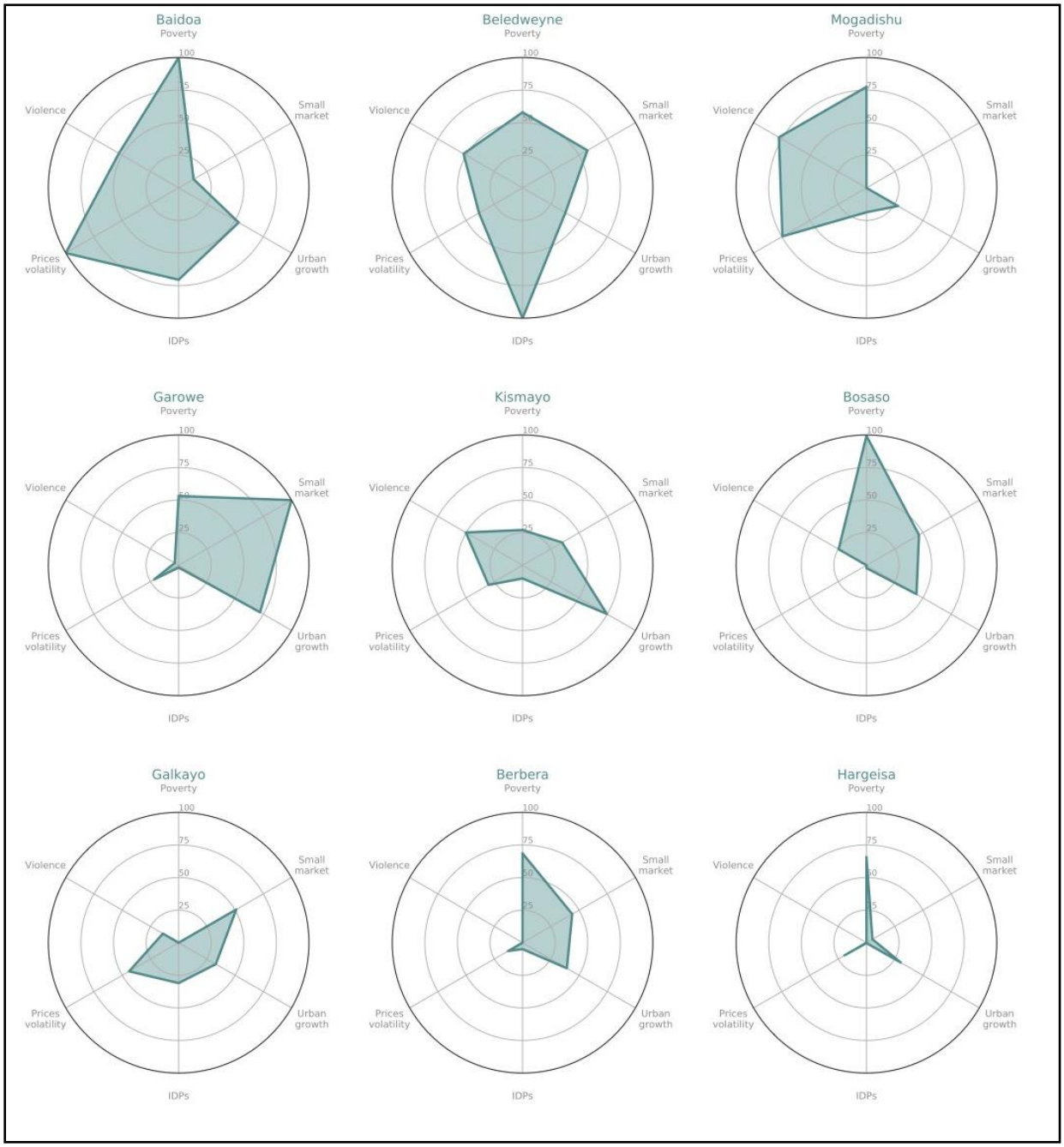
	WSF		AFRICAPOLIS		GHS		TRIPLELINE		OTHER	IDPs (PRMN)
	area (km2)	population	area (km2)	population	area	population	area	population	population	2018
Mogadishu	80.4	2,912,487	148.9	1,712,400	98	1,503,035	116	2,100,000	1,782,796*	550,000
Hargeisa	33.1	1,677,972	58.9	706,400	45	792,311	71.4	800,000	778,960*	21,841
Bosaso	8.3	1,099,209	13.7	116,100	16	223,255	17	350,000	-	11,972
Baidoa	9.4	815,272	18.9	170,200	12	415,899	20	200,000	-	363,000
Galkayo	7.5	441,016	19.3	183,300	17	170,653	16.6	160,000	-	135,000
Beledweyne	9.8	85,987	19.6	176,800	15	100,421	13.5	135,000	-	138,000
Garowe	2.7	444,989	9.7	87,000	9	78,325	7.6	120,000	70-80,000**/ 150,000***	-
Kismayo	7.6	83,949	13.1	104,400	12	191,308	12	120,000	375,479*	107,000
Berbera	3.9	217,585	6.5	39,100	7	72,170	8.3	90,000	392,986*	13,002
Merca	2.8	527,838	3.7	33,300	22	128,180	4.3	40,000	524,271*	-
Jowhar	2.2	478,673	5.1	40,400	-	-	3.9	40,000	-	-
Dhusamareb	1.9	410,049	6.6	23,000	6	91,959	4.4	25,000	-	-

* WUP ** UN-Habitat *** Local Government

Source: World Bank (2020).

Recognizing the importance, and yet fragility, of some Somali cities, the World Bank (2020) analyzed six factors that drive vulnerability for 10 cities, compiling them into a vulnerability index. The cities of Borama, Hargeisa, Berbera, and Galkayo were categorized as less vulnerable; Baidoa, Beledweyne, and Mogadishu were categorized as the most vulnerable, with Kismayo, Garowe, and Bosaso in the middle. These underlying factors for nine cities are displayed in spider diagrams (Figure 22).

Figure 22. Factors Driving Vulnerability for Select Cities



Source: World Bank (2020).

These could help in prioritizing investments by government support agencies, including where and what WASH investments are likely to be the most impactful, not only for economic development, but also for eliminating poverty, reducing inequalities, and ensuring preparedness for IDP populations. For example, given that IDPs contribute considerably to the vulnerability in Beledweyne and Baidoa, solutions for improving affordable access to WASH services could be prioritized. Particularly higher poverty levels in Baidoa, Mogadishu, Berbera, and Hargeisa suggest the importance of pro-poor, equitable WASH solutions. The high urban growth rates for Kismayo, Garowe, and Baidoa indicate the importance of planning services with buffer capacity for the future. Cities with relatively high vulnerability

due to violence—such as Beledweyne, Baidoa, and Mogadishu—may require WASH service provision planning, management, and monitoring to incorporate additional measures to deal with conflicts.

5.1.6 Cities of the Future

The key questions for Somalia are how to develop its cities, including:

- Whether it is actively fostering the development of many cities or enabling the dominance of a few: "*Nigeria and South Africa represent exceptions to this single-city dominance, as they have several large and well distributed urban centers*" (FAO 2015).

- How to allow for repeated influxes of IDPs in cases of drought, some of whom may remain, while others may return to rural areas? And how to support IDPs so that they do not remain worse off than other urban residents in the long-term.

- The landscape and land use within the cities themselves: "*South Africa and Nigeria … [record] the highest amount of impervious surface area (ISA) [West Africa]*" (FAO 2015).

- "*Managing urbanization in Somalia should be a process by which a wide range of formal and informal rules and systems surrounding governance and service delivery incrementally come to have greater coherence, complementarity, credibility, and capacity*". This includes acceptance and buy-in of the state to leverage and partner with "hybrid" governance actors for service delivery (World Bank 2020).

5.2 Water-Related Shocks

Climate, water-related, and environmental shocks in Somalia have all contributed to poverty, displacement, biodiversity loss, and conflict (MoPIED 2020). While periodic shocks can have a tremendous impact, it is extremely important to set these within the wider context of ongoing variabilities of rainfall and surface water, as well as longer-term changes in land use and the environment. Groundwater will become increasingly important for building resilience in Somalia, notwithstanding challenges with respect to its quality and exploitation.

5.2.1 Water Resources

Rainfall

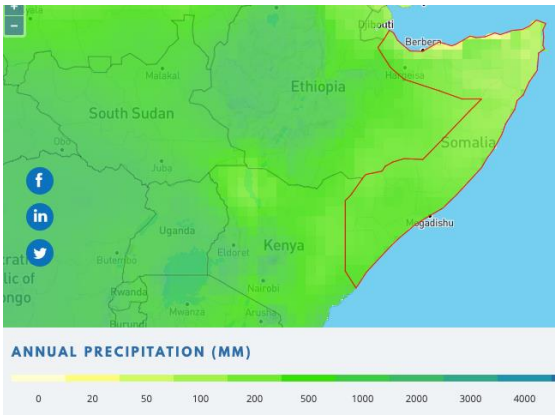
Somalia has hyper-arid as well as arid to semi-arid climates, with only two areas receiving rainfall ranging between 400–600 mm:

- River valleys areas of Shabelle and Jubba; and

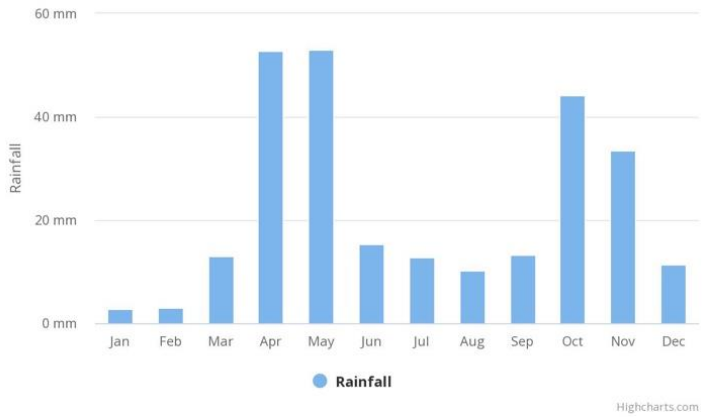
- A small area in the Northwest—the Adwal region.

Somaliland, Puntland, and the central rangelands of Southern Somalia receive about 100–200 mm of annual rainfall (Figure 23). Somalia's bimodal annual rainfall pattern comprising the *gu* rains, the *haggai*, the *deyr* rains and the *jilaal* dry season is visualized in Figure 24, is and illustrated in Figure 23 by average monthly rainfall figures. Isolated rain showers also occur in the coastal areas south of Mogadishu in July to August (Xagaaye season). The varied and high intensity rainfall in the Jubba and Shabelle catchments beyond Somalia's borders in Ethiopia affect the flows of Somalia's two perennial rivers (discussed below).

Figure 23. Rainfall in Somalia



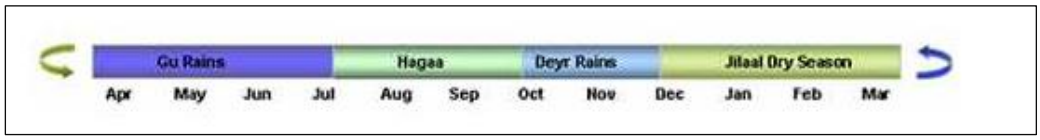
(a) Average annual rainfall of Somalia for 1901–2016.



(b) Average monthly rainfall of Somalia for 1901–2016.

Source: World Bank (2021a).

Figure 24. Bimodal Rainfall in Somalia



Source: FSNAU (2021a).

Weather conditions in Somalia are highly variable and localized during the year and from one year to the next. These obscure the accuracy of short-term seasonal weather forecasts and understanding of long-term climate changes. Across the Horn of Africa, weather phenomena have become increasingly unpredictable in recent decades. While historical trends suggest that climate conditions in the region are becoming drier, more erratic, and more extreme (World Bank and FAO 2018), most climate models predict that the area will become wetter in the future (World Bank and FAO 2018).

Surface water

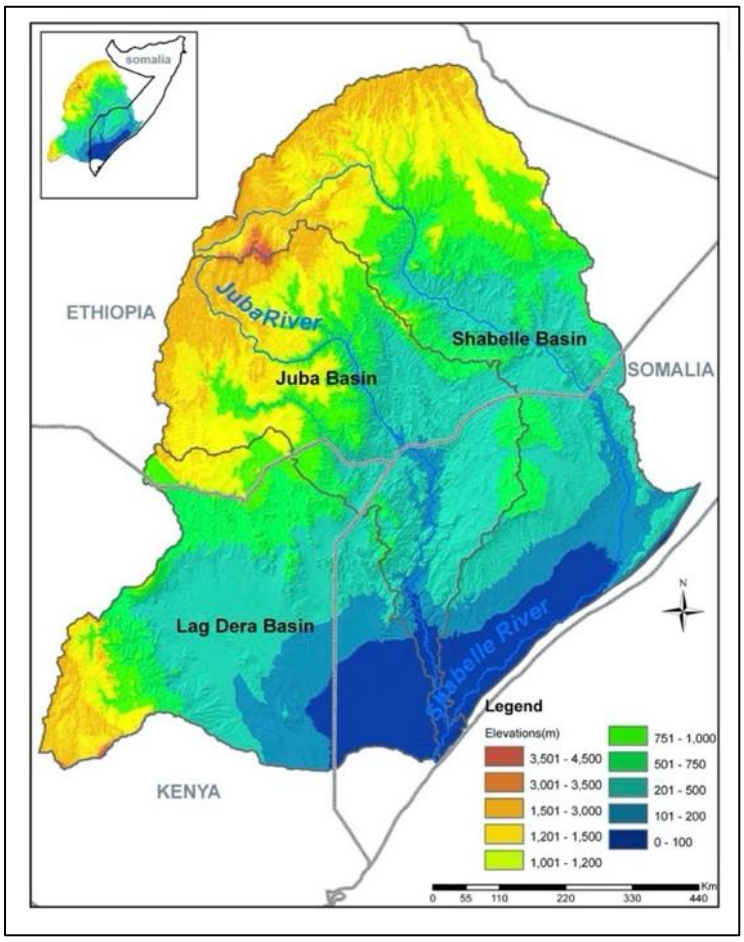
Somalia has two perennial rivers. The total length of the Jubba river[64] is about 1,808 km, of which 804 km lies in Ethiopia and 1,004 km in Somalia. The main course of the Shabelle river from the source to the Somalia border is about 1,290 km, before it traverses 1,236 km until it meets the Jubba river (Figure 25). As flows move downstream, the reductions in the Shabelle River are higher than the Jubba, due to more consumptive water use and more over bank spillage (Basnyat 2009). Institutions and infrastructure to manage the water resources of these two rivers are lacking (Basnyat 2009).

Both rivers experience high seasonal and annual flow variation, as illustrated for the Shabelle by high and low flows in 1977 and 1973 respectively (Figure 26). The effect increases with downstream location. During the highest water flows in the wet growing seasons, the rivers frequently break through their embankments, causing major flooding which can affect adjacent villages and beyond. In the *jilaal* season river flow volumes reduce significantly. In February and March 2016 and the same months in

[64] Known in Ethiopia as the Genale Dawa river.

2017, as well as in early December 17 to mid-March 2018, some sections of the Shabelle dried up completely (Reliefweb 2018).

Figure 25. Map Showing Elevation Variation of Jubba, Shabelle, and Lag Dera Basins



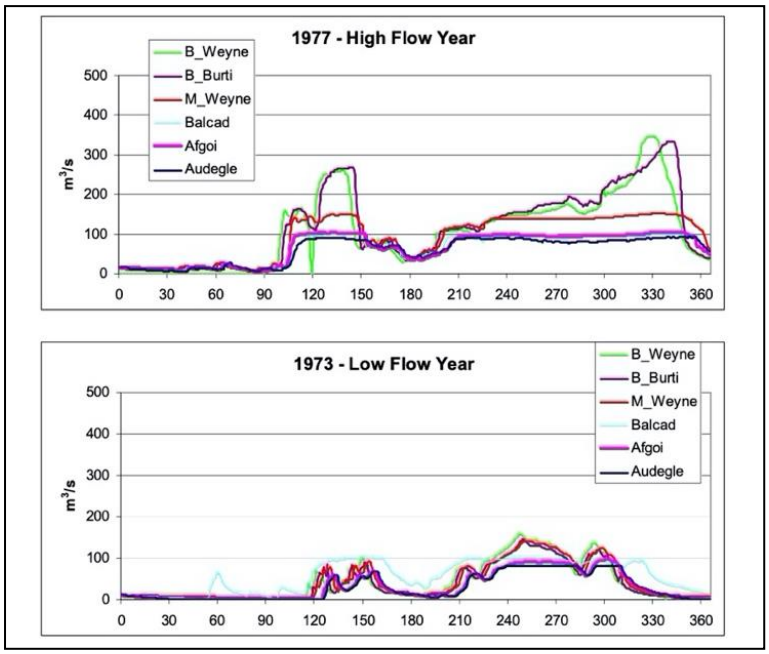
Source: Basnyat (2009).

"Rivers in northern Somalia, and in areas other than the Jubba and Shebelle Valleys, are ephemeral with water flowing for very short periods during the seasonal rains. Following seasonal rains, water infiltrates into shallow aquifers that last for only a few months of the year" (World Bank 2019b).

The swamp areas (wetlands) fed by the Shabelle River would have high ecological value in terms of habitat for flora and fauna, and provide recharge areas for aquifers in the area. Unfortunately, no data is available on these swamps. It could, however, be safely said that the swamps sustain the freshwater available in the aquifers which meets the water needs of coastal towns and settlements in the south. Further study would, however, be required to assess the hydro-geological conditions of the area.

Somalia's wetlands and mangroves also provide unique ecosystems for coastal vegetation (MoEWR 2021). Varying changes in receiving water quality, for example if more water is abstracted upstream for development, could adversely affect these unique ecosystems.

Figure 26. Flow Hydrographs for Selected Years for the Shabelle River



Source: Basnyat (2009).

Groundwater

The buffer capacity of groundwater and its resilience to rapid impacts means that people in water-scarce areas will increasingly depend on it, particularly in the face of climate change (WWQA 2021). However, all over the world, groundwater faces threats from agricultural intensification, urbanization, population growth, and climate change.

Despite widespread groundwater use in Somalia, providing an estimated 80 percent of domestic water supplies, groundwater resources are typically considered as being difficult to identify and access, with deep water tables at 100 to 300 m and often of poor quality, including high salinity in most parts of the country (MoEWR 2021). Somalia's shallow aquifers are fed annually by seasonal, infiltrating surface water, and in the case of sand dams and other infrastructure recharge can be enhanced.

Groundwater quantity is discussed in detail in the 'Economics of Water: Digging for Data' report. Groundwater water quality considerations pertinent for Somalia relate to salinity, fluoride, and microbiological contamination as outlined below.

In general, salinity occurs due to irrigated agriculture, overpumping and mobilizing geologically old saline water, seawater intrusion into coastal aquifers and hydrocarbon production (WWQA 2021). Excessive irrigation and shallow groundwater can exacerbate groundwater salinization due to salt accumulation, which is subsequently leached into groundwater (MacDonald et al. 2016; Zhang et al. 2014). Information and data on salinity in Somalia is summarized in Box 10, which illustrates the districts most affected, as well as significant data gaps.

While the intake of small amounts of fluoride is necessary to control dental caries, excessive amounts provoke caries and stain tooth enamel. With concentrations over 1.5mg/l, dental mottling and

severe osteoporosis can occur, with skeletal fluorosis occurring with fluoride intake of 3 mg/l over several years[65] (Faillace 1998).

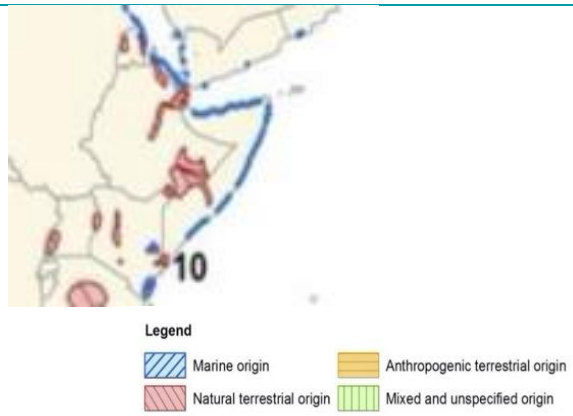
It has been suggested that cases of dental affecting people from Central and Northern Somalia was due to excess fluoride in drinking water (Faillace 1998). High fluoride concentrations have been found in water samples from shallow and deep wells in northern, central and Southern Somalia, but the scattered, often unreliable information on fluorides content did not enable a clear picture to be drawn about the extension and severity of the problem of fluorosis in the country (Faillace 1998). Figure 27 shows probabilities of fluoride concentration in Somalia. There may also be a correlation between high salinity and fluoride, although the evidence of this is not conclusive (Appendix 3).

[65] Symptom severity also depends on other factors including nutritional deficiencies and the chemical composition of the water.

Box 10. Salinity of Groundwater in Somalia

Global assessments of salinity at shallow and intermediate depths indicate that the extent in Somalia is limited to coastal regions and hotspots in central and Southern Somalia (figure at right).

This figure shows the occurrence of saline and brackish groundwater at shallow and intermediate depths (van Weert 2012).



Analysis of in-country data on salinity from the SWALIM database (figure at right) indicates that high salinity (Electric Conductivity [EC] over 3,500µS/cm) is found in 75–100 percent of boreholes in at least two districts, and in 50–75 percent of boreholes in another three districts, with limited data for some districts, particularly in the south and northwest. This figure also shows shaded areas in middle Somalia where boreholes experience high salinity but concentrations are not known.

The figure also shows occurrence of salinity measured in boreholes with over 3,500 500µS/cm data for cases with more than eight measurements, detailed in Appendix 3 (*Source:* Analysis of SWALIM Database of Dec 2020).

Key:
Percentage boreholes with salinities (in electrical conductivity or EC) higher than 3500 µS/cm

- 0 - 25 %
- 25 - 50 %
- 50 - 75 %
- 75 – 100 %

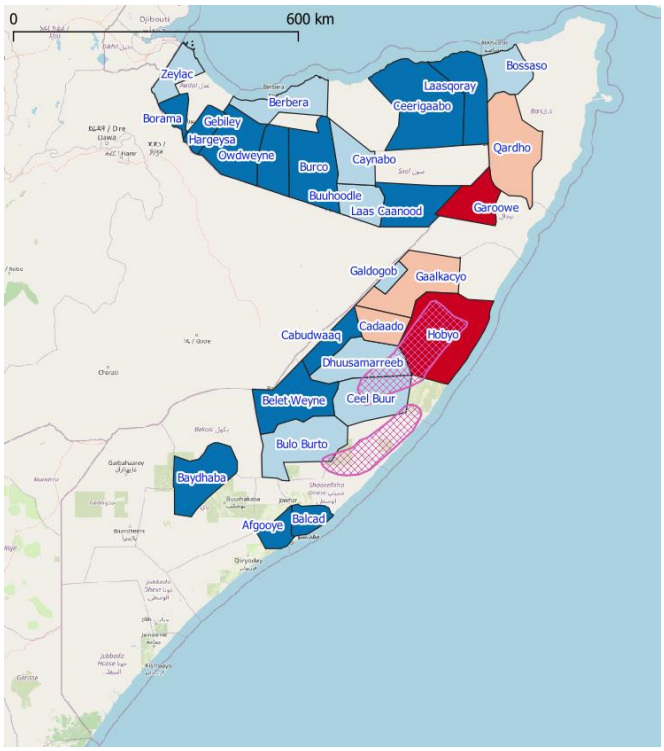
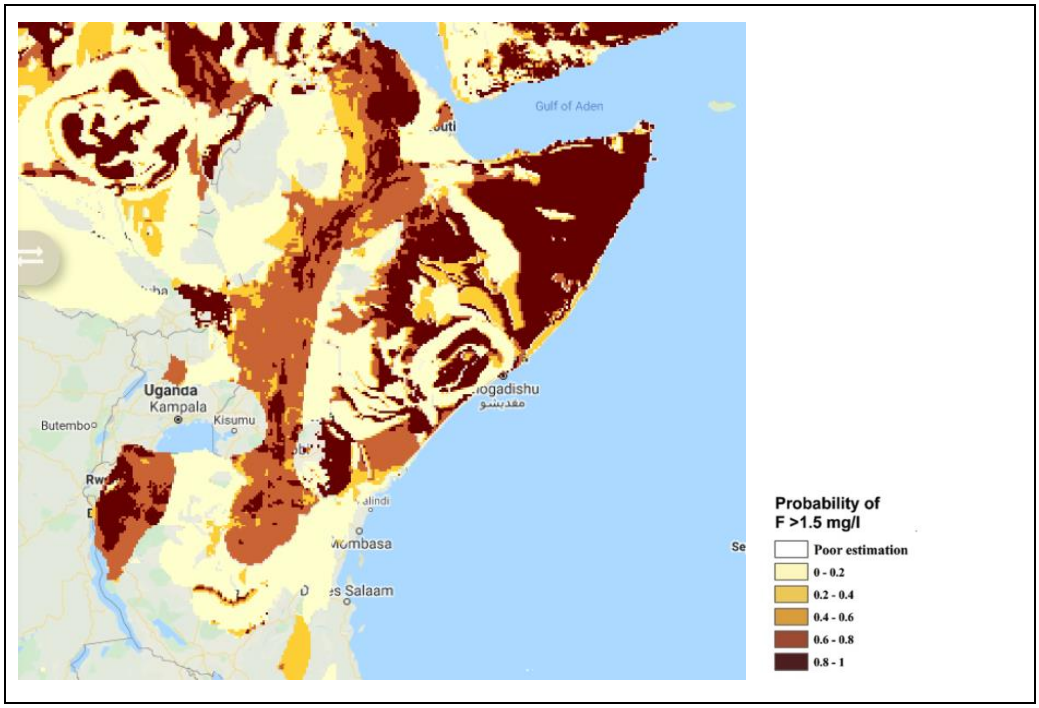


Figure 27. Probability of Fluoride Concentration in Groundwater Exceeding the WHO Guideline of 1.5 mg/L



Source: Amini et al. (2008).

Microbiological contamination: Globally, an estimated 35.2 to 59.4 million cases of acute gastrointestinal illness per year could be attributed to the consumption of groundwater—microbe pollution is common in private household wells, which are often shallow, poorly located and poorly constructed, and lack water treatment (Murphy et al. 2017). While access to deeper boreholes provides some protection, it does not guarantee that water will be free from fecal contamination (Bain et al. 2017). Contamination is often driven by poorly constructed or unmaintained groundwater sources (Pedley and Howard 1997; Sorenson et al. 2020). Even if water sources are free from contamination, poor collection and storage practices in the home can result in contamination before consumption.

As private wells and boreholes are constructed for individuals and firms, coupled with inadequate treatment and disposal of wastewater, city aquifers in Somalia are at risk of pollution (and exhaustion). In Mogadishu, for example, septic tanks are used by the majority of households to dispose of waste, exposing the aquifer to contamination.

Globally, nitrate (NO_3) is the most ubiquitous nonpoint source of groundwater pollution, driven by intensive agriculture involving fertilizer applications. However, due to the slow movements of groundwater flow, the impact of nitrate pollution in groundwater and rivers sustained by baseflow may be delayed for decades (Ascott et al. 2017). Nitrate/nitrite is associated with methemoglobinemia in bottle-fed infants (WHO 2017). Data on nitrate in groundwater in Somalia has not been found.

5.3 Land Use Change

While climate change is no doubt having an effect on the environment, lives, and livelihoods of Somalia and will continue to do so in the future, the phenomenon of droughts and floods in the country is centuries old. Climate change, the political situation, and security problems all contribute to Somalia's humanitarian crises but land use change is another very important factor.

In the Sahel, analysis of vegetation cover found that anthropogenic degradation is relevant to explain the magnitude of 20th century Sahelian droughts (Hein and De Ridder 2006). This may also be the case for Somalia.

There are tensions between the need to enable the natural environment to absorb and buffer the effects of floods, with ongoing exploitation of the environment for economic and human development. Cases in point are all remaining forests, including juniper trees in the northern Golis mountains, tropical vegetation along the Jubba and Shabelle rivers and on their adjacent floodplains, and mangroves along its coast. These are all facing increased pressure of commercial exploitation (MoLFR 2019). The related progressive destruction of plant life has already impaired animal habitats and reduced forage, affecting Somalia's wildlife and its greatest food resource, its livestock (MoLFR 2019).

As noted in Section 4.3, by the end of the 1980s, virtually all of Somalia's floodplain forests had been cleared for irrigated agriculture production (MoLFR 2019). In fact, since the 1980s, 85 percent of Somalia's forest cover, which used to cover 62 percent of land area, has been lost. Deforestation, land degradation, and soil erosion not only reduce access to good quality pasture but can also magnify the severity of the effects of frequently recurring natural shocks, such as drought and floods.

The Government of Puntland has been undertaking environmental rehabilitation efforts since the Ministry of Environment was established in 2009 including: soil and water conservation; gully control; sand dune fixation; reforestation; rainwater harvesting—development of water infrastructure (for example, subsurface and improved earth dams); environmental protection—including rangers reporting to district environmental offices and the establishment of District Pastoral Associations and Village Environmental Committees[66] to raise awareness and training, as well as to reforest and rehabilitate rangelands. Given the importance of finding a balance between the natural environment and human development, it is worth investing significantly to understand the outcomes and lessons learned from these endeavors.

5.4 Risk Events

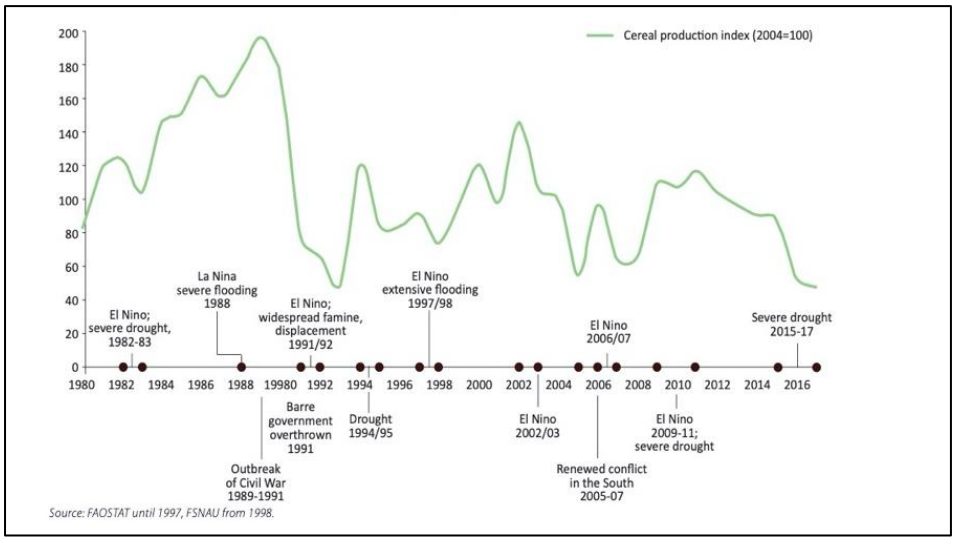
Whereas droughts pose a risk to agriculture, floods can also cripple crop and livestock production. Figure 28 shows the risk events affecting agriculture in Somalia between 1980 and 2017,[67] during which eight major weather events affected cereal production.

Of all the natural disasters occurring in Somalia between 1999 and 2017, droughts have led to the most deaths (an estimated 39,673), followed by bacterial disease epidemics (5,597), and floods (2,814) (World Bank 2017).

[66] In local governments of Qardho, Eyl, and Galkayo and to all communities across Puntland.

[67] For a longer timeline, extending from 1943, see http://sdri.so/somalia-disaster-time-line/.

Figure 28. Risk Events Affecting Cereal Production in Somalia, 1980–2017



5.4.1 Droughts

"Droughts are defined as periods of precipitation anomalies of three to five months" (World Bank 2020). Droughts occur regularly in Somalia, at intervals of two to three years in the *deyr* rains (October to November) and eight to 10 years in both seasons (UNDP 1987). There were at least 14 drought events between 1960 and 2014 (Masih et al. 2014).

"*Mobility of pastoralists and their herds has been a core coping strategy for localized droughts for generations. However, if the frequency of severe droughts is high, rangelands have less time to rebound and recover*" (MoLFR 2019). Climate shocks also facilitate a transfer and consolidation of animal stocks from poorer households to wealthier households (Catley 2017). *"…pastoralist and agro-pastoralist livelihood systems have been weakened by repeated drought and ongoing conflict … [becoming] extremely vulnerable"* MoPIED (2020).[68]

It is believed that the decision to migrate is made very rapidly after crops start to fail (World Bank 2020), although more work is needed to better understand this. "*During the 2016-2017 drought, famine was only narrowly averted in the worst hit areas of the north of the country and of the southwest of the country"* (MoPIED 2020).

5.4.2 Floods

Heavy rains, mainly in the Eastern Ethiopian highlands, raise river water levels, often resulting in floods (UNPFA 2016). Periods subject to extreme El Niño Southern Oscillation (ENSO) variations are often associated with heavy rainfall and widespread flooding. Floods are mainly experienced in the riverine and agro-pastoral zones along the Shabelle and Jubba rivers (OCHA 2013). High floods deposit nutrients in the flood plains and provide opportunities for flood recession cultivation, but uncontrolled flood water destroys infrastructures and inundates scarce cultivated land and settlements (Basnyat 2009).

[68] "*In addition, projects such as the Melka Wakana dam and hydroelectric power station, and other more recent projects in the Shabelle River, affect the lives of Somali agro-pastoralists on the other side of the border*" (MoPIED 2020).

Human intervention in natural drainage systems can cause waterlogging or flooding by river water. Clearing of vegetation and debris in the riverbed reduces the natural ability of rivers to slow down flowrates (Monbiot 2014). Waterlogging can be caused by a rising water table (for example, due to construction of reservoirs or irrigation). It is estimated that waterlogging constitutes 1.5 percent of the nonerosion soil degradation threats in Africa (FAO 2015).

Prior to the civil war outbreak in the early 1990s, embankments protected low-lying areas along the river in the Middle Shabelle Region from flooding. These were maintained annually during the dry season. River gauges[69] monitored water flow and enabled early flood warnings to be issued (World Bank and FAO 2018). Insecurity in Southern Somalia during the civil war has affected farming and contributed to the damage and decline of irrigation and flood control infrastructure and roads, as well as hampering and market access.

In the northern regions, infrastructure has been largely rehabilitated and, in some cases, expanded. Although in better shape than in Southern Somalia, it is still inadequate. Since late 1990, there have been almost no major repairs of the flood control, irrigation, and road infrastructure in Southern Somalia. The few modest rehabilitation efforts—including through cash-for-work approaches by the FAO and NGOs with donor support—have had very little impact (World Bank and FAO 2018).

A lack of data on the situation before the flood control and irrigation infrastructure started to be developed from the 1920s onwards makes it quite difficult to see beyond such infrastructure as a solution. However, Basnyat (2009) found that the flood volumes from high flows were not very big compared to the catchment areas of the two rivers and concluded that flood problems have been aggravated by human and natural actions (Box 11).

Box 11. Natural and Human Actions Aggravating Flood Problems along the Shabelle and Jubba Rivers

The vulnerability of communities to flood problems, even during normal or small peak flows, have been aggravated by the following natural and human actions along the Shabelle and Jubba rivers:

- Natural flood plains being encroached/unregulated settlement in the flood plains.
- Riverbed levels rising higher than adjacent land due to sediment deposition.
- Breaching levees to irrigate land in dry seasons.
- Unplanned closure/opening of natural flood relief channel.
- Breakdown of the existing irrigation infrastructure.
- Absence of central or local governance managing the river basin.

Source: Basnyat (2009).

[69] In Mustahill, Ethiopia, and in Beledweyne, Bulaburde, MahaddayWeyne, and Jowhar.

A recent flood analysis by SWALIM indicates that flood frequency and intensity in the last 10 years along the riverine areas of Jubba and Shabelle rivers has increased (SWALIM 2020). In 2020, the three consecutive flood seasons (*gu*, *haggai* and *deyr*) resulted in thousands of hectares of cropland inundated for more than six months impacting negatively on food security (SWALIM 2020). The scale of the flooding was considerable (Box 11).

Box 11. Example of 2020 Flooding in Jowhar, Balcad, and Afgooye Districts

Flooding affected 10,474 households, with about 72,000 hectares of cropland submerged. Ninety-three weak/open river points were identified as follows:

- Jowhar district—45 points:
  - Four open points* with widths of between 2 m to 20 m.
  - 41 were overflows,** with the longest being 890 m.
- Afgooye—20 points:
  - With very expansive overflows of up to 1 km in some areas.
  - This was the worst impacted district with majority of the riverine communities having been displaced for several months.
- Balcad—28 points:
  - Parts of the flooded areas remained under water from May 2020 at least until December 2020 when the report was published.

SWALIM sought to build a culture of safety and flood resilience among the vulnerable communities in the three districts by creating awareness on best practices on flood preparedness before, during, and after the hazard. Nearly 4,500 flood preparedness leaflets were distributed through meetings and in collaboration with the local authorities.

Note:

* Open points are those whose banks have been cut either deliberately or by raging waters.

** Overflows are points that have caused flooding by overbank spillage.

Source: SWALIM (2020).

Widespread flooding also provides ideal conditions for transmission of the mosquito-borne virus that causes Rift Valley Fever. Somalia also suffers from repeated cholera epidemics:

- The 2016 epidemic was attributed as: “uncontrolled population movement, flooding, poor access to water and sanitation, poor hygienic behavior and limited access to health services have contributed to the spread of the cholera epidemic”.
- The current cholera outbreak started in December 2017 but was still ongoing in February 2021. It broke out following floods in the basins of the Jubba and Shabelle rivers. Although it was contained in five of the six regions, active transmission was still reported from Benadir.

- "Flash floods caused by heavy *gu* rains in April 2020 led to the contamination of water sources that led to an increase in the number of cholera cases" (WHO 2021).

Flooding tests short-term emergency response efforts. However, a much greater challenge is presented by flood prevention and mitigation of its effects, particularly trying to deal with the complex causes that aggravates flood effects in the first place.

5.5 Resilience

5.5.1 Pastoral Traditions under Threat

Centuries-old pastoral practices that cope with climate variability by pastoral communities, include moving livestock and families, keeping diverse animal species, reciprocal arrangements with other pastoralist groups for access to pasture and water, water conservation techniques, sharing information on early signs of impending drought, and alternative livelihoods (MoLFR 2019). Increasingly, pastoral mobility, a traditional strategy, is changing and is under threat, undermining the resilience of pastoral systems.

A rapidly growing number of nomadic communities are building private enclosures, often on large tracts of land close to urban centers. Thus productive, once-open grazing areas, including those in fertile depressions that benefit from floods and slowly receding water to regenerate grasses and shrubs, are being fenced for rainfed crop or fodder production during the wet season and for semi-permanent living settlements. Grazing on these areas in the dry seasons or at times of drought by others is being forbidden. This has significantly reduced communal grazing areas and has hampered the movement of livestock along the routes used by pastoralists searching for potential pastures in other areas. The issue has become increasingly contentious, especially in Somaliland, where the authorities and elders describe it as a new and very serious source of conflict and insecurity (World Bank and FAO 2018).

Satellite livestock management involves families in permanent, or semi-permanent households, engaged in agriculture, with male family members migrating with herds for pasture and water (FSNAU 2012). Splitting the family is a survival mechanism (Gardner 2004).

5.5.2 Displacement and IDPs

Around 31 percent of the Somali households that moved between 2004 and 2014 relocated due to drought, the second reason after security[70] (UNFPA 2016). Sometimes women and children from rural areas move to an IDP camp to access resources and for security, while men migrate to urban centers in search of economic opportunities (World Bank and FAO 2018).

While most IDP movement has been to the larger cities, including Mogadishu, Bosaso, Hargeisa, Berbera, Baidoa, and Kismayo, IDPs typically move to nearby cities (World Bank 2020). Returnees and refugees from neighboring countries are believed to primarily settle in cities. IDPs tend to move from rural areas into IDP camps, which are increasingly concentrated at the edge of cities, beyond the reach of infrastructure and basic services. In Mogadishu, for example, of the 400,000 IDPs profiled, more than half lived in the city outskirts of Daynile and Kaxda (World Bank 2020). Within cities, there has also been forced eviction from older IDP camps. Most IDPs do not have security of tender on the land on which they reside (World Bank 2020).

[70] Correlations between migration flows and violence at origin and destination might not be adequate to understand how conflict affects migration (World Bank 2020).

Quantifying the exact number of IDPs in Somalia is difficult. While it is estimated that cumulatively, from 2007–2018, 4.5 million people have been forcibly displaced (Figure 29), data collection mechanisms only capture populations and do not count stock, track the return of IDPs or count integration into host communities (World Bank 2020). This lack of data, coupled with uncertainly about populations in the future, presents challenges for planning and delivering services.

There are examples of IDP movement impacting dramatically on the form of cities, such as in Kismayo, where the IDP-occupied area increased sevenfold between 2013 and 2017, and a tripling in Baidoa. In 2019, Galkayo is estimated to host approximately 135,000 IDPs in over 70 settlements, and thereby tripling in size since 1985. Such changes can be long-lasting (World Bank 2020).

Urban IDPs tend to be worse off than the rest of the urban population, with a likelihood of being deprived for their former livelihood assets and social networks as well as having more limited access to services (Figure 1, Figure 2, Figure 3, and Figure 4) (World Bank 2020). They are also educationally disadvantaged, which may prevent them from accessing good jobs. IDPs supply manual labor in nearby towns and throughout the country, with some, especially those originating from the south, working on small and medium-size farms in the northern regions, thus contributing to the establishment and growth of irrigated agriculture (World Bank and FAO 2018).

5.5.3 Other Coping Strategies

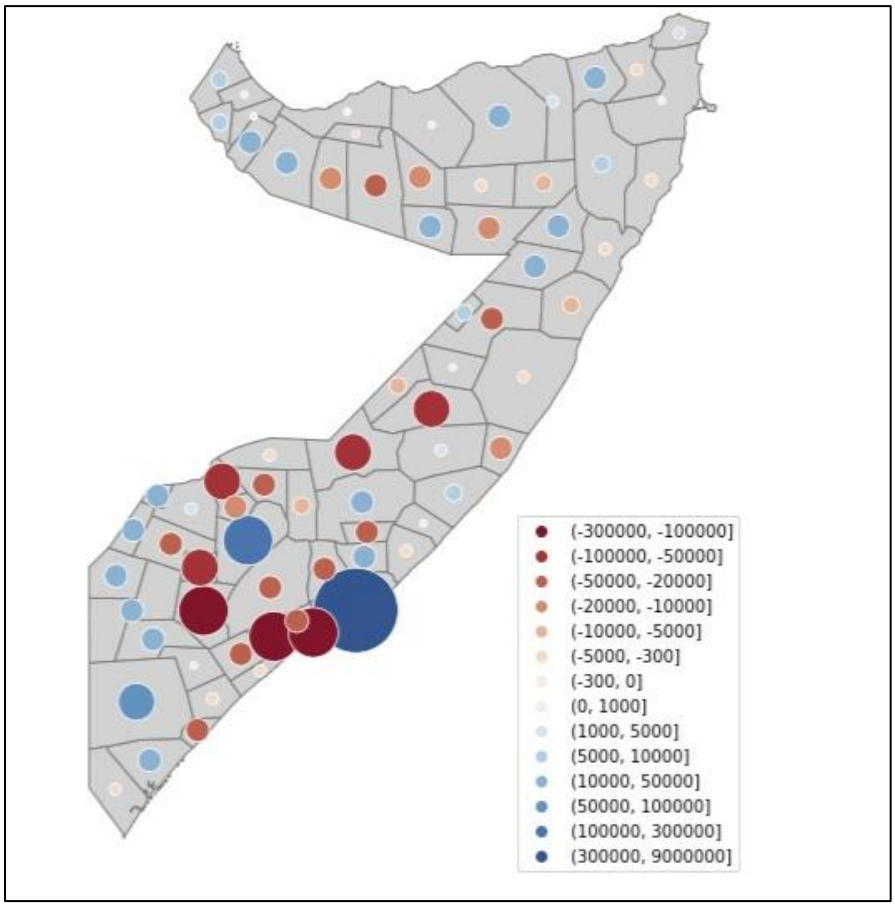
There are numerous strategies practiced in Somalia to deal with water-and environment related shocks including:

- **Water tankers for livestock:** As a way of coping with poor water and road infrastructure, livestock survival during severe droughts has become dependent on very costly and often unaffordable privately-owned water tankers (World Bank and FAO 2018). The World Bank-funded WALP project constructed seven sand dams in Somaliland and Puntland. Water truckers present a significant threat in some areas; the uncontrolled withdrawals by water truckers may deplete the reservoir and rob local communities of access and utilization of the resource (World Bank 2019c).

- **Humanitarian assistance:** Since the end of Somalia's 2011 famine, approximately US$4.5 million has been spent in emergency response in the country (World Bank et al. no date). As discussed above, there are large numbers of IDPs in the country but reliable estimates of stock and returnees are lacking. Moving from rural areas to IDP settlements where humanitarian assistance is provided in times of droughts and floods has become a coping strategy.

- **Joint emergency response:** In February 2017, the Somali President declared a severe nationwide drought and state of national disaster, due to two consecutive seasons of drought. National and international partners collectively responded, scaling up life-saving assistance throughout the country and preventing famine. Local partners comprised communities, civil society, youth groups, the diaspora, the private sector, local and national authorities. While famine was averted, malnourishment was widespread.

Figure 29. Cumulative Net Migration Per District over Selected Years (2007–2018)



Source: World Bank (2020).

- **Private sector:** With lack of restrictions on capital transfers, and low barriers to market entry, Somali's private sector is growing with respect to commerce and private goods.

- **Remittances from diaspora:** These are used mostly for food purchases and are estimated to account for 60 percent of average annual household income, and are a vital contributor to food security and for household resilience during crises (World Bank and FAO 2018).

Indexed agricultural insurance has been introduced, mostly as pilots in other parts of SSA including Kenya (World Bank n.d.), and studies have been undertaken on the feasibility of index-based livestock insurance in Ethiopia and Niger (Zewide et al. 2020; Fava et al. 2018). While this has not been undertaken in Somalia to date, it may be something of interest in considering, or even piloting, in the future.

5.6 Climate Change

Historically in Somalia, rainfall is variable in space and time. However, there is *"no consensus … over whether the Horn of Africa will experience more or less rainfall in coming decades. However, all studies and projections by climate scientists agree on a warmer future, with increased variability and frequency of extreme rainfall events, with related cycles of intensified floods and drought*" (MoLFR 2019). Even if wetting would provide benefits for agriculture, this may be offset by temperature increases (MoLFR 2019). Higher air temperatures will increase evapotranspiration, while more variable

and extreme rainfall on barren soils may reduce spatial infiltration and facilitate more runoff and erosion, resulting in less groundwater recharge and surface water for plant growth (MoLFR 2019).

Other likely impacts include reduction of vegetation for grazing and more variable water availability, with grave impacts on livestock herding and related livelihoods. Rising sea temperatures and acidification will also reduce fish stocks and change their distribution (World Bank and FAO 2018).

"Water demand management is a useful and more immediate response to climate variability in comparison to developing climate resilient water infrastructure given the capital intensive and long- term lead time required for implementation. Sustainable water demand management options such as water conservation, water efficient agricultural practices, curbing nonrevenue water, and water reuse can be explored" (MoEWR 2021).

The effect of land degradation on the release of carbon into the atmosphere is discussed in Section 3.1.

5.7 Recommendations

In Somalia, the "*cycle[s] of natural resource degradation and poverty are linked and without meaningful intervention to break this cycle, the impacts on communities, on levels of conflict over resources and local economies could be devastating"* (MoEWR 2021).Going forward, there is need to identify priority areas for action that not only respond to immediate needs, for short-term economic development but also to lay a solid foundation for longer-term economic and human development and building resilience.

Ideally, integrated planning should take place between sectors including energy, agriculture and food security, health and hygiene, the management of disasters and more, alongside "vertical" planning between different levels of government and different spatial scales (MoEWR 2021).

Four potential investments to address the transitions of urbanization, water-related shocks, resilience, and climate change relate to:

- Facilitating water supply infrastructure planning, development and management catering for vulnerable urban contexts with hybrid governance (for example, transition management).
- Piloting locally-based Natural Resources Management and Water Resources Management, including soil rehabilitation.
- Researching viable flood mitigation and drought resilience measures, including forest stewardship.
- Supporting research and development of climate-resilient water and sanitation technologies and management techniques.

Appendix 4 sets out select investments which have led to resilience to water related shocks in in similar climatic and socioeconomic contexts, and are well documented.

Appendix 1. Compilation of Data on Water Access and Supplies

Table A1.1: What is Documented About Water Supplies in Cities?

	Water Supplies		Comments	Plans
City (Reference)	**Piped Infrastructure**	**Non-Piped Supplies**		
Afgooye				
Baardhere				
Baidoa*				
Baki*				
Bandarbeyla				
Bargaal				
Beledweyne*				
Berbera* World Bank (2018a)	Six boreholes (two of which were dry in 2018) feed two reservoirs (150 m^3 and 4,000 m^3)—producing 1,800 m^3/d. 300 m^3 steel tank served by gravity exists but is not functioning. <50% household connections.		Boreholes drawing from the Fara Dero well field. 3.5 million cattle per year transit through Berbera. Water demand distribution: domestic (3,000 m^3/day), livestock (3,500 m^3/day), commercial (800 m^3/day), public uses (400 m^3/day), port (400 m^3/day), firefighting (200 m^3/day), industrial (800 m^3/day), other uses (200 m^3/day), network losses (500 m^3/day). Present water demand is 9,500 m^3/day during the summer season, which drastically reduces in the winter (for livestock and human consumption). Good water quality but some of sources are relatively saline (TDS >1 g/l) and rich in sulphates (content higher than 0.25 g/l). A few cases of cholera have been recorded in the area in 2017.	Investment plan prepared for short/emergency, medium and long term actions

	Water Supplies		Comments	Plans
City (Reference)	**Piped Infrastructure**	**Non-Piped Supplies**		
			Some of the piped network (built over 145 years ago) contains asbestos.	
Bereeda				
Borama **World Bank (2018a)**	Three aquifers provide the water supply producing 4,000 m^3/d. <60% household connections.	Insignificant contribution from trucking companies.	SHABA Co run the system. The three aquifers are overexploited. Safe yield is half of withdrawals, with the water table dropping steadily. There is mention of a UNICEF Reservoir- Water is saline (TDS >1 g/l). The existing piping system is affected by rust. A few cases of cholera recorded in the area during in 2017.	Investment plan prepared for short/emergency, medium- and long-term actions
Bosaso* **World Bank (2018b)**	14 boreholes excavated in 2 nearby aquifer zones—a 500 m^3 elevated tank and a 1,000 m^3 semi-buried storage tank which is currently nonoperational.	Private companies manage and truck water from 18 additional wells located in the vicinity of the city.	Bosaso Water Agency (GUMCO) operating under lease contract.[71] Water is unevenly distributed among rich areas and poor areas and some portions of the city, such as the western quarters, are not served at all. Water is generally saline near the coastline (TDS >2 g/l) and of good quality everywhere else. Overexploitation of the privately-owned wells caused many of them to run dry and/or become saline. A few cases of cholera were recorded during the past year	Investment plan prepared for short/emergency, medium- and long-term actions.
Bu'aale*				
Burco/Burao* **World Bank (2018a)**	9 municipal wells, many of which are not correctly gravel-	Numerous private boreholes in the farms surrounding the town.	Water is generally saline (TDS ranging between 0.8 and 6 g/l).	Investment plan prepared for short/emergency,

	Water Supplies		Comments	Plans
City (Reference)	**Piped Infrastructure**	**Non-Piped Supplies**		
	packed and have not yet been fully developed. About 80% of the town is supplied by the Burco Water Agency—piped water and trucking service, the daily production is about 3,700 m^3. Al Nafoora Company (7%) and MAAXDA Bottling Company (4%) provide water by a buried piped network and trucking service. <50% household connections.	On the riverbanks there are numerous hand–dug wells to water cattle and the poorest areas of the city. .	A few cases of cholera have been recorded in the area in 2017.	medium- and long-term actions.
Buulobarde				
Buurhakaba				
Cadale				
Caluula				
Ceelbuur				
Ceeldheer				
Ceerigaabo*	Water is currently provided by 4 main wells able to yield up to 2,350 m^3/day. Production is 1,000 m3/d. <50% household connections.		The system is broken into two subsystems, both of which are in severe need of repair. The waters produced by shallow wells and springs are saline (TDS> 3 g/l). The water supplied in the town by the deeper boreholes is good quality for human consumption (TDS <1 g/l). No cases of cholera recorded in the area during in 2017.	Investment plan prepared for medium- and long-term actions.

	Water Supplies		Comments	Plans
City (Reference)	**Piped Infrastructure**	**Non-Piped Supplies**		
Dhusamareb*				
Eyl				
Galkayo* **World Bank (2018b)**	Water distribution system with 5 boreholes. 11 privately owned boreholes. <30% household connections.	Shallow hand dug wells.	Galkayo Water Agency (GAWA) operating under lease contract.[71] Large portions of the city are currently not connected to the existing network. The water produced is salty (TDS >3 g/l), bitter, absolutely disagreeable, and showing above norm levels of boron and sulphates. Sporadic cases of cholera have been recorded during the past year. No piped sewerage system, wastewater from sewers seeps into the ground and pollutes the perched aquifer tapped by shallow hand dug wells (World Bank 2018b).	Investment plan prepared for short/emergency, medium- and long-term actions.
Garbahaarrey*				
Garowe* **World Bank (2018b)**	10 municipal wells, 7 of which are connected to the water supply system. 2 wells are connected to a 650 m^3 storage tank. <30% household connections.		Nugal Water Company (NUWACO) operating under lease contract.[71] Water is saline (TDS: 2.7—and 6 g/l) and bitter, containing excessive amount of heavy metals and fluorides. Risk of contamination of the freatic, shallow, aquifer with the sewage water is high as a sewage network is not existing in the area. A few cases of cholera have been recorded in the area during the past year (World Bank, 2018b)	Investment plan prepared for short/emergency, medium- and long-term actions.

[71] Puntland State Agency for Water, Energy and Natural Resources (PSAWEN) entered into a lease contract with private service providers that now function as water utilities. Lease contracts were signed between 2000 and 2006 for a 10-year period.

	Water Supplies		Comments	Plans
City (Reference)	Piped Infrastructure	Non-Piped Supplies		
Hargeisa*				
Hobyo				
Iskushuban				
Jalalaqsi				
Jamaame				
Jawhar*				
Jilib				
Kismayo*				
Laascaanood*				
Las Khorey				
Luuq				
Mahaddayweyne				
Marka*				
Mogadishu*		Private boreholes and networks serve >1 million people (anecdotal—no reference).		
Oodweyne				
Qandala				
Qoryooley				
Saacow				
Waajid				

	Water Supplies		Comments	Plans
City (Reference)	Piped Infrastructure	Non-Piped Supplies		
Wanlaweyn				
Xuddur*				
Yeed				

Notes

*** Regional capital.**

Distribution of Mapped Water Points in the Districts and Regions of Somalia

Table A1.2: Human Population (2014 and 2020) and Mapped Water Points Per District

Regions	Districts	Population (UNDP 2014)				Population 2020 (based on UNDP 2014)				Waterpoints (SWALIM Dec 2020)						
		IDP	Urban	Rural	Total	IDP	Urban	Rural	Total	Berkad	Boreh.	Hafir	Dugw.	Others	Springs	Total
Awdal	Baki	0	4243	92642	96885	-	5'412	103'048	108'460		6	1	99	3	20	129
Awdal	Borama	60	271045	127504	398609	67	345'738	141'826	487'630	30	83	22	83	10	23	251
Awdal	Lughaye	7860	6407	86552	100819	8'743	8'173	96'274	113'189		16		17	2	1	36
Awdal	Zeylac	70	6127	70754	76951	78	7'815	78'701	86'595		17		43	6	16	82
Bakool	Ceel Barde	3000	4626	51503	59129	3'337	5'901	57'288	66'526		4	3	19			26
Bakool	RabDhuure	0	0	0	0	-	-	-	-			24	14			38
Bakool	Tayeeglow	7200	17898	48577	73675	8'009	22'830	54'033	84'872		4	15	31			50
Bakool	Waajid	9000	19413	97108	125521	10'011	24'763	108'015	142'789		2	56	60			118
Bakool	Xudur	4800	19992	84110	108902	5'339	25'501	93'557	124'398	3	18	23	44			88
Benadir	Benadir	369289	1E+06	0	1650228	410'768	1'633'932	-	2'044'700		5		140			145
Bari	Bandarbeyla	0	4360	11121	15481	-	5'561	12'370	17'932		1		17	1	30	49
Bari	Bossaso	49000	394831	25735	469566	54'504	503'636	28'626	586'765	1	120		85	1	55	262
Bari	Caluula	0	9209	39777	48986	-	11'747	44'245	55'992		1		29		11	41

Regions	Districts	Population (UNDP 2014)				Population 2020 (based on UNDP 2014)				Waterpoints (SWALIM Dec 2020)						
		IDP	Urban	Rural	Total	IDP	Urban	Rural	Total	Berkad	Boreh.	Hafir	Dugw.	Others	Springs	Total
Bari	Iskushuban	0	3616	54799	58415	-	4'612	60'954	65'567	2	7		35		17	61
Bari	Qandala	0	6792	45319	52111	-	8'664	50'409	59'073		2		5		3	10
Bari	Qardho	10646	52976	21966	85588	11'842	67'575	24'433	103'850	4	54		11	1	2	72
Bay	Baydhaba	20670	36576	258433	315679	22'992	46'655	287'461	357'108		87	31	43		7	168
Bay	BuurHakaba	11770	25192	160236	197198	13'092	32'134	178'234	223'460		3	23	25			51
Bay	Diinsoor	3330	23692	147910	174932	3'704	30'221	164'524	198'449		3	18	25		1	47
Bay	QansaxDheere	4050	7586	92737	104373	4'505	9'676	103'153	117'335		19	19	6		1	45
Galgaduud	Cabudwaaq	12168	46328	43463	101959	13'535	59'095	48'345	120'974	58	33	24	33			148
Galgaduud	Cadaado	27000	50099	52489	129588	30'033	63'905	58'385	152'322	11	49	6	56			122
Galgaduud	CeelBuur	27290	12628	43692	83610	30'355	16'108	48'600	95'063	10	18	4	7			39
Galgaduud	CeelDheer	17910	38399	53561	109870	19'922	48'981	59'577	128'480	4	12		82			98
Galgaduud	Dhusamareb	35400	36099	72908	144407	39'376	46'047	81'097	166'520	11	59	9	68			147
Gedo	Baardhere	18000	30369	129015	177384	20'022	38'738	143'506	202'266	5	4	23	10		5	47
Gedo	BeletXaawo	12560	26920	43636	83116	13'971	34'338	48'537	96'847		2	1	4			7
Gedo	CeelWaaq	13010	10106	36930	60046	14'471	12'891	41'078	68'440		4		2			6
Gedo	Doolow	7778	7559	25908	41245	8'652	9'642	28'818	47'112		2		12			14
Gedo	Garbahaarey	9000	18422	49530	76952	10'011	23'499	55'093	88'603		8	15	26			49
Gedo	Luuq	16380	15765	37515	69660	18'220	20'109	41'729	80'058		1	4	93		2	100
Hiraan	Beledweyne	32410	31874	170930	235214	36'050	40'658	190'129	266'837	33	40	14	33			120
Hiraan	BuloBurto	9620	25949	102714	138283	10'701	33'100	114'251	158'051		16		5			21
Hiraan	Jalalaqsi	9130	23556	114503	147189	10'156	30'047	127'364	167'567		2					2
Middle Jubba	Bu'aale	12000	17475	79511	108986	13'348	22'291	88'442	124'080		3	4	20			27
Middle Jubba	Jilib	8000	20761	146059	174820	8'899	26'482	162'465	197'845				1			1
Middle Jubba	Saakow	7000	18006	54110	79116	7'786	22'968	60'188	90'942		1	11	9		3	24

Regions	Districts	Population (UNDP 2014)				Population 2020 (based on UNDP 2014)				Waterpoints (SWALIM Dec 2020)						
		IDP	Urban	Rural	Total	IDP	Urban	Rural	Total	Berkad	Boreh.	Hafir	Dugw.	Others	Springs	Total
Lower Jubba	Afmadow	13000	34783	124702	172485	14'460	44'368	138'709	197'537			2	1			3
Lower Jubba	Badhaadhe	600	11483	44095	56178	667	14'647	49'048	64'363							0
Lower Jubba	Jamaame	7000	10155	80756	97911	7'786	12'953	89'827	110'566							0
Lower Jubba	Kismayo	10000	116440	36293	162733	11'123	148'528	40'370	200'021				2			2
Mudug	Galkayo	46322	270651	72221	389194	51'525	345'235	80'333	477'093	6	134	1	49			190
Mudug	Galdogob	20	41754	37821	79595	22	53'260	42'069	95'352		42		14			56
Mudug	Hobyo	11680	13943	89599	115222	12'992	17'785	99'663	130'440	8	68	5	112			193
Mudug	Jariiban	90	25028	56772	81890	100	31'925	63'149	95'174		14		18		1	33
Mudug	Xarardheere	12770	30117	9074	51961	14'204	38'416	10'093	62'714		1	9	12			22
Nugaal	Burtinle	0	31193	33770	64963	-	39'789	37'563	77'352	1	22					23
Nugaal	Eyl	0	8155	72877	81032	-	10'402	81'063	91'465	3	9		33	1	23	69
Nugaal	Garoowe	9495	99581	137626	246702	10'562	127'023	153'084	290'669	1	68		139	1	35	244
Sanaag	CeelAfweyn	0	26043	73907	99950	-	33'220	82'208	115'428	12	12	3	120	3	39	189
Sanaag	Ceerigaabo	810	85119	119389	205318	901	108'576	132'799	242'276	14	108	4	180	1	23	330
Sanaag	Laasqoray	100	48555	190200	238855	111	61'935	211'564	273'610	3	26	2	22	1	5	59
Middle Shabelle	Adan Yabaal	0	7183	30598	37781	-	9'162	34'035	43'197	0	0	0	0	0	0	0
Middle Shabelle	Balcad	22220	25295	164746	212261	24'716	32'266	183'251	240'232		29	2	46			77
Middle Shabelle	Cadale	3370	18780	64746	86896	3'749	23'955	72'018	99'722		3		4			7
Middle Shabelle	Jowhar	26370	63090	89637	179097	29'332	80'476	99'705	209'513		9	1	18			28
Lower Shabelle	Afgooye	24810	61604	152241	238655	27'597	78'580	169'341	275'518		137	12	49			198

Regions	Districts	Population (UNDP 2014)				Population 2020 (based on UNDP 2014)				Waterpoints (SWALIM Dec 2020)						
		IDP	Urban	Rural	Total	IDP	Urban	Rural	Total	Berkad	Boreh.	Hafir	Dugw.	Others	Springs	Total
Lower Shabelle	Baraawe	13640	12296	48136	74072	15'172	15'684	53'543	84'399							0
Lower Shabelle	Kurtunwaarey	1490	8613	252214	262317	1'657	10'987	280'543	293'187							0
Lower Shabelle	Marka	37100	42057	119144	198301	41'267	53'647	132'527	227'440							0
Lower Shabelle	Qoryooley	10890	42398	239106	292394	12'113	54'082	265'963	332'158				2			2
Lower Shabelle	Sablaale	750	6658	16039	23447	834	8'493	17'841	27'168							0
Lower Shabelle	WanlaWeyn	14290	42126	56619	113035	15'895	53'735	62'979	132'608		7		2			9
Sool	Caynabo	1400	19572	38108	59080	1'557	24'966	42'388	68'911	1	21	2	55			79
Sool	Laas Caanood	3420	76498	76520	156438	3'804	97'579	85'115	186'498		54	2	109		15	180
Sool	Taleex	0	13579	59950	73529	-	17'321	66'684	84'005		6	1	71	2	9	89
Sool	Xudun	0	11344	27036	38380	-	14'470	30'073	44'543			10		101	1	112
Togdheer	Burco	25760	376010	58584	460354	28'653	479'628	65'164	573'446	87	176	23	67	2	2	357
Togdheer	Buuhoodle	0	49979	33768	83747	-	63'752	37'561	101'313	28	21	1	29	3		82
Togdheer	Owdweyne	0	22798	78560	101358	-	29'081	87'384	116'465	14	29	15	74	4		136
Togdheer	Sheikh	0	34937	40967	75904	-	44'565	45'569	90'133		3		39		30	72
Woqooyi Galbeed	Berbera	590	73971	101447	176008	656	94'355	112'842	207'853		42		47	6	25	120
Woqooyi Galbeed	Gebiley	0	36917	69997	106914	-	47'090	77'859	124'950	9	60	59	76	6	10	220
Woqooyi Galbeed	Hargeysa	44000	691852	223229	959081	48'942	882'508	248'303	1'179'753	28	172	61	189	9	22	481
Total		1117388	5216392	5993751	12327531	1'242'896	6'653'891	6'666'984	14'563'770	387	1979	565	2871	164	437	6403
Notes:																

Regions	Districts	Population (UNDP 2014)				Population 2020 (based on UNDP 2014)				Waterpoints (SWALIM Dec 2020)						
		IDP	Urban	Rural	Total	IDP	Urban	Rural	Total	Berkad	Boreh.	Hafir	Dugw.	Others	Springs	Total
Population figures are based on the UNDP survey of 2014 and projected to 2020 using an annual urban growth rate of 4.14 percent and rural and IDP growth rates of 1.79 percent (World Bank Database Somalia 2020).																

Table A1.3: Estimated Human and Livestock Population and Mapped Water Points Per Region (2014 and 2020)

Region	Population (UNDP 2014)				Livestock (UNDP '14)	Population 2020 (based on UNDP 2014)				Livestock (2020)	Waterpoints (Swalim Dec 2020)						
	IDP	Urban	Rural	Total		IDP	Urban	Rural	Total		Berkad	Boreh.	Hafir	Dugw.	Others	Springs	Total
Awdal	7990	287822	377452	673264	38,83997	8'887	367'138	419'848	795'874	4'320'257	30	122	23	242	21	60	498
Bakool	24000	61929	281298	367227	28,55344	26'696	78'995	312'894	418'585	3'176'063	3	28	121	168	0	0	320
Banaadir	369289	1E+06	0	1650228	0	410'768	1'633'932	-	2'044'700	-	0	5	0	140	0	0	145
Bari	59646	471784	198717	730147	2,328,669	66'346	601'795	221'037	889'178	2'590'231	7	185	0	182	3	118	495
Bay	39820	93046	659316	792182	2,451,010	44'293	118'687	733'372	896'352	2'726'313	0	112	91	99	0	9	311
Galgaduud	119768	183553	266113	569434	3,377,426	133'221	234'135	296'003	663'359	3'756'787	94	171	43	246	0	0	554
Gedo	76728	109141	322534	508403	3,683,575	85'346	139'217	358'762	583'325	4'097'323	5	21	43	147	0	7	223
Hiiraan	51160	81379	388147	520686	3,662,516	56'906	103'805	431'745	592'456	4'073'899	33	58	14	38	0	0	143
Lower Jubba	30600	172861	285846	489307	2,167,593	34'037	220'497	317'953	572'487	2'411'062	0	0	2	3	0	0	5
Lower Shabelle	102970	215752	883499	1202221	2,267,433	114'536	275'208	982'736	1'372'479	2'522'117	0	144	12	53	0	0	209
Middle Jubba	27000	56242	279680	362922	1,557,086	30'033	71'741	311'094	412'868	1'731'982	0	4	15	30	0	3	52
Middle Shabelle	51960	114348	349727	516035	1,963,214	57'796	145'859	389'009	592'665	2'183'727	0	41	3	68	0	0	112
Mudug	70882	381493	265487	717862	3,389,640	78'844	486'622	295'307	860'773	3'770'373	14	259	15	205	0	1	494
Nugaal	9495	138929	244273	392697	3,555,266	10'562	177'214	271'710	459'486	3'954'602	5	99	0	172	2	58	336
Sanaag	910	159717	383496	544123	5,121,676	1'012	203'731	426'571	631'314	5'696'955	29	146	9	322	5	67	578
Sool	4820	120993	201614	327427	3,045,707	5'361	154'335	224'260	383'957	3'387'808	1	81	15	235	103	25	460

Region	Population (UNDP 2014)				Livestock (UNDP '14)	Population 2020 (based on UNDP 2014)				Livestock (2020)	Waterpoints (Swalim Dec 2020)						
	IDP	Urban	Rural	Total		IDP	Urban	Rural	Total		Berkad	Boreh.	Hafir	Dugw.	Others	Springs	Total
Togdheer	25760	483724	211879	721363	3,037,441	28'653	617'025	235'678	881'357	3'378'614	129	229	39	209	9	32	647
Woqooyi Galbeed	44590	802740	394673	1242003	4,545,914	49'598	1'023'954	439'004	1'512'556	5'056'522	37	274	120	312	21	57	821
Total	1'242'896	6'653'891	6'666'984	14'563'770	58'834'633	242'896	6'653'891	6'666'984	14'563'770	58'834'633	387	1979	565	2871	164	437	6403

Note:

Population figures are based on the UNDP survey of 2014 and projected to 2020 using an annual urban growth rate of 4.14 percent and rural, IDP and livestock growth rates of 1.79 percent (World Bank Database Somalia 2020)

Table A1.4: Estimated Livestock Types in Regions of Somalia

Region	Livestock (UNDP, 2014)				
	Goats	Sheep	Camel	Cattle	Total
Awdal	2'594'454	1'088'945	396'890	65'696	3'883'997
Bakool	1'622'887	454'751	687'310	411'115	3'176'063
Benadir	-	-	-	-	-
Bari	1'664'460	829'390	96'382	-	2'590'231
Bay	1'303'060	130'150	402'174	890'930	2'726'313
Galgaduud	2'259'127	946'534	513'331	37'794	3'756'787
Gedo	2'030'933	834'466	857'483	374'440	4'097'323
Hiiraan	2'219'772	757'399	710'702	386'025	4'073'899
Lower Jubba	814'469	548'011	358'215	690'367	2'411'062
Lower Shabelle	1'091'213	516'332	318'981	595'590	2'522'117
Middle Jubba	531'965	437'509	183'906	578'602	1'731'982
Middle Shabelle	1'223'308	580'364	173'676	206'380	2'183'727
Mudug	2'288'983	980'019	486'832	14'538	3'770'373
Nugaal	2'179'699	1'354'587	420'315	-	3'954'602
Sanaag	3'162'146	2'274'589	260'219	-	5'696'955
Sool	1'714'820	1'410'191	262'797	-	3'387'808
Togdheer	2'172'274	648'138	552'618	5'582	3'378'614
Woqooyi Galbeed	3'053'842	1'267'184	628'083	107'414	5'056'522
Total	**31'927'412**	**15'180'874**	**7'354'492**	**4'371'853**	**58'834'633**

Note:

Figures are based on the UNDP survey of 2014 and projected to 2020 using an annual growth rate of 1.79 percent (World Bank Database Somalia 2020) human and livestock population and mapped waterpoints (2014 and 2020) per region

Appendix 2. Estimated Population of Cities of Somalia

For orientation, the map below provides an overview of the territories and emerging states, and respective regions. Note that disputed boundaries remain.

Figure A2.1: Emerging Somalia Federal Member States and Regional Administrations (World Bank 2018)

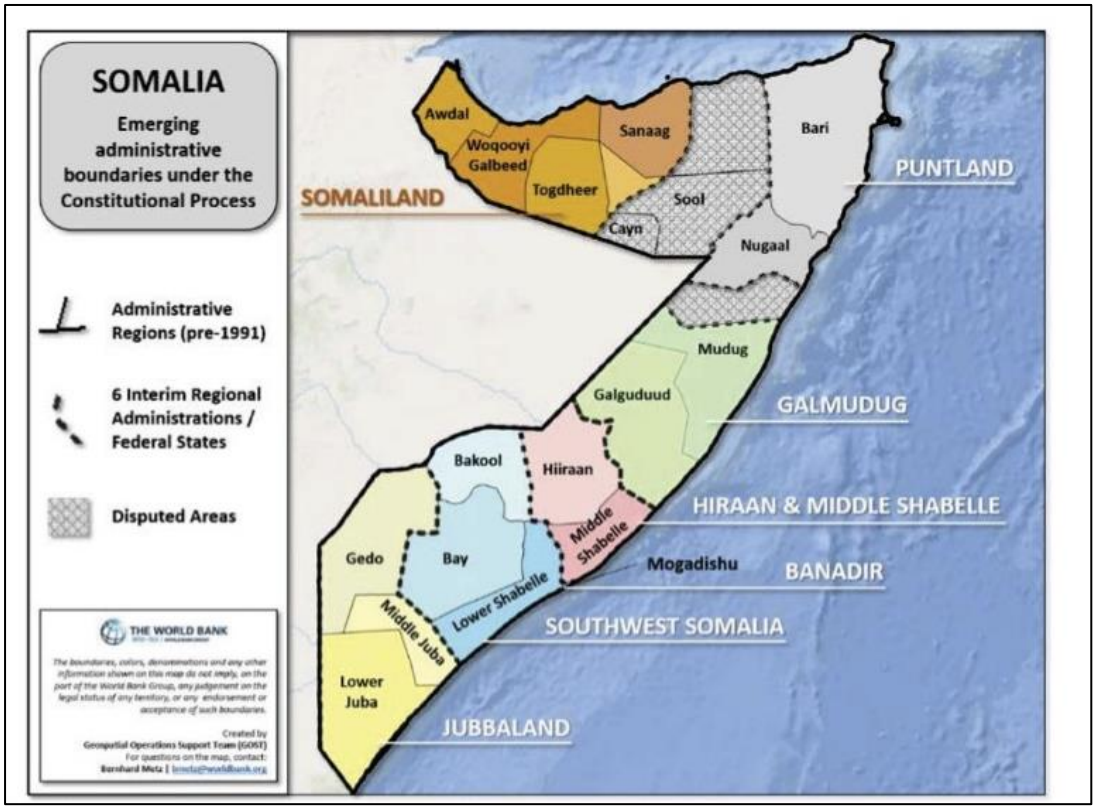


Table A2.1 Estimated Population of Cities of Somalia

Territory/State	Region	City	Estimated Population (Current)		Notes
			WPR[72] (2021)	Other Source	
Somaliland	Adwal	Baki*	20,000		
	Adwal	Borama	-	120,000[c]	▪ The city hosts a number of visitors in the summer months—mainly IDPs and residents from Djibouti.
	Sanaag	Ceerigaabo*	33,853	20,000[c]	▪ Over 3,000 houses.
	Sanaag	Las Khorey	6,941	400,000[c]	▪ Estimated 10,000 IDPs.
	Togdheer	Burco/Burao*	99,270		
	Togdheer	Oodweyne	5,491		
	Woqooyi Galbeed	Hargeysa*	47,7876		
	Sahil	Berbera*	242,344	67,000[c]	▪ It is estimated that there are 2,500 IDPs.[a]
Disputed[73]	Sool	Laascaanood*	60,100		
Puntland	Bari	Bosaso*	74,287	425,000[a]	▪ It is estimated that 40,000 are IDPs.[a]
		Qandala	15,923		
		Bandarbeyla	13,753		
		Bereeda	11,262		
		Bargaal	6,798		
		Caluula	6,100		
		Iskushuban	5,759		
	Nugal	Garoowe*	57,300	150,000[a]	▪ If Puntland remains peaceful, many of the nearly 30,000 IDPs, or refugees will return home over the next years [a].
		Eyl	18904		▪

[72] https://worldpopulationreview.com/countries/cities/somalia data source stated as GeoNames (https://www.geonames.org/).

[73] Disputed between Somaliland and Puntland.

Territory/State	Region	City	Estimated Population (Current)		Notes
			WPR[74] (2021)	Other Source	
Galmudug/Puntland?	Mudug?	Gaalkacyo*	61,200	300,000[a]	▪ Believed to host more than 135,000 IDPs across over 70 settlements[b] ▪ Has tripled in special footprint since 1985[b] ▪ 2017 drought added 20,000 IDPs[b]
Galmudug	Galguduud	Ceeldheer	26562		
		Ceelbuur	9031		
		Dhusamareb*	9000		
	Mudug	Hobyo	12564		
		Gaalkacyo*	61,200		
Hiraan and Middle Shabelle	Hiiraan	Beledweyne*	55410		
		Buulobarde	16928		
		Jalalaqsi	9743		
	ShabeellahaDhexe	Jawhar*	47086		
		Mahaddayweyne	8273		
		Cadale	5385		
Southwest Somalia	Bakool	Xuddur*	12500		
		Yeed	8429		
		Waajid	6666		
	Banaadir	Mogadishu*	2587183	2,912,487[b]	
	Bay	Baidoa*	129839		▪ Area occupied by IDPs tripled from Sept 16 to Apr 17[b]
		Buurhakaba	27792		
	ShabeellahaHoose	Marka*	230100		
	ShabeellahaDhexe	Afgooye	65461		
		Qoryooley	51720		
		Wanlaweyn	22022		

[74] https://worldpopulationreview.com/countries/cities/somalia data source stated as GeoNames (https://www.geonames.org/).

Territory/State	Region	City	Estimated Population (Current)		Notes
			WPR[75] (2021)	Other Source	
Jubbaland	Gedo	Baardhere	42240		
		Luuq	33820		
		Garbahaarrey*	12652		
	JubbadaHoose	Kismayo*	234852		▪ From 2013 to 2017 IDP-occupied area increased seven-fold[b]
		Jamaame	185270		
	JubbadaDhexe	Jilib	43694		
		Saacow	7893		
		Bu'aale*	5,000**		

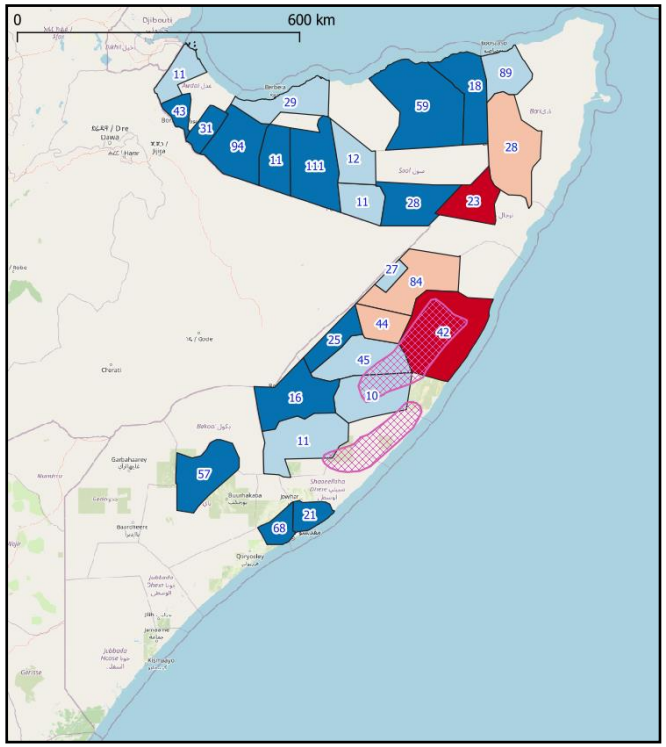
* Regional capital.
** No population given in source, so population taken from Wikipedia entry https://en.wikipedia.org/wiki/Bu%27ale
Note: Hoose = Lower; Dhexe = Middle.
[a] World Bank (2019a).
[b] World Bank (2020).
[c] World Bank (2018b).

[75] https://worldpopulationreview.com/countries/cities/somalia data source stated as GeoNames (https://www.geonames.org/).

Appendix 3. Groundwater Quality

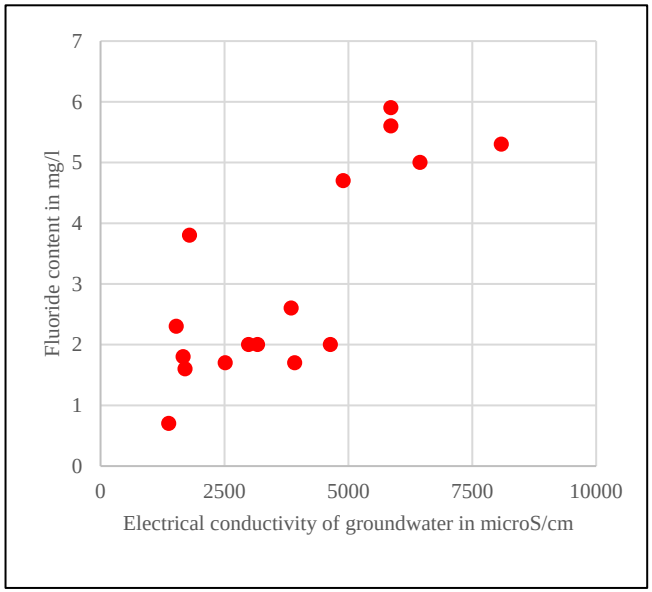
Data Availability on Borehole Salinity

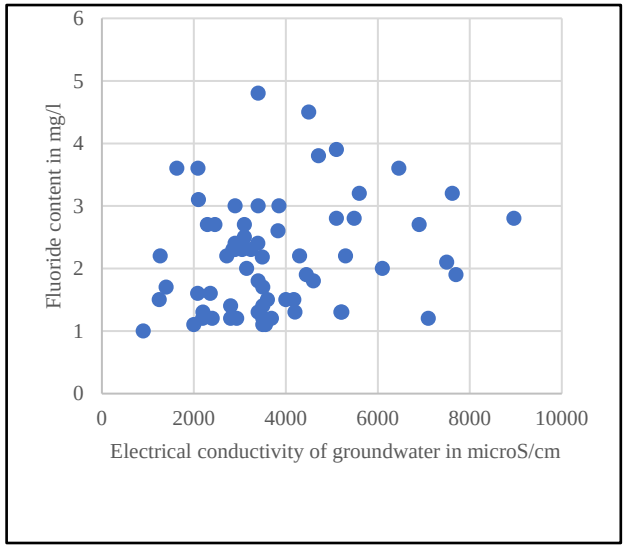
Figure A3.1: Number of Boreholes in SWALIM Database in Each District with EC Measurements



Comparing Electrical Conductivity and Fluoride Levels in Groundwater

Figure A3.2 Relation between Fluoride Concentration and Salinity (in Electrical Conductivity)





Left: In Middle Somalia, from Nasreldin et al (2016). Right: In all Somalia, from Faillace (1998).

Appendix 4. Recommended Policies and Investments

The benchmarking exercise and sectoral analysis has recommended a number of policies and investments. These are collated in this Appendix, together with statements from national documents in relation to their relevance where these are clearly stated, and with examples of relevant experiences from other countries or from within Somalia where they have been found. Due to resource constraints, the data is not comprehensive, but provides a good starting point for further analysis of these select potential policies and investments.

Domestic/Multiple-Use Water Supplies

Water Supply 1. Investment Plans for Major Cities

Develop water investment plans for each major city	
Relevance to Somalia	
•	
Experiences and examples from Somalia	
Summary	Short, medium and long-term investment plans have been undertaken by the World Bank for seven cities in Somaliland and Puntland.
Data	–
References	World Bank (2018a); World Bank (2018b)

Water Supply 2. Data Management and Targeted Investments to Reduce Inequalities in Water Access

Improve data collection on water access and use, linked to investments which reduce geographic inequalities and improve access to basic water supplies, emphasizing reducing the distance and time to collect water, and thus the vulnerability of women and children to violence	
Relevance to Somalia	
• **Inadequate data and significant data gaps with respect to water supplies and water use in rural and urban Somali (as highlighted by this report, Chapter 2).** • **Contributing to National Water Resources Strategy - Strategic Objective 18b: Delivery of sustainable and safe WSS services is improved (MoEWR, 2021).**	
Experiences and examples from other countries	
Summary	
Data	
References	

Water Supply 3. Small Water System Development, Expansion, and Management

Investments in new small water systems/expansion including innovative technologies and management	
Relevance to Somalia	
•	
Experiences and examples from other countries	
Summary	**Puntland and Somaliland (2017 – date)** **Outputs:** Increased water harvesting and storage in the dry lands through water management infrastructure (for example, sand dams, subsurface dams and infiltration galleries) (World Bank, 2019b). **Outcomes:**
Data	
References	
Summary	**Kenya (?)** **Outcomes:** Sand dams can improve adaptive capacity of drylands by helping to sustain vegetation biomass during drought. Improved soil management supports agriculture and food production, including livestock watering.
Data	
References	Ryan and Elsner, 2016

Pastoralists and Livestock

Pastoralists 1. Rangeland and Water Management

Secure the rural economy through participatory rangeland and water management: Participatory Rangeland Management (PRM)
Relevance to Somalia
• **Improving the natural rangelands resource base is critical to sustaining the production and productivity of livestock, in parallel with improving livestock productivity and value addition (MoLFR, 2019).** • **Address *"Lack of access to good quality pasture, due to land degradation and reduction of productive land, … the result of deforestation, soil erosion, invasion of unpalatable plant species, spread of private enclosures, and climate change bringing increasingly frequent recurrence of drought and floods"* (MoLFR, 2019).** • **Enhance regulation and management of rangelands and forestry resources, including strengthened mechanisms for land rights and disputes and enhancing availability of water and nutrition sources for livestock (MoLFR, 2019).** • **There is need for consultative, participatory approaches whereby livestock stakeholders have a voice in policy formulation, project design and implementation (MoLFR, 2019).** • ***"… future interventions to support delivery of services to rural communities in Somalia's marginalized dryland areas should emphasize a learn-by-doing approach to generate new understanding"*[76]**

[76] Learning about the dynamics of nomadic pastoralist systems, the specific needs of pastoral communities, and their relationships other livelihood groups, reforms relating to access to pasture land and water and mechanisms for emergency access for pastoralists to water, pasture and fodder during droughts (World Bank,[76] in MoLFR 2019).

• ***"…management of rangelands through effective community and producers' associations [and] … Participatory land use planning and enforcement, including communal control over the expansion of enclosures, are … priorities*** **(MoLFR, 2019).** • **Improve environmental stewardship of rangelands, including their adaptation to an increasingly threatening climate change (MoLFR, 2019).**
Experiences and examples from other countries

Summary	**Ethiopia, Kenya and Tanzania (2010 – 2019)** **Outcomes**: strengthened inclusive governance institutions, management of resources and improved productivity of rangelands. Stronger perceived land and resource security, willingness to invest in sustainable land management and opportunities for improving livelihoods[77]
Data	
References	Flintan et al. 2019

Pastoralists 2. Watering Facility Management and Maintenance

Improve watering facilities management and maintenance by community organizations, combined with conflict resolution efforts
Relevance to Somalia
• ***As a result of the prolonged civil war and the absence of nomadic community's organization, most of the prewar infrastructure for flood control and irrigation has no been maintained and it currently not functioning adequately"*** **(World Banks and FAO, 2018).** • ***"In recent years, livestock survival during annual or seasonal severe droughts has become dependent on very costly and often unaffordable water transported by privately owned water tankers"*** **(World Banks and FAO, 2018).** • ***"Rehabilitate the existing water reservoirs and increase … water catchment facilities… along the two major rivers and on the rangelands"*** **(MoLFR, 2019).**
Experiences and examples from within Somalia

Summary	**Puntland and Somaliland** **Activity**: Rehabilitation of existing water infrastructure and small works including small sand and subsurface dams in dry riverbeds (wadis), surface water storage infrastructure, area infiltration interventions such as semi-circular bunds or soil bunds, and rock catchments **Outcomes:**
Data	
References	World Bank (2019b.
Experiences and examples from within other countries	
Summary	Establishing or empowering water users' associations that bring together users to collectively manage water. Particular attention should be given to engaging women and nonconsumptive water users (for example, fisherfolk), who are often disadvantaged and ignored
Data	
References	FAO (2020)

Pastoralists 3. Water Supplies for Livestock Resting Areas, Transit Stops and Livestock Value Chains

Technical assistance/co-funding for private and community investments to improve water access in/for: ▪ **livestock resting areas, transit stops and livestock value chains;** ▪ **sanitary slaughtering facilities and markets;** ▪ **wet blue tanning (with regulation); and**

[77] Directly responds to 9th NDP—3.6 Interventions: "Improving the natural rangelands resource base to sustain the production and productivity of livestock, in parallel with improving livestock productivity and value addition".

▪ **slaughtering facilities and markets.**
Relevance to Somalia
• ***"… animal welfare issues arise during loading, transporting and unloading of livestock, …mainly because of the inadequacy of available facilities and services, such as sanitation, nutrition, water, and veterinary care, both in rural areas and along transit routes"*** **(MoLFR, 2019).** • ***One constraint to animal production is the "lack of adequate resting areas (including pre-quarantine holding grounds) with water, pasture and health/vaccination facilities for the large number of livestock in transit between the major livestock collection centres and … export ports"*** **(MoLFR, 2019).** • ***"Most slaughterhouses and meat markets are largely unhygienic, in various states of disrepair, and lack drainage systems"*****(MoLFR, 2019).** • **The need to *"Formulate an enabling policy and regulatory framework for a future tanning industry"* (MoLFR, 2019).** • **Dairy imports, of which 90 percent are for long-life processed milk and milk powder, may be a missed opportunity for import substitution (MoLFR, 2019).** • ***"… the focus should be given to sustainable water services and to water use productivity in agriculture and livestock."*** **(MoEWR, 2021)**
Experiences and examples from other countries

Summary	**Milk and dairy production in Togo**
Data	Milk production (12.8 million liters) exceeds milk consumption (11.1 million liters) and the country exports milk—primarily long life dairy products (that is, condensed milk and powdered milk). There is also good quality data available
References	Molina-Flores et at, 2020

Farmers, Crops, and Forests

Crops 1. Land, Water, and Soils

Support to integrated land and water management practices, including soil conservation and flood management.
Relevance to Somalia
• **Need public investments in … reforestation and afforestation, (c) the reseeding of pastures, (d) the planting of drought-resistant and fast- growing grasses and legumes, (e) the use of micro-catchments to enhance water filtration and various flood control technologies.** • ***"WALP… demonstrated that while enhancing access to water is an essential ingredient in addressing acute vulnerability among dryland communities, these investments are insufficient on their own and need to be complemented by parallel investments designed to restore a more healthy ecosystem and to strengthen the capacity of local communities to sustainably and equitably manage their water assets and the natural resource base (that is, soils, pastureland, and forests) that underpins their livelihoods"*** **(World Bank, 2019b).**
Experiences and examples from other countries

Summary	**Ethiopia** Outcomes: reforestation and minimum tillage: benefits in terms of ecosystem services, reducing erosion and surface runoff. Rainfed yields also improved
Data	
References	FAO, 2020c

Crops 2. Dryland Cropping

Support to the promotion of water and soil conservation and water harvesting methods in drylands.
Relevance to Somalia
• **Increased water availability supported by improved vegetation biomass and soil management means better potential to support agricultural activities and food production, and thus increased resilience to climate change and other risks (World Bank, 2019).**

• **Alternative means of maintaining soil fertility, such as crop rotation with biological nitrogen fixing (BNF) species, application of green manure, agroforestry, composting, rock phosphates, etc., have proved to be highly effective at the local scale** • **One of the state's priority is to develop rainwater harvesting technology, as groundwater in Puntland is too deep or its quality too poor for consumption and irrigation (World Bank and FAO, 2018).** • **Improvements to rainfed agriculture and conjunctive water use practices are vital to strengthen resilience to environmental shocks. Need tools and practices, the compilation of guidelines and the provision of extension support (MoEWR, 2021).** • **Support small-scale farmers to improve dryland agricultural practices to improve local and national economies (MoEWR, 2021).** • **Need to promote the widespread adoption of smart agricultural techniques in rainfed cultivation (MoLFR, 2019).** • **Need public investments in (a) intensified soil and water conservation, …(e) the use of micro-catchments to enhance water filtration and various flood control technologies (World Bank and FAO, 2018).**

Experiences and examples from other countries	
Summary	Water-conservation and - harvesting coupled with soil nutrient management
Data	**Outcomes**: Crop yields increased by 30–50 percent and cropping intensities increased by 80–150 percent, while helping mitigate the impacts of drought
References	FAO (2020c)

Experiences and examples from other countries	
Summary	Rainwater harvesting and soil moisture: Landscapes are covered by stone bundles to catch surface runoff, turn it into soil moisture, and grow food.
Data	
References	Partey et al(2018)

Crops 3. Farmer-to-Farmer Communication

Introduction of mechanisms to enable and support farmer to farmer communications and learning
Relevance to Somalia
• **Frankincense and myrrh: "poor harvesting practices by a new generation of tree owners and minders eager to maximize short-term earnings but unaware of the trees' long-term health needs" alongside illegal harvesting (World Bank and FAO, 2018).** • **"Use of appropriate technologies and inputs, such as hybrid seeds, fertilizer, and pesticides, and good agriculture practices, is very limited, a problem that is at the root of low agriculture productivity (World Bank and FAO, 2018).**

Experiences and examples from other countries	
Summary	Farmers Voice Radio
Data	
References	(LYF, 2014)

Crops 4. Farmer-Led Irrigation

Further research into farmer-led irrigation development, in combination with consideration of pastoralism and flood management.
Relevance to Somalia
• **Double crop production through investments in the rehabilitation of irrigation and flood control infrastructure needed (MoLFR, 2019).** • **Expansion of agriculture requires a diversified approach that includes improved catchment management to sustainably support cropping and soil conservation, expansion and significant improvements in infrastructure to support irrigation including barrages, canals and other infrastructure such as rainwater harvesting, improvements in water use efficiencies and irrigation practices as well as developing innovations to support rain-fed agriculture.**

Experiences and examples from other countries	
Summary	

Data	
References	

Crops 5. Livestock Feed

Further research into boosting year-round affordable good quality livestock feed	
Relevance to Somalia	
• **"Improve animal quality, to mitigate lack of pasture and browse during seasonal or prolonged severe droughts, and to reduce the pressure of a large animal population on increasingly scarce natural resources" (MoLFR, 2019).** • **"Developing a strategy to strengthen availability of natural feed on rangelands and to expand greatly availability of quality commercial fodder" (MoLFR, 2019).**	
Experiences and examples from other countries	
Summary	
Data	
References	

Transitions: Urbanization, Water-Related Shocks, Resilience, and Climate Change

Transitions1. Water Supply Infrastructure Planning

Water supply infrastructure planning, development and management catering for vulnerable urban contexts with hybrid governance (for example, transition management).	
Relevance to Somalia	
• **"*need… a comprehensive assessment of the current infrastructure base including the condition of these assets, the current levels of performance, the remaining useful life for each asset as well as remaining economic value MoEWR"* (2021).**	
Experiences and examples from other countries	
Summary	
Data	
References	

Transitions 2. Local Natural Resources and Water Resources Management

Pilot locally-based Natural Resources Management and Water Resources Management including soil rehabilitation	
Relevance to Somalia	
• ***"In the medium-term, widespread water management planning and investment in rainwater and water runoff catchment infrastructure are essential, at individual household level as well as with large-scale pans, reservoirs and dams without losing too much to evaporation"* (MoLFR, 2019).** ***See also Pastoralists 1***	
Experiences and examples from Somalia	
Summary	District Pastoral Associations and Village Environmental Committees – Puntland (since 2009)
Data	
References	

Transitions 3. Floods, Droughts, and Forests

Research viable flood mitigation and drought resilience measures including forest stewardship
Relevance to Somalia
• ***"…noting the impact that droughts and floods have on agriculture and irrigation, there is need to develop infrastructural and institutional capacity to manage these disasters and [their] impact*" (MoEWR)** • **"*Large scale investments in watershed management and infrastructure that would mitigate the impact of extreme cycles of rainfall, floods and drought will be critical for the resilience of Somali livelihoods, including those dependent on livestock"* (MoLFR, 2019).** • **"*Severe deforestation and other environmental degradation of rangelands already threaten the viability of both the livestock and crop subsectors"* (World Bank and FAO, 2018).** • ***"With stronger environmental stewardship of the country's forests and trees, [the resins] subsector retains good potential for expanded value addition and export revenues, though it would have a small impact on employment"* (World Bank and FAO, 2018).** • **Need public investments in … reforestation and afforestation, (c) the reseeding of pastures, (d) the planting of drought-resistant and fast- growing grasses and legumes, (e) the use of micro-catchments to enhance water filtration and various flood control technologies.**
Experiences and examples from other countries

Summary	
Data	
References	

Transitions 4. Climate-Resilient WASH

Research and development of climate resilient water and sanitation technologies and management techniques.
Relevance to Somalia
• ***"Traditionally, catchments for water storage have been dug; however, with expected dramatic climatic shifts, widespread management is needed to take advantage of either additional or reduced water supply. Otherwise, soil erosion and gully formation caused by flooding and erratic rainfall, which is already taking a toll on Somali agriculture, including the livestock sector, will continue to increase. Beyond planning, expanded management requires strong institutions, infrastructure development, market access, and skills and technology development"*** **(MoLFR, 2019).** • **Supporting adoption and scale up of climate- smart agriculture practices and innovations (World Bank and FAO, 2018).** • ***"there is a need to develop new appropriate, context-adapted and attractive systems for WASH sector services. This includes new sanitation systems, adapted to a dry environment…."*** **(MoEWR, 2021).**
Experiences and examples from other countries

Summary	
Data	
References	

Appendix 5. Areas for Further Study

In addition to the recommendations, there are a number of areas that deserve further study to inform policies and investments in the future as follows:

- Assess the impact and sustainability of initiatives in Somaliland and Puntland that have tried to address widespread communal rangelands degradation, including investments at grassroots levels in establishing and upgrading community-managed rangelands reserves.
- Examine degradation of land around watering points and explore ways of mitigating this.
- Examine which water harvesting technologies are best suited for the various types of Somali terrain and populations.
- Undertake studies which help to understand the most appropriate methods to train and expose communities and government staff to water supply infrastructure operation and management.
- Assess the hydrogeological conditions of wetland areas.
- Invest in understanding the outcomes and lessons learned from environmental rehabilitation efforts in Puntland that have been ongoing since 2009.

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