# Could Flood Risk Management Measures contribute to a Sustainable Blue Economy in Somalia?

Literature Review and Case Study from the Juba and Shabelle Basin

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Swedish Agency for Marine and Water Management

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## Literature Review and Case Study from the Juba and Shabelle Basin

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# Preface

**Current and projected flood risks are significant and growing due to climate change, increasing the need for flood risk management measures. These measures could potentially have negative impacts on coastal environments and coastal communities. This report, commissioned by SwAM, the Swedish Agency for Marine and Water Management, focuses on the linkages between flood risk management and the blue economy in Somalia. The results show that measures such as nature-based solution and strengthening of planning and preparedness could strengthen the blue economy of Somalia while avoiding negative trade-offs.**

We supported this study through our development cooperation programme SwAM Ocean. With SwAM Ocean we aim to increase the opportunities for people to get out of poverty thanks to sustainable use of the sea and waters.

The findings of the study could be relevant to other coastal nations in Africa where flood risk management is not yet fully developed and operationalized, with negative consequences for food and water security and opportunities to meet the targets of the Sustainable Development Goals (SDGs) on water SDG 6, and oceans SDG 14.

Governance approaches that link upstream floods with downstream impacts are required, where multi-level and multi-scale governance arrangements can account for links across sectors and scales from source-to-sea. Trade-offs need to be considered between socio-economic benefits from development of the blue economy downstream with upstream flood risk management priorities and measures.

Thomas Klein, Head of the Department of Environmental Analysis

Swedish Agency for Marine and Water Management

# Summary

Somalia experiences cyclic droughts every two to three years accompanied by devastating floods, particularly in the Southwestern regions. The floods occur when the Juba and Shabelle rivers burst their banks, affecting the livelihoods of about 1.8 million people. Flood control measures are therefore urgently needed, but their impacts on downstream communities and ecosystems have not been analyzed.

This study therefore aims to investigate how floods and different control measures in the Juba and Shabelle river basins, including mitigation and prevention measures affect the coastal environment and the development of a sustainable blue economy in Somalia.

A mixed-methods approach was used combining reviews of academic as well as grey literature on flood risk management and the Blue Economy of relevance to Somalia, with a questionnaire survey and interviews with local stakeholders in the central Juba-Shabelle River basin as well as key informants from international development partners. However, the literature and data from Somalia covering the targeted watersheds and rivers are limited, which has impacted the results and what is feasible to recommend.

Key Blue Economy sectors considered important include fisheries, livestock and agriculture, ports and shipping as well as energy and tourism. All sectors have been affected by floods and associated pollution, but especially small-scale fisheries.

This study has identified the following recommendations on actions to address challenges related to flood risk management and development of the Blue Economy in Somalia:

1. The enabling environment needs to be strengthened to allow for multi-level policy implementation that links state-level and federal institutions and involve local communities and civil society.
2. The destruction and decay of water infrastructure needs to be addressed as well as the very serious pollution related to solid waste, untreated sewage and chemicals from hospitals and farms from upstream sources of the Juba-Shabelle Rivers that also affects coastal areas and threatens small-scale fisheries.
3. To strengthen the conditions for the Blue Economy, there are opportunities to implement more nature-based solutions and work with landscape features, such as forests, dunes and reefs.
4. Planning and preparedness also need to be improved and a flood risk management strategy developed.
5. Information, data sharing and monitoring should be strengthened and transboundary cooperation with Ethiopia pursued through for example transboundary water diplomacy and other security and reconciliation mechanisms.
6. To save artisanal fisheries, the Juba and Shabelle Rivers need to be cleaned, and laws need to be enacted to reduce waste and pollution from upstream sources.
7. The coastal area needs to be cleaned up and stabilized through use of landscape features and nature-based solutions, such as dune stabilization, planting of trees, mangroves and sea grass, and protection of natural habitats, such as wetlands, mangroves and coral reefs, building on analysis conducted by UNEP.

8. Governance approaches that link upstream floods with downstream impacts are required, where multi-level and multi-scale governance arrangements can account for links across sectors and scales.
9. Environmental flows should also be considered to ensure conservation of natural habitats important for regulation of water flows downstream and for conservation of biodiversity and provision of fish spawning grounds and nurseries, such as mangroves, coral reefs and sea grass beds.
10. Trade-offs need to be considered between socio-economic benefits from development of the Blue Economy downstream with upstream flood risk management priorities and measures. Consideration must also be given to the effects of climate change and the ongoing drought.

In general, Somalia is at the early stages of readiness and awareness raising on source-to-sea linkages and the need for a holistic approach to development challenges. However, as some progress has been made with coordination between sectors and development of a shared vision for FRM through the Hiiraan/Beledweyne Flood Committee and the federal Flood Risk Management Committee, the source-to-sea approach could be piloted in the Juba-Shabelle basin for priority flows of pollutants and waste that are threatening the development of the Blue Economy through capacity building of key stakeholders, action planning and development of monitoring and accountability mechanisms, building on ongoing support from UNDP, FAO and the World Bank.

# Swedish summary/Svensk sammanfattning

Somalia drabbas av cyklisk torka vartannat till vart tredje år åtföljt av förödande översvämningar, särskilt i de sydvästra regionerna. Översvämningarna inträffar när floderna Juba och Shabelle bryter igenom sina flodbankar, vilket påverkar försörjningen för cirka 1,8 miljoner människor. Åtgärder för att minska risken och kontrollera översvämningar är därför brådskande, men effekten på nedströms samhällen och ekosystem har inte analyserats.

Studien syftar därför till att undersöka hur översvämningar och olika kontrollåtgärder i Juba och Shabelle flodernas avrinningsområden, inklusive begränsnings- och förebyggande åtgärder, påverkar kustmiljön och utvecklingen av en hållbar blå ekonomi i Somalia.

En kombination av olika vetenskapliga metoder har använts så som granskning av akademisk såväl som grå litteratur om översvämningsriskhantering och den blå ekonomin av relevans för Somalia. En enkätundersökning och intervjuer med lokala intressenter i Juba-Shabelleflodens centrala avrinningsområde har också genomförts samt insamlandet av kritisk information från olika internationella utvecklingspartners verksamma i Somalia. Litteratur och data för Somalia som täcker de specifika floderna samt avrinningsområdena är emellertid begränsad vilket påverkar vilka slutsatser som är möjliga att dra.

Nyckelsektorer för den blå ekonomin som anses viktiga inkluderar fiske, boskap och jordbruk, hamnar och sjöfart samt energi och turism. Alla sektorer har drabbats av översvämningar av förorenat vatten, men särskilt det småskaliga fisket är hårt drabbat.

Denna studie har identifierat följande förslag på åtgärder för att ta itu med relaterade till hanteringen av översvämningsrisker och utvecklingen av den blå ekonomin i Somalia:

1. Den institutionella miljön behöver stärkas för att möjliggöra en strategi på flera nivåer som länkar samman statliga och federala institutioner och involverar lokala samhällen och det civila samhället.
2. Förstörelsen och förfallet av vatteninfrastruktur behöver åtgärdas liksom den mycket allvarliga föroreningen av floderna Juba och Shabelle som även påverkar kustområdena och hotar det småskaliga fisket.
3. När det gäller åtgärder för hantering av översvämningsrisk finns det möjligheter att implementera mer naturbaserade lösningar och arbeta med landskapselement, såsom skog, sanddyner och rev.
4. Planering och beredskap behöver också förbättras och en strategi för hantering av översvämningsrisker utvecklas.
5. Information, datadelning och övervakning bör stärkas och gränsöverskridande samarbete med Etiopien bedrivas genom t.ex. vattendiplomati och andra säkerhets- och försoningsmekanismer.
6. För att rädda det småskaliga fisket behöver floderna Juba och Shabelle renas, och lagar stiftas och implementeras för att minska avfall och föroreningar från orenat avlopp och kemikalier från sjukhus och jordbruk från uppströms områden.
7. För att förbättra förutsättningarna för att utveckla den blå ekonomin i Somalia behöver också kustområdet saneras och stabiliseras genom användning av landskapselement och naturbaserade lösningar, såsom dynstabilisering, plantering av träd, mangroveskog

och sjögräs samt skydd av naturliga livsmiljöer, såsom våtmarker, mangroveträsk och korallrev, som bygger på UNEP:s tidigare analyser.

8. Det behövs styrningsmetoder och instrument som kopplar samman översvämningar uppströms med effekter nedströms, där flera nivåer av statlig styrning av myndigheter och sektorer tar hänsyn till kopplingar mellan uppströms åtgärder och nedströms påverkan.
9. Det är också viktigt att ta hänsyn till miljöflöden för att säkerställa bevarandet av naturliga livsmiljöer som är viktiga för reglering av vattenflöden nedströms och för bevarande av biologisk mångfald och tillhandahållande av lekplatser för fisk, såsom mangroveområden, korallrev och sjögräsbäddar.
10. Avvägningar behöver göras mellan socioekonomiska aspekter av utvecklingen av den blå ekonomin nedströms med prioriteringar och åtgärder för hantering av översvämningsrisker uppströms. Hänsyn behöver också tas till effekter av klimatförändringarna och den pågående torkan.

I allmänhet befinner sig Somalia i ett tidigt skede av förberedelse och förståelse av kopplingar mellan vattenkällan och utloppet (havet) samt behovet av ett holistiskt förhållningssätt till utvecklingsutmaningar. Eftersom vissa framsteg har gjorts med samordningen mellan sektorer och utvecklingen av en gemensam vision för hantering av översvämningsrisk *genom Hiiraan/Beledweyne Flood Committee* och den federala *Flood Risk Management Committee*, skulle källa-till-hav-metoden kunna testas i avrinningsområdena for Juba och Shabelle för prioriterade flöden av föroreningar och avfall som hotar utvecklingen av den blå ekonomin. Detta skulle kunna göras genom kapacitetsuppbyggnad av nyckelintressenter, handlingsplanering och utveckling av övervaknings- och ansvarsmekanismer som bygger på pågående insatser från UNDP, FAO och Världsbanken.

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## List of acronyms

| | |
|---|---|
| AfDB | African Development Bank |
| AU | African Union |
| BE | Blue Economy |
| BGI | Blue Growth Initiative |
| CBM | Community Based Management |
| CSO | Civil Society Organization |
| FAO | Food and Agriculture Organization of the United Nation |
| FGG | Flood Green Guide |
| FGS | Federal Government of Somalia |
| FRM | Flood Risk Management |
| GDP | Gross Domestic Product |
| ICG | International Crisis Group |
| IDP | Internally Displaced People |
| IFM | Integrated Flood Management |
| IGAD | Intergovernmental Authority on Development |
| ICG | International Crisis Group |
| IUU | Illegal Unreported and Unregulated |
| IWRM | Integrated Water Resource Management |
| LDCs | Least Developed Countries |
| MoEWR | Ministry of Energy and Water Resources |
| NAPA | National Adaptation Programme of Action |
| NBS | Nature Based Solution |
| NNBF | Natural and Nature Based Features |
| NWRS | National Water Resource Strategy |
| R2R | Ridge-to-Reef |
| S2S | Source to Sea |
| SDGs | Sustainable Development Goals |
| SGP | Small Grants Programme |
| SIDS | Small Island Developing states |
| UNDP | United Nations Development Programme |
| UNECA | United Nations Economic Commission for Africa |
| UNEP | United Nations Environment Programme |

# Part 1: Introduction

This report is an assignment commissioned by the Swedish Agency for Marine and Water Management and their development cooperation programme – SwAM Ocean. The programme aims to support holistic marine management and sustainable blue growth addressing the challenges pertaining to poverty alleviation through the sustainable use of marine ecosystem services, with a focus on coastal areas in Least Developed Countries (LDCs) and Small Islands Developing States (SIDS). This assignment focuses on the linkages between land-based activities related to flood risk management, and the marine ecosystems in Somalia in the Western Indian Ocean region.

## a. Objectives

The purpose of the study is to:

1. Provide insights into how different flood control measures in the Juba and Shabelle river basins, including mitigation and prevention measures, could affect the coastal environment, coastal communities, and the development of a sustainable blue economy in Somalia.

2. Provide recommendations on how to minimize negative effects and maximize benefits of flood control measures.

The target audience for this study consists of a wide range of stakeholders in the Western Indian Ocean (WIO) region such as governmental agencies, international organizations, non-governmental organizations and development aid agencies that are in different ways working with holistic water and marine management, flood risk management, and sustainable blue economy.

## b. Methods

We use the following methods:

- Review and desktop analysis of scientific and grey literature using Google and Google scholar:
    - Literature review of existing studies on how flood control measures affect the coastal environment and coastal communities in relevant countries and regions.
    - Literature review of opportunities and challenges for development of a sustainable blue economy in Somalia.
- Reviews of relevant strategies and plans related to flood and flood-risk management from Somalia.
- Interviews with key stakeholders – open-ended questions using an interview matrix (see Table 1). A total of 44 stakeholders were interviewed, including 35 local interviews in

Beledweyne, Somalia, and 9 online interviews with relevant staff in international organizations working with Somalia (Annex 1).

- The interviewees from Beledweyne, Somalia consisted of 20 persons from local Civile Society Organizations (CSO's)s, 5 from local government, 8 from local NGOs and 2 from local marginalized communities. 29 persons were male and 6 were female. The youngest person interviewed was 20 years old and the oldest was 60 years old.

- Interviewees from international organization included staff from the Food and Agriculture Organization (FAO), the United Nations Environment Programme (UNEP), the United Nations Development Programme (UNDP), the DHI Group, the World Bank, the Intergovernmental Authority on Development (IGAD), the International Crisis Group (ICG) and the Swedish Embassy in Kenya.

- For the data collected through local interviews a method called analysis to identify, examine, and present patterns within the data was used. First, we transcribed the responses. Then assigned codes to identify recurring themes and patterns. To help with this coding and categorization process we utilized NVivo, a software specifically designed for data analysis. By using this approach we were able to extract insights and gain an understanding of the stakeholder's overall opinions and perspectives.

To ensure the reliability and credibility of our findings we utilized a triangulation technique. This involved cross-referencing data gathered from stakeholder interviews with information obtained from literature reviews and strategy assessments. By comparing and contrasting sources of data our aim was to identify consistencies and discrepancies ultimately strengthening the trustworthiness of our conclusions. Furthermore, we shared findings with a subset of stakeholders to obtain feedback ensuring that our interpretations aligned with their perspectives.

Throughout the research process, ethical considerations were given importance. Prior, to conducting interviews:

- All participants received information about the research purpose, their role in it, and how their data would be used. They were then asked for their consent to participate.
- Participants were assured that their identities would remain confidential and that any shared data would be anonymized in the report. Personal identifiers were either altered to maintain anonymity.
- Stakeholders were informed that participating in the study was entirely voluntary and they had the right to withdraw at any point without facing any consequences.
- All participants were provided with contact details, for the research team. Encouraged to reach out if they had any questions or concerns.

| **Topic 1: Flood management (national, Juba/ Shabelle basin region)** | | **Topic 2: Blue Economy** | |
|---|---|---|---|
| ***Sub-topics*** | ***Questions*** | ***Sub-topics*** | ***Questions*** |
| **1.1 Current water governance and flood control challenges** | • What are the primary flood control measures are ongoing or planned in Juba and Shabelle basin at national?<br>• What are the priority challenges for flood management from your view? | **2.1 Somalia blue economy sectors, challenges and opportunities** | • What are the key blue economy sectors in Somalia?<br>• What are the opportunities and challenges for these sectors to achieve sustainable growth? |
| **1.2 Current information gaps in flood risk assessment and management** | • How would you evaluate your current capacity and key challenges to collect and utilize data to inform your flood risk management strategies?<br>• What are the best information sources for Juba/Shabelle basin region?<br>• What are the priorities for improving the capacity to collect and use relevant information for flood risk management? | **2.2. Linkages between blue economy sectors and opportunities to coastal system and coastal community development** | • Which of these sectors dependent is most dependent on coastal environmental health?<br>• Has this been considered in blue economy strategy and planning?<br>• Do you know of key risks that have been assessed in these sectors related to coastal environment and development? |

| | | | |
|---|---|---|---|
| **1.3 Flood management measures w/ high potential application in region** | • What are the priority measures or challenges to address in the current planning to reduce flood risks and impacts in the region?<br>• Are there any additional measures that could be important but are currently missing in plans? | **2.3 Challenges and opportunities for coastal management and development and coastal ecosystem protection** | • What coastal protection measures are ongoing or planned in the Juba and Shabelle basin or at national level?<br>• What are the priority challenges to support coastal protection and development in coastal communities from your view? |
| **1.4 Knowledge on co-benefits of flood risk management measures to coastal environments /communities** | • Are there existing assessments of how current or planned flood measures can potentially affect the coastal environment and coastal communities, particularly in the Juba and Shabelle river basin? | **2.4 Vulnerabilities of blue economy sectors to floods or impacts from flood control measures** | • Have flood events or any flood infrastructure impacted coastal development in ways that you know of?<br>• Which are priority areas to consider and evaluate potential risks or opportunities for blue economy development? |
| **1.5 Stakeholder engagement** | • Which stakeholders are currently engaged flood management?<br>• Are there additional stakeholders that can or should be engaged in order to minimize the potential negative effects and maximize benefits from the positive effects? What should they do? | **2.5 Stakeholder engagement** | • Which stakeholders are engaged blue economy sectors connected to coastal health and development?<br>• Are there additional stakeholders that can or should be engaged in order to minimize the potential negative effects and maximize benefits from the positive effects - and what should they do? |

Table 1. Interview Matrix

- Online questionnaire survey of FRM and the Blue Economy in Somalia (Annex 2) using Google Questionnaire (43 respondents). Respondents indicated that they represented Upper Shabelle Region, Hiiraan Region and University, local development partner organizations, doctors' association, federal and state government and international development organizations.
- Consultative workshops with key stakeholders during World Water Week 2022.
- Triangulation of findings and water governance analysis to develop recommendations.
    - × The water governance analysis is using the source-to-sea framework (Granit et al., 2017; Mathews et al., 2019) as well as the framework developed by Jiménez et al. (2020) that is focused on governance attributes, such as multilevel, participation, inclusiveness, transparency, impartiality, and rule of law.

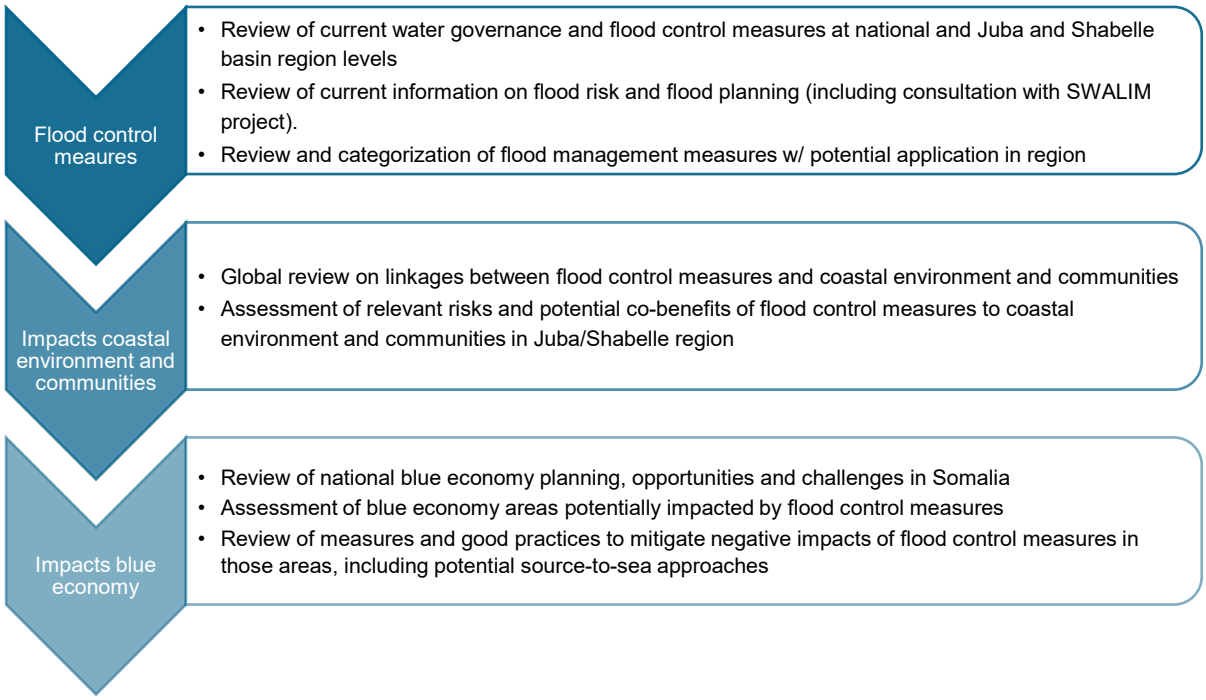



Figure 1: Analytical framework to assess flood control, coastal and blue economy linkages

## c. Limitations

There were limitations that we encountered during our research and these limitations may have had an impact, on the findings and recommendations It was challenging to find literature and data about Somalia especially regarding the targeted watersheds and rivers. This limited availability of localized data might have affected the depth and specificity of our analysis. Despite our efforts to engage a range of stakeholders, it is possible that we did not capture all perspectives comprehensively. Some important stakeholders might not have been available or willing to participate in the interviews. Our research primarily focused on the Juba and Shabelle river basins in Somalia. Therefore, it is essential to note that the findings might not be applicable to regions within Somalia or other countries with geographical and socio-political contexts.

Limitations of the study thus include the selection of interviewees that primarily came from the case study area in Beledweyne where respondents were better informed about flood risks and

local impacts than on downstream impacts on the Blue Economy. However, the respondents from international organizations had more knowledge about the Blue Economy. See Appendix 1 for the selection of interviewees. Respondents to the online survey came from the same international organizations and also included stakeholders from the case study area. Other major limitations are the lack of monitoring and data from Somalia on floods and their impacts as well as the security situation that makes it difficult to access many areas (see Boxes 2 and 3).

# Part 2: Literature review on flood risk management and coastal linkages

## Global Analysis – Literature Review

The following chapter provides an overview of key terms and definitions related to flood risk management as well as management strategies and governance approaches.

### a. Global review of flood risk management and categories of measures

Around 1.5 billion people or 19 percent of the world's population are directly exposed to substantial flood risks with the majority found in low- and middle-income countries. Of the 132 million people who are estimated to live in both extreme poverty and in high flood risk areas, 55 percent are in Sub-Saharan Africa (Rentschler & Salhab, 2020). In Africa, over the period 2008-2018, floods accounted for 65 percent of disaster events and caused 24 percent of deaths. Countries with a high share of the population exposed to floods include Egypt, Sudan, the Central African Republic, Somalia and Mali. Current and projected flood risks in Africa are significant and growing. However, flood risk management in Africa is not yet fully develop and operationalized (Global Center on Adaptation, 2021). Climate change, including increases in frequency and intensity of extremes, have reduced food and water security, hindering efforts to meet the targets of the Sustainable Development Goals (SDGs), including on water (SDG 6) and oceans (SDG 14) (Langsdorf et al., 2022).

#### Box 1: Definition of terms

**Flood** – a flood is defined by different criteria, such as its genesis, duration, frequency, volume and peak flow.

**Risk** – is defined as the combination between hazard and vulnerability (Risk=hazard x vulnerability).

**Hazard** – is a phenomenon, physical manifestation or activity that could result in loss of life or injury, damage to property, social and economic disruption or environmental degradation.

**Vulnerability** – is a propensity to damage or failure of different exposed elements (property, people, activities, functions, systems) of a given territory and society.

Risk is thus related to a natural or anthropogenic hazard whose foreseeable effects involves a large number of people, cause significant damages and exceed the response capacity of the directly concerned authorities (after SAMI et al., 2020).

**Flood Risk Management (FRM)** - actions taken to reduce future damage to people and property caused by flooding and erosion in coastal and fluvial systems. It requires the understanding of the types, causes and likelihood of flood events as well as the population and assets in affected areas and their vulnerability.

**Structural measures** - to reduce floods include measures such as dams, reservoirs, dikes and levees, embankments and diversions, or river and channel improvements

**Non-structural measures** - to reduce flood risk include emergency planning and management, early warning systems, preparedness via capacity building and information dissemination (Global Center on Adaptation, 2021).

**Integrated Water Resources Management (IWRM)** - is a holistic approach to water use and management. It therefore differs from the traditional and fragmented approach in which different sectors implement water projects independently, often with overlapping responsibilities.

**Integrated Flood Management (IFM)** - aims to maximize the productivity and efficient use of floodplains and coastal zones, while minimizing the loss of life and impacts on livelihoods through protective measures.

**Source to pathway to receptor (SPR)** - the chain from flood hazard to flood impact (WMO, 2017).

Globally, the concepts of flood risk management (FRM) and integrated flood management (IFM) are replacing the earlier focus on flood control, which has resulted in larger recognition of non-structural measures as vital components of managing flood risk (Sayers et al., 2015; WMO, 2017)). WMO (2017) has developed the 'source to pathway to receptor' concept (SPR) to measures the chain from flood hazard to flood impact. The type of FRM measures related to the source and pathway part of the cascade will, in general differ, depending on the type of flood, whereas the receptor part depends on the socio-economic situation and governance structures. The cascade of potential measures is illustrated in Figure 2.

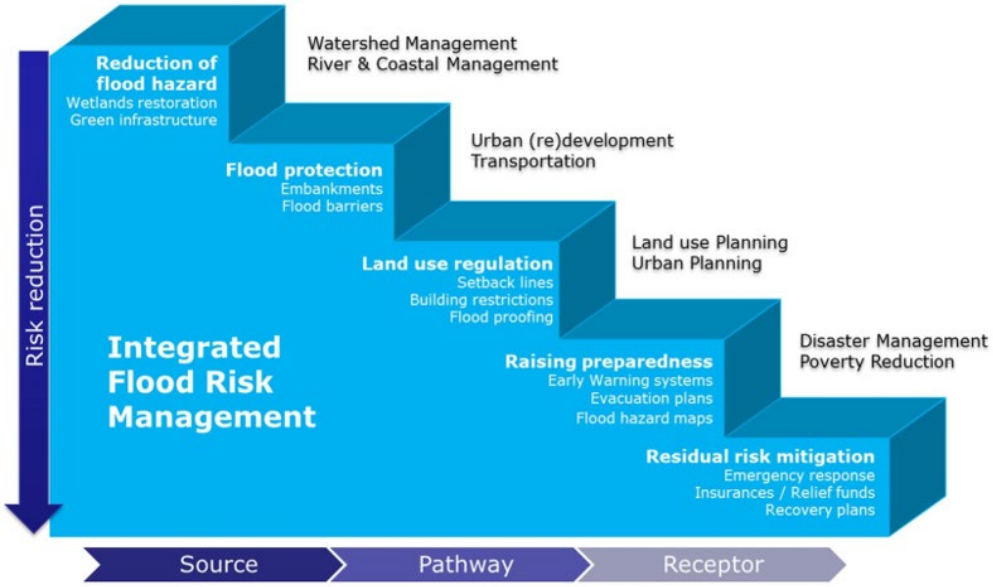


Figure 2: Cascade with potential integrated flood management measures and associated policy and management fields (adapted from Marchand & Long, 2012; WMO, 2017).

Floods can have wide-ranging impacts on infrastructure, agriculture, fisheries and ecosystems in both upstream and downstream areas in river basins and watersheds, which in turn affect local livelihoods. Due to climate change, flood and drought-related acute food insecurity and malnutrition have increased in Africa (Langsdorf et al., 2022). Africa's low-lying coastal zones and their artisanal fishing communities are very vulnerable to floods (Adelekan & Fregene, 2015). Urban communities have been documented to be affected by a combination of high tides and high rainfall in upstream areas that cause damage to housing, especially to informal settlements, and infrastructure in for example the coastal town of Mombasa in Kenya (Okaka & Odhiambo, 2019) and the Western Cape Province of South Africa (Dube et al., 2021).

The literature from Africa on FRM and IFM with a watershed/catchment and landscape focus is relatively scarce. A systematic review of FRM in West Africa revealed that non-structural measures, such as spatial planning, participatory and inclusive governance, and early warning systems were critical. A study from Ghana on effectiveness of structural and non-structural measures in FRM highlighted the crucial role of community participation in planning and management as well as financial preparedness (Almoradie et al., 2020). In wide floodplains, such as the Zambezi River basin, a structural approach to FRM cannot be justified on both environmental and economic grounds (Lumbroso, 2020). Lumbroso et al. (2008) concluded that there was very little practical information available aimed specifically at rural communities in Sub-Saharan Africa to improve their preparedness to flooding and other natural hazards, but that there was plenty of technical information available. Based on experiences from Bangladesh, they identified and developed a range of non-structural solutions to reduce rural communities' vulnerability to floods in Mozambique by raising their awareness to floods and improving preparedness, including the use of educational tools, such as a source book, posters, check lists and games. It has also been documented that degradation and erosion of watersheds in Ethiopia, as a result of intensive cultivation, overgrazing, increase in population, and deforestation, have led to increase in flood risk as well as decrease in crop yields in downstream areas in Somalia (Gebretsadik, 2014). There is much work that remains to be done in FRM in Africa when it comes to assessment, mapping and forecasting of floods (Lumbroso, 2020).

Integrated Water Resources Management (IWRM) is a key aspect of FRM and IFM, as flood risk depends in many cases on the characteristics and management of river basins and catchment areas. Integrating flood risk in development and IWRM strategies can support a move from reactive approaches to flood control to more preventive approaches based on risk-informed decision-making for floods. Ecosystem-based management and green infrastructure provide opportunities to strengthen the natural regulating functions of ecosystems and vegetation to retain water in soils and wetlands and to regulate downstream flows, while providing biodiversity and socio-economic co-benefits (WMO, 2017). This includes nature-based solutions (NBS). NBS are inspired by and supported by nature and use or mimic natural processes to contribute to the improved management of water. NBS can involve conserving or rehabilitating natural ecosystems and/or enhancement or creation of natural processes in modified or artificial ecosystems, and can be applied from micro- to macro-, for example landscape, scale. NBS for flood management can involve water retention by managing infiltration and overland flow (WWAP (United Nations World Water Assessment Programme) & UN-Water, 2018).

Dadson et al. (2017) analysed over 20 types of NBS flood management measures at catchment scale in the U.K. and grouped them into three main categories:

1. **Retaining water in the landscape, including water retention through management of infiltration and overland flow** – specific measures include land use changes, arable land use practices, livestock land practices, tillage practices, field drainage, buffer strips and buffer zones, machinery management, and urban land use;
2. **Retaining water in the landscape managing connectivity and conveyance** – specific measures include management of hillslope connectivity, buffer strips and buffering zones to reduce connectivity, channel maintenance, drainage and pumping operations, field and farm structures, on-farm retention, river restoration, and upland water retention;
3. **Making space for water, including flood plain conveyance and storage** – specific measures include water storage areas, wetlands, river restoration, river and water course management, and floodplain restoration.

A categorization for coastal flood mitigation (Gómez Martín et al., 2020) included three types of NBS:

1. NBS Type 1: Low human intervention – also known as natural solutions and can include creation of coastal and marine protected areas;
2. NBS Type 2: Medium human intervention – also known as soft engineering. This can include extensive and intensive physical approaches and involve restoration and rehabilitation of coastal habitats;
3. NBS Type 3: Creation of new ecosystems and hybrid solutions – commonly referred to as hybrid solutions that combine NBS Type 2 with hard grey infrastructure for maximum coastal protection.

These measures are more focused on mitigation flooding caused by sea-level rise and/or storm surges along the coast than on floods from upstream areas. However, maintaining coastal habitats in a healthy state will also increase the resilience against upstream floods.

Natural and Nature-Based Features (NNBF) is a type of NBS that refers to the use of landscape features to produce FRM benefits. In the International Guidelines on NNBF for flood risk management (Bridges et al., 2021), FRM refers to actions taken to reduce future damage to people and property caused by flooding and erosion in coastal and fluvial systems. NNBF landscape features can include beaches, dunes, wetlands reefs and islands and can be used alone, in combination with each other, and in combination with conventional engineering measures or structural measures, such as levees, floodwalls, etc. The framework for developing and implementing NNBF projects has five phases that are scoping, planning, decision-making, implementation and operation (Bridges et al., 2021). Important steps include establishment of a funding strategy, determining risk, assessment of NNBF and hybrid options, socio-economic analysis, monitoring and adaptive management.

The “Flood Green Guide” (FGG) (WWF, 2017) is an example of a holistic NBS framework that supports communities at local level in using NBS for flood risk management. It stresses that flood risk management measures should be site-specific, integrated and balanced across all sectors concerned, and based on IFM. The key principles of the FGG are:

- Design flood management methods to maximize the net benefits of floodwater while minimizing flood risks;
- Apply flood risk management with a watershed/catchment perspective;
- Consider non-structural methods in flood management, and then, if needed, include structural, natural, NBS or hard engineering as part of an integrated approach;
- Recognize the multiple social, economic, environmental and political aspects affected by flood management in a watershed;
- Integrate flood risk reduction and adaptation to a changing climate, so that flood recovery improves community resilience, avoids introduction of new social or environmental vulnerabilities, and enhance community adaptation capacity;
- Support social equity and comply with local/national laws and institutions, including informal social norms and customs during decision-making processes; and
- Strengthen resilience processes and livelihoods and empower women and/or disadvantaged social groups.

The relevance of these different approaches, measures and guidelines for FRM in Somalia will be discussed in Part 3 and compared with the findings from interviews with different local stakeholders.

***The following chapter provides an overview of the impact of flood risk management on environmental flows and the coastal environment, as well as of existing management guidelines and awareness raising tools***

## b. Overview of potential impacts of flood risk management measures on coastal environments and coastal communities, including existing management guidelines and approaches

FRM measures can have both on-site and off-site benefits in terms of for example reduction of erosion and improvement of agricultural productivity and livelihoods of local communities in upper catchment areas or on a flood plain and adjacent coastal area. However, there can also be trade-offs that need to be considered, such as impacts on downstream riparian and coastal ecosystems as well as coastal livelihoods based on for example artisanal fishing if environmental flows are not maintained and coastal ecosystems are negatively impacted by upstream FRM measures.

Due to high gradients, the rivers flowing into the Western Indian Ocean carry high sediment loads and, in combination with strong tides of 2-4 m and seasonal rainfall, create biodiversity rich and productive ecosystems on floodplains and in deltas and estuaries that, through flooding, have sustained indigenous use systems. However, river catchments from Somalia in the north to Mozambique in the south are rapidly changing due to deforestation and other land-use changes. Hydropower dams also increasingly alter flood characteristics and the flood pulse that ranges from semi-annual in the Shebelle-Juba system to single annual in the Ruvuma and southwards (Duvail et al., 2017). Extreme flood events from the Shebelle to the Rufiji can, in some years, be linked to positive El Nino-Southern Oscillation (ENSO) events (Erftemeijer & Hamerlynck, 2005). For the sustainable development of these rivers and their downstream areas, it is essential to maintain flood rhythms through, for example, environmental flows and regulated releases from upstream dams.

Guidelines for assessment of environmental flows (e-flows) have been developed for the Western Indian Ocean and its littoral countries, (UNEP-Nairobi Convention/WIOMSA, 2020), where e-flows are defined as the magnitude, frequency, timing, and quality of water and sediment flows necessary to sustain freshwater and estuarine ecosystems and the human livelihoods and well-being that depend on these ecosystems. Over 200 e-flow assessment have been completed for this region, but none in Somalia. Over time, there has been a progressive move towards more basin-wide assessments.

Healthy coastal habitats, such as mangroves, reefs and dunes, are nature-based solutions (NBS) valuable to protect the coast against extreme events (Inácio et al., 2020). Guidelines on mangrove ecosystem restoration have been developed for the Western Indian Ocean (UNEP-Nairobi Convention/USAID/WIOMSA, 2020) in response to the wide-spread degradation and loss of mangrove forests across the region, including in Somalia (Groeneveld et al., 2021). Mangroves play a crucial role in moderating coastal flooding and local communities depend on mangrove wood for construction, fuel, fish traps and boat building, and non-wood products, such as traditional medicine. Mangroves also provide habitats and nursery grounds for fish and other wildlife, control coastal erosion and support nutrient cycling and carbon sequestration.

Small-scale fisheries are very vulnerable to floods caused both by flash floods from upstream catchments, heavy rainfall and by sea level rise, which has been studied and documented in for example Bangladesh (Islam et al., 2021), Vietnam (Thanh et al., 2004), Nigeria (Adelekan & Fregene, 2015), and in small-scale reef fishing in Madagascar and Kenya (D'agata et al., 2020). Common for these studies is that they focus on factors determining the vulnerability and adaptive capacity of coastal fishing communities. It is considered that adaptive capacity could be strengthened through increasing market access and education, and mitigating future climate exposure and unsustainable fishing through marine conservation and management (D'agata et al., 2020), and through implementation of the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (SSF Guidelines) developed by FAO (FAO, 2015). The SSF Guidelines state that:

*"All parties should recognize and take into account the differential impact of natural and human-induced disasters and climate change on small-scale fisheries. States should develop policies and plans to address climate change in fisheries, in particular strategies for adaptation and mitigation, where applicable, as well as for building resilience, in full and effective consultation with fishing communities including indigenous peoples, men and women, paying particular attention to vulnerable and marginalized groups."*

Finally, because of the increasing attention being paid to stakeholders in upstream-downstream relationships, there is a growing use of 'serious games' in FRM. The aim of serious games is not primarily to provide entertainment, but to support learning, reflection, civic engagement, promote behaviour change, as well as preparing players for future roles (Forrest et al., 2022). Games are increasingly recognized in capacity development and increasing competencies for sustainable water management. The majority of FRM measures incorporated into games focus on pre-flood actions, as opposed to actions during flood events or in recovering from flood events. Pre-flood measures included structural preventive measures, whilst land management strategies and spatial measures were also popular. An example of a game that has been plaid in Africa is the River Basin Game (DFID, 2003), which is a tool for promoting dialogue over water resources. It is a physical representation of a sub-catchment or small river with a gradient to show upstream-

downstream flow of water and includes intakes into irrigation systems. An example from Mozambique includes development of a 52-pack card game to help educate school children about flooding to gain an understanding of the important issues and share what they have learned with their parents, such as methods by which rural water supply and sanitation infrastructure can be flood proofed (Lumbroso et al., 2008). Games are also used for land-use planning, which is an important element of river basin management. In a practical example from southeast Asia, a board game was designed to represent a village with 100 cells representing one hectare each. After several games and cycles of negotiations and discussions, a consensual land-use plan emerged (Castella & Lestrelin, 2021).

**The *following chapter provides an overview of how the Source-to-Sea governance frameworks can support cross-sectoral collaboration and bridge the divisions of government structures and siloed approaches to flood risk management.***

## c. Review of governance arrangements to mitigate negative impacts of flood control measures, including potential source-to-sea approaches

There is a growing global recognition of the need for better basin-to-coast ecosystem management approaches to IWRM and environmental flows, which has led to the development of the source-to-see approach (Granit et al., 2017; Mathews et al., 2019) that link the governance and management of upstream and downstream areas along the different segments in the source to sea continuum and stimulates coordination across sectors and segments (Figure 3). The Source-to-Sea (S2S) system is defined as the land area that is drained by a river system, its lakes and tributaries (the river basin), connected aquifers and downstream recipients including deltas and estuaries, coastlines and near-shore waters, the adjoining sea and continental shelf as well as the open ocean. S2S key flows are water, biota, sediment, pollution, materials (the built environment) and ecosystem services.

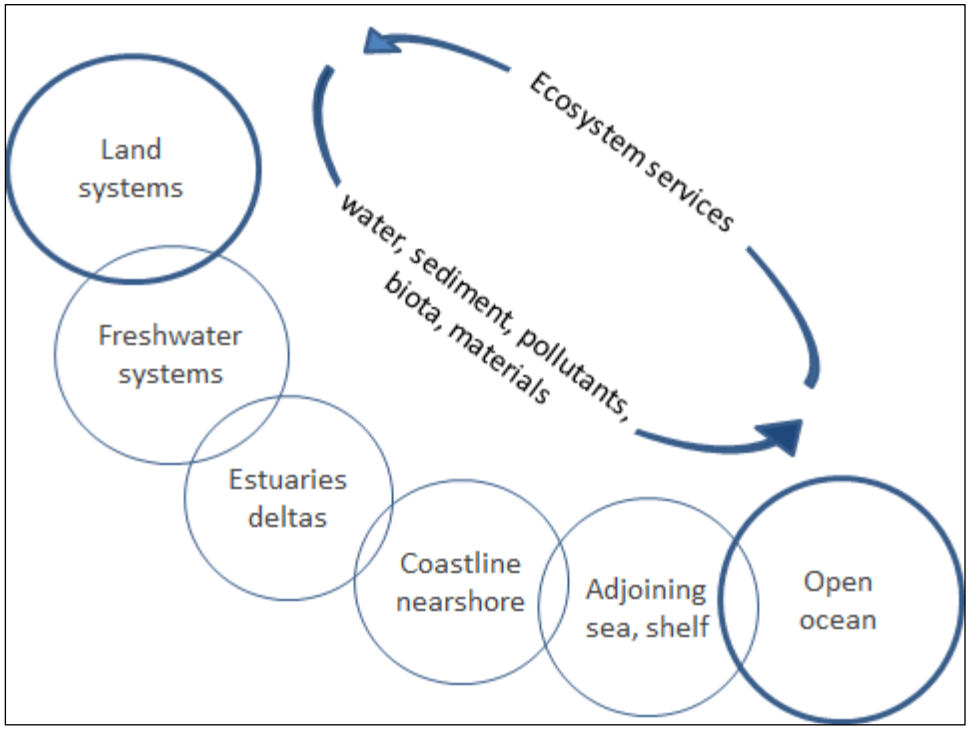



Figure 3: Key flows connecting geographies from source to sea: water, sediment, pollutants, biota, materials and ecosystem services flows (adapted from Granit et al. (2017).

Governance is often structured around individual segments of the S2S system and can be focused on one sector or a specific S2S flow and may be poorly suited to manage the S2S system as a whole. Resource management tends to be dealt with segment by segment, or sector by sector, aiming for outcomes that may or may not be optimal for the entire system. Practices, following in line with the segmentation in policies, procedures and regulations, are often directed toward maximizing local benefits and are blind to their upstream and/downstream impacts. This can result in benefits for one sector or in one S2S segment having negative consequences either on other upstream or downstream segments or sectors that are not adequately accounted for in governance and practices. The approach begins with understanding the pressures and drivers of alteration of key flows. This, in combination with selecting an appropriate scale of intervention, engagement of stakeholders (both upstream and downstream) and a thorough understanding of the governance context sets the basis for defining a theory of change to guide development of an action plan.

## National/basin level analysis – Literature Review

**The *following chapter gives an overview of the current governmental readiness to handle environmental challenges and the current ongoing work in launching the water resources management plan of Somalia. The chapter covers flood and drought related challenges to Somalia's economic development and the impact of insecurity and Al Shabab, including a case study and online survey of FRM strategies in Beledweyne.***

## d. Overview of flood challenges in Somalia and need for flood protection, at national level and Juba/Shabelle basin region levels.

Somalia experiences cyclic droughts every two to three years accompanied by devastating floods, particularly in the Southwestern regions. The floods occur when the Shabelle and Juba rivers burst their banks and, in the process, causes displacement of people and destruction of properties. Floods in these regions affect the livelihoods of about 1.8 million people (AfDB et al., 2016) The Juba and Shabelle basin, shared by Ethiopia and Somalia and to a marginal extent by Kenya brings its own set of complex dynamics (Krampe, 2020). Ethiopia and downstream Somalia have the clearest domestic interests in the Juba–Shabelle Basin's water resources and their development. The region around the basin, marked by three decades of civil war and state collapse, is dependent on the river for agriculture, drinking water and hydropower. Despite the significance of water access, there has never been a bilateral agreement surrounding international cooperation over the rivers' usage. The lack in shared upstream data with Somalia prevents the further analyzing and planning around the recourse.

The map below (Figure 4) of the Juba-Shabelle basin shows that precipitation is predicted to increase (green) in certain areas but decrease (yellow) in others[1]. The precipitation anomaly map shows that the precipitation is projected to increase in a broad band while some other areas will see stable or slightly reduced precipitation. The basin is projected to see temperatures increase by 1º to 2ºC. Due to its interaction with socioeconomic and political factors, the projected changes will have a significant negative impact on water access and subsequent multidimensional security in the Horn of Africa.

In addition, temperatures are expected to increase in Somalia along with more erratic rainfall patterns and sea level rise, leading to higher frequency and intensity of natural hazards (MoEWR, 2021c). Climate projections for 2030, 2050 and 2070 re-confirm an increase in annual maximum and annual minimum temperatures. Increased evaporation, coupled with land degradation from deforestation and over-grazing increases the risk of flash floods and hence to loss of arable land. The increased insecurity of water and food, destruction of land and livelihoods increases vulnerability and elevates existing tensions that might lead to conflicts as people are forced to move away.

Hydrology projections indicate a stronger and continued rise of evapotranspiration (MoEWR, 2021c). The southern and northern Somali regions will for example see an increase of 0.8-3.9% in 2030, and further to between 3.7-7.5% in 2080, compared to levels during the year 2000.

[1] https://www.newsecuritybeat.org/2020/04/regional-approach-water-security-governance-horn-africa/

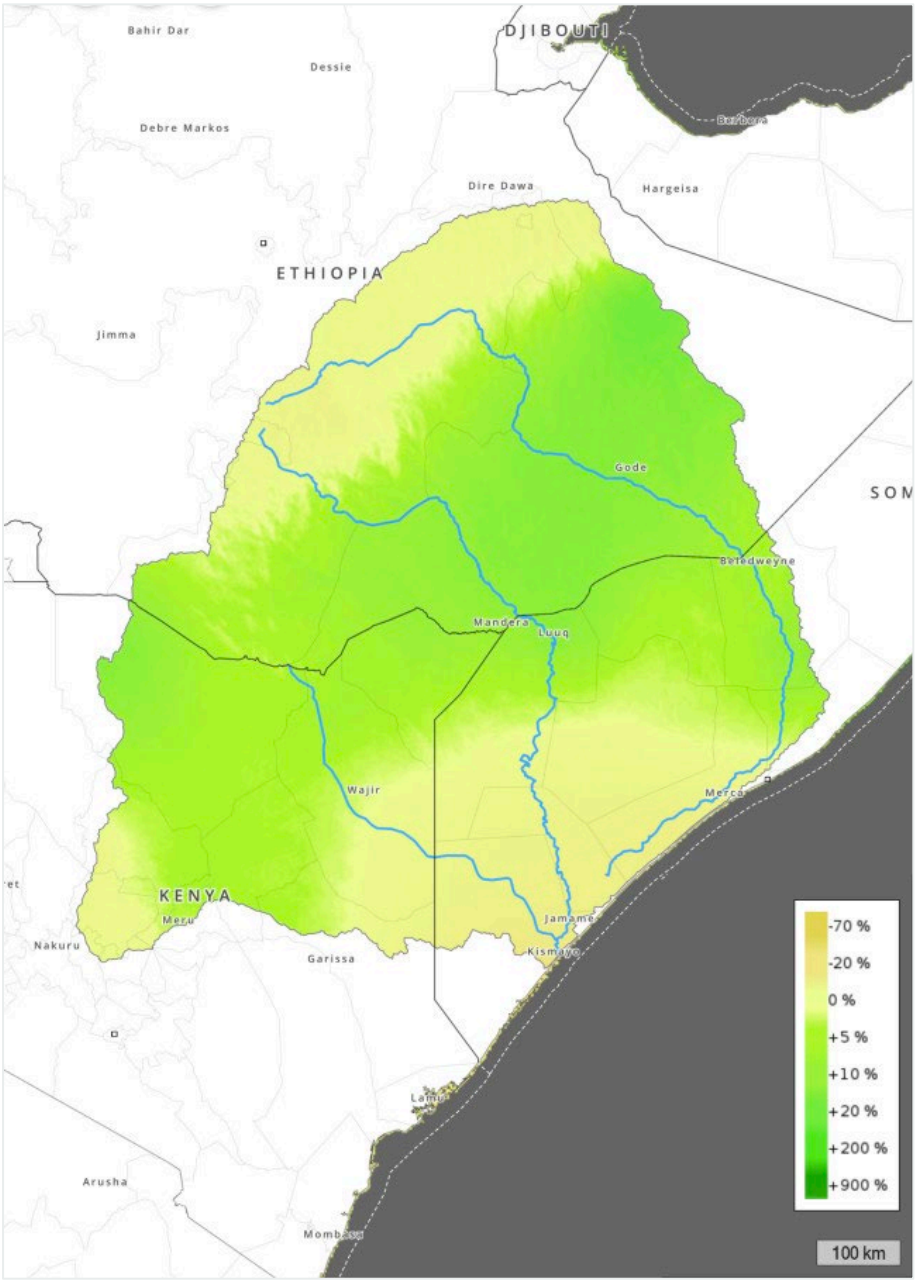



Figure 4: Map of Juba-Shabelle Basin Annual Mean Difference Precipitation Projection, 1973–2013 vs. 2041–2060 (MoEWR, 2021c).

Weak state institutions and distrust between states in the region are two key political constraints in the Horn of Africa. These constraints have a negative effect on regional organizations, institutions, and initiatives. They also limit the options for sustainable governance of water resources and for anticipating and pre-empting other climate-related security risks in the region. National agendas and ambitions prevent countries from acknowledging shared regional interests.

Illegal logging, deforestation and land degradation have been problems in Somalia for decades. These problems, worsened by overgrazing, conflict and climate change, have made many areas prone to devasting flash floods, caused by heavy rainfall that leads to a sudden increase in river flow followed by a quick recession. Many ephemeral rivers, or wadis, in Somalia are prone to flash floods resulting in a sudden increase in river flow followed by a quick recession (UNEP-DHI

Centre, 2022). In turn, the severity and frequency of flooding from the Shabelle River has increased within the past few decades, particularly in the reach between Beledweyne and Jowhar, and a major contributor to flooding is increased deposition and raising of the riverbed due to high sediment loads. This tends to happen during the Gu rainy season between March and June and the Deyr season from October to December. At the same time, Somalia also suffers frequent periods of water scarcity or drought.

In May 2021, a prolonged downpour of rains in Somalia caused the Shabelle River to overflow, flooding the nearby region of Jowhar and resulting in entire communities being submerged. More than 13,700 people were affected by the flood, resulting in thousands losing their homes and livelihoods from the extensive damage to farmlands and infrastructure. Further, as is often the case with floods, the resulting still water became a catalyst for cholera.

Sequential seasons of reduced rainfall, drying up of strategic water sources, and dying livestock exposed millions across Somalia at risk of famine[2]. The current drought conditions have affected about 6.1 million people and displaced 759,000 people from their homes in search of water, food, and pasture. Women and girls continue to bear the brunt of the crisis. The impact of the drought and resulting crisis overwhelmed national response capacities in Somalia. Currently, up to 80 per cent of the water sources across the country are drying up, including the Shabelle and Juba rivers whose water levels are below historic minimum levels. As of 23 April 2022, an estimated 4.2 million people are facing acute water shortages with over 159 strategic communal boreholes are in need of urgent upgrading to restore their functionality.

Despite the onset of Gu rains in late March in some areas of Somalia, large parts of the country are yet to see the 2022 Gu rains. As a result, only minimal improvements are expected during this season and in some areas further deterioration in water access and food security is expected. This sets the stage for a possible famine in later parts of 2022, if the humanitarian assistance does not reach the beneficiaries in time. Prevailing La Niña conditions are most likely to result in a historic, fourth consecutive below-average rainfall season in April-June 2022 with potentially catastrophic results.

According to SWALIM (FAO)[3], both the Juba and Shabelle basin suffered from several dam breakages in August this year. In the Juba basin, the open breakages amounted to 30 sites, potential breakage to 32 sites and overflows at 91 sites. Additionally, the breakages were closed with sandbags at 13 sites. In the Shabelle basin, the recorded and verified breakages amounted to 70 sites, 12 confirmed overflows, 369 potential overflows and 121 potential breakages. 31 breakages were closed with sandbags. There are many reasons from the flooding, farmers upstream often break the dams to irrigate their farms, dams are under-dimensioned or needs repair, or simply used by Al Shabab as a strategy in their warfare again clans and communities.

## Box 2: Profile of the Shabelle and Juba basin

The Shabelle and Juba basin is highly important for Somalia's food production. Virtually all the countries crop production takes place in these river basins. Although crop production only contributes to roughly 5% of GDP, it is an important sector for food security and employment (MoEWR, 2021b). Livestock production in the Shabelle,

[2] UNICEF, Somalia Water Shortage Update, visited 23.04.2022 *Website: https://reliefweb.int/report/somalia/somalia-water-shortage-update-23-april-2022*

[3] http://www.faoswalim.org/content/status-river-breakages-along-juba-and-shabelle-rivers-august-2022

which is often coupled with crop production had a higher economic value and GDP contribution of 40%[4] and contributes to 75% of total export value.

The Shabelle is the principal water resource for 4 million people in Somalia that have no other access to other water sources (MoEWR 2021: Shabelle Basin Diagnostic and Strategic Action Plan). The basin itself is 297,000 km$^2$, with 64% on the Ethiopian side of the boarder. This means that this basin has the same geographical coverage as Italy (301,230 km$^2$). Pressure is growing on the water resources from the rapidly increasing population, economic growth, and unregulated irrigation. Sewage and dumping of garbage in the river canal system is impacting the water quality. There is not enough research commissioned on the water quality in Shabelle, but the current situation is of major public health concerns.

The infrastructure in the Shabelle basin is poor. There are about 4,000 km of primary roads, of which 2,800 km is paved and 1,200 km unpaved. 90% of this road network is in poor condition and in urgent need of maintenance. The lack of maintained and good quality roads prevents farmers to transport produce to markets. Production of fragile crops, such as tomatoes and lettuce are no longer viable as the poor infrastructure ends up destroying the produce during the transport.

Violence and insecurity are prevalent in Somalia. Clashes are particularly common between Beledweyne and Mogadishu and in the lower Shabelle area (Federal Government of Somalia, 2021; ACLED, 02.08.2022). Al-Shabab is controlling most rural areas in the middle and lower Shabelle basin but clashes between clans and communities are common, especially around water access (Interview, ICG, 02.08.2022).

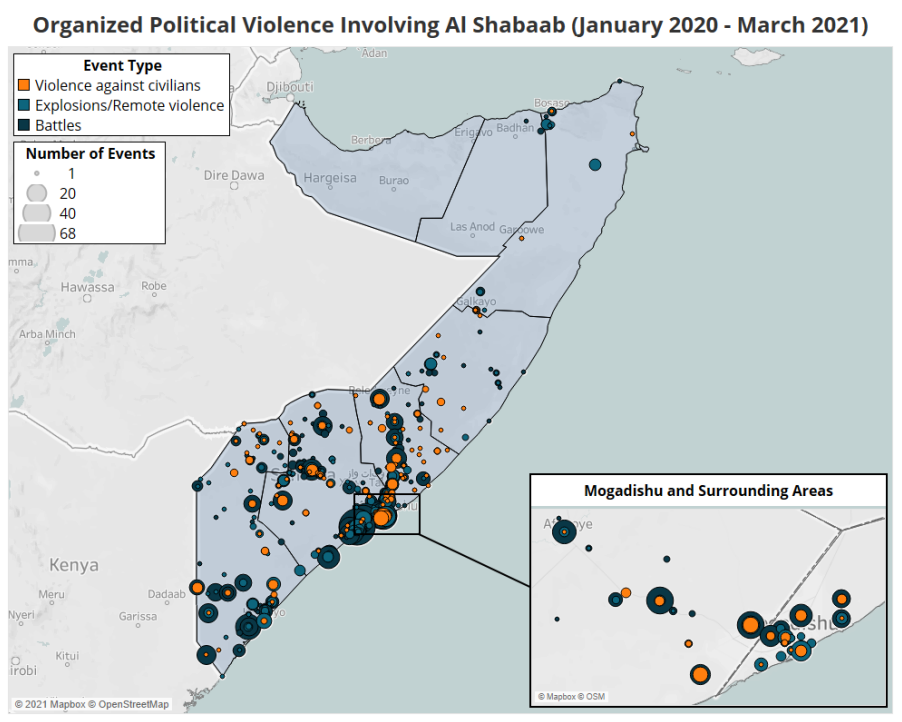



Figure 5. A Turbulent Run-up to Elections in Somalia. 2022Overview of current water governance and flood control measures at national and Juba and Shabelle basin region levels

Somalia is currently in the process of re-establishing a sound water governance framework to provide an effective structure for Somalia population (MoEWR, 2021c). At the National level, the Ministry of Energy and Water Resources (MoEWR) is responsible for all water related issues. This includes overall formulation, direction, and coordination of national water resources. As a response to the weak coordination between line Ministries and Federal Member states, MoEWR developed the National Water Resources Strategy 2021-2025. This strategy, planned out in two

[4] Moody's Analytics, visited 02.08.2022. *Website: https://www.economy.com/somalia/indicators*

phases has three major goals. Goal 1: *Establishing a Functional Water Sector Governance Framework* - provides the strategic approach and actions towards strengthening water sector governance; Goal 2*: Operationalizing Integrated Water Resources Management* - provides the strategic approach and actions towards improved and integrated water resource management as a basis for ensuring sustainable water resource development and the provision of sanitation services. Goal 3*: Improving the Provision of Priority Water Services* – provides the strategic approach and actions to guide the development of water resources to realize improvements in water related services. 20 different sub-categories fall under the three goals as well as a structured activity plan with accompanying indicators.

One of the governance challenges facing the water sector is largely inadequate baseline and real-time data and information, as well as the lack of scientific analytics on water resources availability, quality, and quantity (MoEWR, 2021c). Efforts have been made to maintain the critical archives and produce relevant studies over the past twenty years, the SWALIM data base project is one of those examples. Allocation and water resources planning is currently based on anecdotal and outdated data and in need of urgent modernization (MoEWR, 2021b). The Shabelle basin has for example only one gauging station, which is inadequate for a basin (297,000 km2) with the same geographical coverage as Italy (301,230 km²) (FGS. 2021. Shabelle Basin Diagnostic and Strategic Action Plan 2021). Current observations can only be done through satellite observations, which are sufficient but not as good a real time data from the basin (Interview, FAO).

The Somalian Government is also in the process of establishing the legal structure for setting up National Hydrology and Meteorology Services (Interview, Senior Advisor to MoEWR). Although the country lacks senior professionals, efforts are being made to build a work force of junior meteorologists and hydrologists. The FGS has proactively sent baches of students to Kenya for professional hydrology and meteorology training. Active communication with WMO is established and capacity building programmes are being developed.

During the civil war, water sector infrastructure suffered either from destructive actions or from lack of maintenance. In addition, the destruction of infrastructure because of flooding has been significant. Infrastructure development is therefore a top priority for Somalia. There is limited information on the existing infrastructure asset base, its value, or conditions, however, it is estimated that about 60% of existing water supply infrastructure assets requires rehabilitation, expansion, or replacement in both urban and rural areas to meet demands (MoEWR, 2021).

Somalia's National Adaptation Programme of Action (NAPA) (MoNR, 2013) has identified water resources as one of the most vulnerable sectors to climate change. Similarly, Somalia's Nationally Determined Contribution (FGS, 2021) flags that the availability of water resources is going to be impacted by climate change and provides a suite of priority water sector interventions that are targeted at increasing the resilience of Somalia's population while bolstering socio-economic development.

The Somalia NAPA identifies watershed management and construction of medium to large-scale infrastructure as priority adaptation strategies. This specifically includes dams, diversions for irrigation, livestock watering points and boreholes, construction, and rehabilitation of community level infrastructure. Prioritized community level infrastructure includes *berkeds*, shallow wells, ponds, construction of embankments/gabions and check-dams that will protect flood-prone areas

during heavy downpours. Somalia's National Development Plan (2020-2024) identified water and infrastructure management as a key priority to reduce poverty and boost economic growth (MoPIED, 2020).

Effective flood control will require the repair of old water management infrastructure, including dams, offtakes, and sluices. Nine barrages were built on the Shabelle River and one on the Juba River. With these barrages being the most significant forms of irrigation infrastructure in Somalia. The Middle Shabelle region had some of the best irrigation and flood control infrastructure in the country but these need to be improved and maintained (MoEWR, 2021).

The Ministry of Energy and Water Resources (MoEWR) in collaboration with the United Nations Environment Programme (UNEP) recently carried out the project "*Sustainable Flood Management and Risk Reduction Action: applicability of Nature-based Solutions for Flood and Drought Management in Somalia*" from August 2021 to March 2022.The main objectives of the project were to support government stakeholders with data, information and tools to carry out flash flood risk assessment, research on applicability of Nature-based Solutions (NBS) for flood and drought mitigation and capacity building (UNEP-DHI Centre, 2022).The first step in the UNEP assessment of the applicability of NBS to Somalia's conditions was the identification of a list of tested NBS targeting flood (and in some instances drought) in Somalia context. The key output of this work is the NBS catalogue. Secondly, a selection of the options with highest potential were examined in more depth using hydrologic and hydraulic mathematical modelling and indicators for future prioritization of most suitable NBS have been identified.

In the Shabelle River, from Beledweyne to Jowhar, the primary sediment process is deposition and the process most affecting the locations of bank overflows is also deposition. Thus, the effectiveness of the application of NBS to decrease the mass of sediment entering the river, decrease sediment deposition, and decrease the incidence of river flooding. Summaries of each of the three tested cases are as follows:

**Embankment Collapse:** Local bank erosion/collapse does not significantly affect the risk for increased flooding elsewhere along the river. The study likewise shows that the impact of reducing sediment entering the river by using bank stabilization measures has a minimal impact on river flooding.

**Topsoil Erosion:** The impact of reducing sediment entering the river from the Shabelle catchment in Somalia has a large impact on river flooding. NBS for prevention or trapping of topsoil erosion can include reforestation and revegetation of the catchment, sand dams, and gully rehabilitation.

**River Sediment Load at Beledweyne:** The impact of reducing the load of sediment carried by the river at Beledweyne was shown to impact only the first 100km of the modelled domain. Reduction of load in the river would be accomplished by implementation of measures to reduce eroded topsoil from entering the river in the Ethiopian part of the Shabelle River catchment. NBS to accomplish this are the same as those that could be applied in Somalia, including reforestation and revegetation of the catchment, sand dams, and gully rehabilitation.

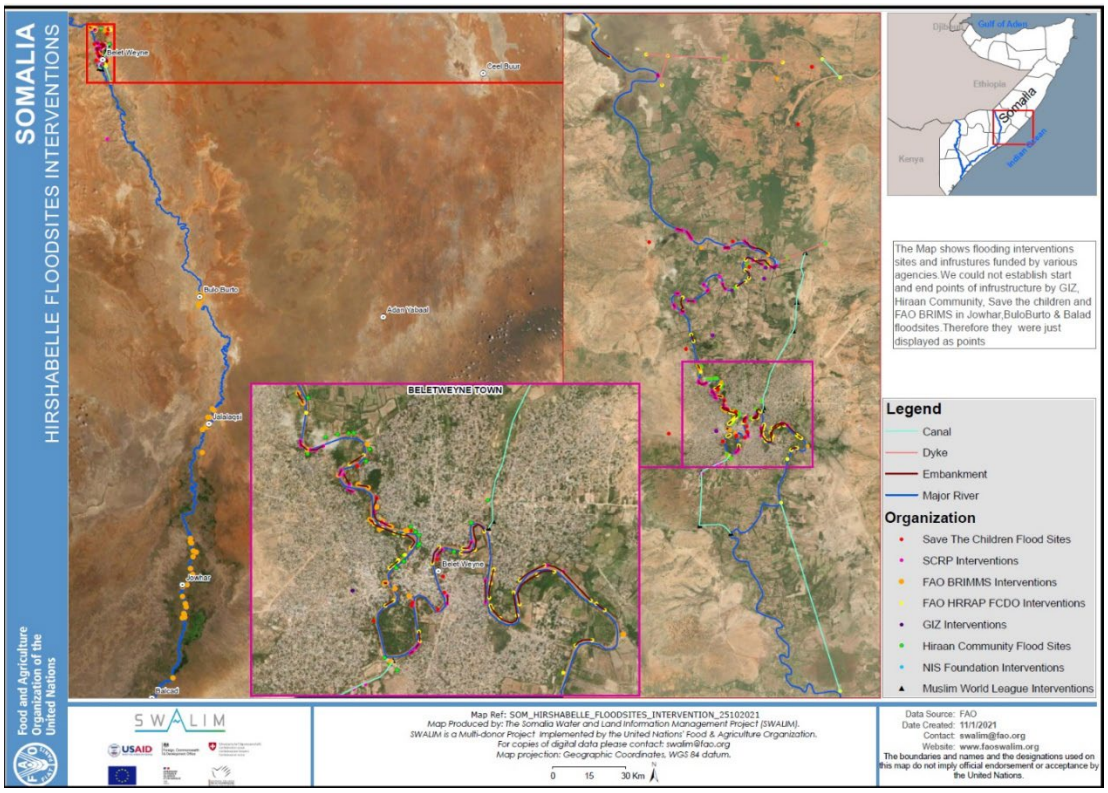



Figure 6. Somalia Hirshabelle flood sites Intervention 25.10.2021. Source: FAO, SWALIM.

### Beledweyne case study

Beledweyne is the capital of the Hiiraan Region in Hirshabelle State. It is located on the banks of the Shabelle River and has a history of flooding. Most of the wadis in the area do not enter the Shabelle River but dry up as they reach the flood plain, so flooding in the town is mainly driven by river discharge from Ethiopia. During extreme events, the discharge from the wadis will enter the Shabelle.

The data analyses done by (UNEP-DHI Centre, 2022) indicate that the local contributions to flooding in the town generally appear as smaller peaks during a larger event driven by inflow from Ethiopia. An example of this is shown in Figure 5. There is a gradual increase in discharge in the river, caused by inflow from Ethiopia with a sharp peak around the 14th of October caused by local rainfall.


Figure 7. Discharge in the Shabelle River at Beledweyne during October 2009 (UNEP-DHI Centre, 2022).

Generally, the locally generated discharge is expected to affect the discharge in Beledweyne Town as smaller, more sudden peaks during larger events. A more detailed analysis and calibration could determine the part of the flood that is generated locally. However, it is expected that the locally generated floods will mainly affect the wadis while Beledweyne Town will be more affected by water that is already in the Shabelle River.

FAO has been running three flood prevention programmes since 2020 in Somalia, two in Beledweyne and one larger project for Shabelle and Juba basin where they together with World Bank and FGS trained, planned and constructed sand dams in order to prevent the town from flooding (Figure 8). The current infrastructure will be sufficient for a few seasons, but additional work is needed to secure long-term flooding risks.


Figure 8. November 2020, Beledweyne town, Somalia -A construction vehicle works on the water drainages at Waraabole, Beledweyne town in Somalia. Source: FAO

43 responses were received to the online survey about the impacts of flooding, flood risk management measures and the Blue Economy. Most of the respondents were based In Beledweyne and they considered that the main impact on flooding was on agricultural

production, water and sanitation and on housing and shelter (Figure 9(1)). In terms of structural flood management measures, channel improvements, dams and spillways as well as diversion channels were the preferred measures (Figure 9(2)). Management of floodplain conveyance and water storage and sediment trapping in wetlands were the preferred NBS and NNBF solutions (Figures 9(3) and 9(4). Financial preparedness and early-warning systems were considered to be the most important non-structural FRM measures (Figure 9(6)). To strengthen water governance, IWRM and mechanisms for intersectoral coordination were the top priorities (Figure 9(6)).

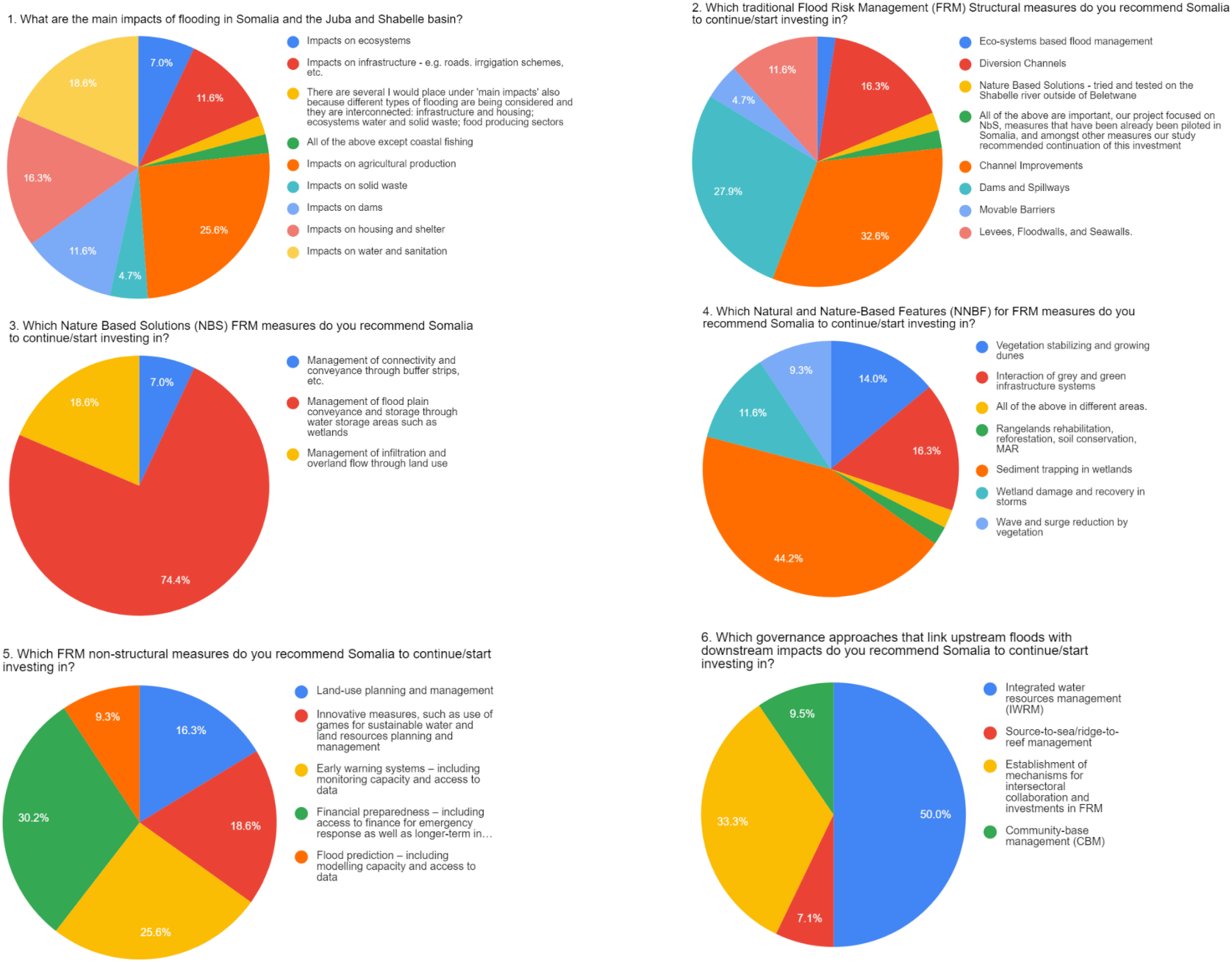



Figure 9. Impacts of floods and flood risk management measures and approaches according to online survey targeting stakeholders working in Beledweyne (n=43 ).

The case study also included in-depth interviews with 35 key informants in Beledweyne, from the upper Shabelle basin (see Annex 1) using the interview matrix in Table 1. A summary of their perceptions of flood risk management and challenges and opportunities is found in Box 3. The formation of a flood committee, a non-structural measure, was considered very important in coordinating and implementing local FRM efforts. Lack of sewage systems, treatment of pollution and waste management are seen as major challenges with serious health impacts, exacerbated by uncontrolled housing development in response to displacement of people in response to conflict. Lack of access to information on water resources and sharing of information between upstream and downstream areas prevents planning and development of preparedness mechanisms. Enhanced collaboration across different parts of the government as well as among development partners is needed as well as better monitoring systems for floods and river pollution.

## Box 3: Local perceptions of Flood Risk Management - results from interviews in Beledweyne

With respect to **existing flood control measures**, the Hiiraan/Beledweyne Flood Committee was considered to play an important role in working with local communities and coordinate efforts such as building a wall along the river, closing water canals dug by farmers to drain water from their fields, restoration of levees, and in dam construction. It has engaged local youth in cleaning the riverbed of water in times of drought and has also managed to reduce the number of people displaced by floods. However, it is pointed out that the flood control measures that are being implemented so far are only temporary solutions, focusing on responses rather than solutions to the flooding. It was also mentioned that traditional elders and religious leaders have important roles in educating people about the negative effects of canals and small dams dug by farmers, as well as dumping of waste in the river.

**Major challenges** include the emptying of untreated sewage, chemical waste from hospitals and farms, and solid waste, such as metals and plastics, into the river that exacerbate the flooding as the riverbed is filling up, while also causing problems with diseases affecting both humans and livestock. Conflicts about water abstraction and allocation among different clans are common. Other challenges include uncontrolled housing developments along the riverbanks to house for example Internally Displaced People (IDPs) that blocks canals as well as lack of resources and awareness about flood risk management. However, a flood risk assessment has been made by the government and a warning has been issued to people living along the river to relocate. The fact that Ethiopia sometimes empties its upstream dams without communicating this to downstream areas also cause problems. Underlying problems are the security situation in Somalia and lack of government authority.

**Information and databases on water resources** are not available in the state or in Somalia, but upstream in Ethiopia. This information is sometimes shared by Ethiopian Somalis through smart phones. There therefore needs to be cooperation and data sharing with Ethiopia. Local people also share information on floods through word-of-mouth and smartphones, and flood warning messages are sometimes sent out by NGOs. To improve the sharing of information, collaboration is needed between various parts of the government, local and international organizations, civil society and different clans as well as the business community. An information center for FRM needs to be established that can forecast risks and educate people in prevention measures as well as undertake studies on the timing and location of floods. A long-term flood risk management plan that involves local communities needs to be developed and implemented and monitoring systems for floods and water pollution established. The impacts of drought also need to be taken into consideration.

# Part 3: Literature review on the impact of flood risk management on the blue economy of Somalia

**The *following chapter provides an overview of key Blue Economy definitions and key sectors considered in the Blue Economy framework. It also reviews the development of the concept and relevant projects leading up to the current definition of the Blue Economy in Somalia.***

## a. The Blue Economy and Ecosystem Services

The concept of 'Oceans Economy' or 'Blue Economy' is recent and originates from the United Nations Conference on Sustainable Development held in Rio de Janeiro in 2012 (UNCTAD, 2014). The Blue Economy concept builds on Integrated Coastal Zone Management (ICZM) (UN Environment, 2018) and recognizes that the productivity of healthy freshwater and ocean ecosystems is a pathway for aquatic and maritime-based economies, and that it requires an integrated, holistic and participatory approach. In the African context, the Blue Economy covers both aquatic and marine spaces, including oceans, seas, coasts, lakes, rivers, and underground water (UNECA, 2016). It encompasses a range of productive sectors, including fisheries, aquaculture, tourism, transport, shipbuilding, energy, bioprospecting, and underwater mining and related activities. UNECA (2016) has summarized the key ecosystem services and sectors included in the Blue Economy in Africa (Table 2).

Table 2:Key Blue Economy ecosystem services and sectors (adapted from UNECA, 2016).

| Type of ecosystem services | Blue Economy sectors |
|---|---|
| Harvesting of living aquatic resources (seafood, plant marine organisms, and marine-biotechnological products) | Fishing (inland, coastal, and deep seas)<br>Aquaculture<br>Mariculture<br>Pharmaceuticals, chemicals, cosmetics, genetic research |
| Extraction of non-living resources and generation of new energy resources | Deep-sea and seabed mining<br>Offshore oil and gas<br>Renewable energy<br>Marine salt harvesting<br>Coastal mining of sand, gravel, and other construction materials |
| Commerce and trade in and around the ocean and rivers | Maritime transport and services<br>Port infrastructure<br>Shipbuilding and repairs<br>River transport<br>Tourism and recreation |
| Protection | Coastal protection<br>Marine ecosystem protection<br>Water resource protection |
| Cultural and religious values | Cultural and religious practices |
| Knowledge and information | Biophysical, socioeconomic, and political research |

The World Bank's Blue Economy programme has a focus on SIDS and coastal Least Developed Countries (LDCs) and considers the term Blue Economy to comprise the range of economic sectors and related policies that together determine whether the use of oceanic resources is sustainable (World Bank, 2017). The European Union include all those activities that are marine-based or marine-related in its latest Blue Economy Report (EU, 2021). These two programmes do not as the UNECA include lakes, rivers, and underground water, and inland fisheries, as FAO, and are therefore considered to be less relevant for this report with its focus on flood risk reduction in river basins and watersheds in Somalia.

The FAO Blue Growth Initiative (BGI) is a framework for sustainably developing fisheries and aquaculture (FAO, 2017). Its goals are to maximize economic and social benefits while minimizing environmental degradation from these sectors. The BGI is active in Africa, the Caribbean and Asia and the Pacific. The framework for transitioning to Blue Growth consists of three phases:

- Creating enabling conditions;
- Implementing targeted interventions; and
- Mainstreaming.

The BGI supports so called Blue Production through implementation of ecosystem-based approaches to responsible fisheries and aquaculture management. It also supports Blue Communities by empowering communities to take full advantage of fisheries and aquaculture. Inland capture fisheries are a key component of these strategies of special interest when discussing flood risk management, with the potential to provide quality nutrition, food security and income from large to small freshwater bodies. These water bodies are often not achieving their full potential for food production, and there could also be missed opportunities for integration between inland fisheries and agriculture, especially in irrigated systems (FAO, 2018).

Lessons learned from community case studies addressing the poverty-environment nexus were analysed for UNDP's Blue Economy portfolio financed by the Global Environment Facility's Small Grants Programme (SGP). Relevant case studies addressed issues such as restoration and sustainable management of mangrove forest for eco-aquaculture in China, land and seascape rehabilitation for livelihood improvement (including reforestation and sustainable artisanal fishery practices) in Central America, as well as mainstreaming of biodiversity conservation into marine ecosystems and fisheries management in the Western Indian Ocean region (Chen et al., 2020; UNDP, 2018). The lessons highlighted the significant role of science and technology in innovating solutions as well as the crucial impact of community leaders. Continuous advocacy and generation of tangible economic benefits for local communities were also considered important, as did multi-stakeholder partnerships with local governments, NGOs and community members that made necessary resources and know-how available (Chen et al., 2020).

The baseline assessment of the transboundary diagnostic analysis for the western Indian Ocean (ASCLME/SWIOFP, 2012), and its littoral countries stretching from Somalia in the north to South Africa in the south, includes important lessons for the Blue Economy from across the region, although the information and data from Somalia is sparse. Challenges to sustaining and developing coastal livelihoods and opportunities vary between countries and sectors. One of the common challenges is revenue leakage, i.e. only small proportions of the revenues received remain in the countries and even smaller proportions trickle down to communities. Weak infrastructure and facilities constrain development in, for example, small-scale fisheries, mariculture and ports and coastal transport. It is generally linked to a lack of access to finance

and capital for development. This ranges from lack of access to credit for small-scale fishers to the problems associated with insufficient development capital for ports and transport.

Environmental degradation and environmental impacts are also important constraints across all sectors. Over-exploitation of resources is common in fisheries, agriculture and forestry and is frequently linked to poverty and over-dependence on the resources. Limited and often inadequate human capacity is also common to nearly all the sectors and encompasses inadequate governance capacity, research capacity and capacity for fulfilling financial, operational and human resource functions. Security concerns, political instability, weak service delivery, conflicts between sectors and centralized control and over-regulation were also identified as problems in some sectors and countries. Nevertheless, there are many examples of progress being made. For example, support to small-scale fishers through soft-term loans and duty concessions from the governments in some countries. Also in fisheries, progress towards decentralized and participatory management is being made in several countries. Examples of promotion of alternative sources of income can be seen in the development of bee keeping, honey production and tree nursery management as means of reducing the pressure on coastal resources, as well as pottery, horticulture, and small-scale cashew nut and coconut collection (ASCLME/SWIOFP, 2012).

More recently, a status report of the coastal cities of the Western Indian Ocean region and the Blue Economy (WIOMSA & UN-Habitat, 2021), analysed key Blue Economy sectors, including ports, tourism, fishing, roads, water and sanitation, solid waste, town planning and education. It concludes that strengthening of the Blue Economy in this region will involve a mix of cross-cutting strategies and sector-specific policies. Blue economy planning also requires understanding and appreciation of the interconnected relationship between urban and natural systems, and coastal and inland populations.

**The *following chapter provides an overview of the African Unions definition of the Blue Economy and its thematic areas.***

## b. National blue economy planning opportunities based on the Africa Blue Economy Implementation Plan

According to the Africa Blue Economy Implementation Plan 2021-2025 (AU-IBAR, 2020), The Thematic Areas that are critical to the blue economy growth for Africa are:

1. **Fisheries, aquaculture, conservation, and sustainable aquatic ecosystems** - contribute to poverty alleviation, provision of food and nutritional security. However, the current institutional arrangements are not appropriately designed and are inadequately resourced. This includes the absence of up-to-date policies, laws, and regulatory standards at the national level; non-harmonization of policies, laws, regulatory standards at the regional level; and low compliance and inadequate enforcement and limited effective involvement of stakeholders in the fisheries management process.

2. **Shipping/transportation, trade, ports, maritime security, safety, and enforcement -** in most African countries, port infrastructures are obsolete and transport corridors are in poor condition. International conventions and related agreements, even if they are ratified, are not implemented, and Sub-regional organizations responsible for coordinating maritime activities do not have the support that States should grant them.

3. **Coastal & Marine Tourism, Climate Resilience, Environment, and Infrastructure - t**he blue economy is emerging as a potential source of revenue for African countries.

However, there is a need to move beyond the current political dialogue or advocacy debate about achieving sustainable development through the blue economy to develop and strengthen technical capability and institutional abilities required to deliver practical solutions.

4. **Sustainable Energy, Mineral Resources, and Innovative Industries - m**ost States do not have adequate regulatory frameworks to implement especially blue energy and ocean mining projects. There is a lack of awareness of the potential of sustainable blue energy as well as limited technical capacity and knowledge especially with regard to the technological advancement and application of blue energy technologies, sea-bead mining and innovative technologies. Inadequate power grid infrastructure also hinders collaborations with neighboring States in implementing mega projects that benefits regional States.

5. **Polices, Institutional and Governance, Employment, Job creation and Poverty Eradication, Innovative Financing -** significant institutional and governance challenges remain, constraining the ability of Member States to effectively formulate and implement policies relating to growth and development of the blue economy in Africa.

Somalia has the longest coastline in Africa and is endowed with diverse aquatic resources. Whereas, this resource remains underdeveloped, if well managed it can contribute to food/nutrition security and economic growth. However, the resource is threatened by lllegal Unreported and Unregulated (IUU) fishing. The coastline presents many commercial and strategic opportunities but also associated national security risks, including arms and human trafficking, piracy, and as a channel for terrorists to move arms and personnel from the Middle East to the Horn of Africa. The Blue Economy approach will be key for Somalia to develop a sustainable economy and environment. A strong blue economy is expected to increase employment for youth and make available entrepreneurial opportunities for new enterprises, attract international investment, and inject new technologies into the sector (MoPIED, 2020).

***The following chapter provides an overview of key Blue Economy sectors in Somalia and a synthesis from the online survey and key stakeholder interviews of sector priorities and their importance for economic development. The chapter also highlights the gap between FRM and BE.***

## c. Somalia's progress in developing a blue economy strategy

With a vast marine area, Somalia's marine fisheries could make important contributions to the national economy, local livelihoods, food supply and export earnings. Somali waters are seasonally productive and home to various fish and shellfish species, including valuable pelagic tuna resources. Conversely, the narrow continental shelf limits shallow-water habitat and, therefore, the abundance of demersal species. The seasonally abundant offshore pelagic and the more limited nearshore demersal fish species are accessible to small-scale fishers as well as to large industrial vessels. Demersal resources are vulnerable to overexploitation if management of these resources is not strengthened quickly.

The Federal Government of Somalia have actively cooperated with IGAD over the past few years in order to develop a baseline on which their National Blue Economy Strategy can be developed upon (MoEWR, 2021a). The National Report was developed jointly by the FGS and IGAD and validated by the Ministry of Foreign Affairs, National Focal person for BE, Ministry of Ports and Marine Transport, Ministry of Fisheries and Marine Resources, Ministry of Information, Culture &

Tourism, Ministry of Petroleum, Environment Directorate Office of Prime Minister, Ministry of Energy Water Resources and Ministry of Agriculture and Irrigation.

The report concludes that the shelf and fringing coral system along the Somali cost is poorly understood, and the most recent (but limited) studies are from 1994 (MoEWR, 2021a). These studies point more towards the inventory of various coral reefs but does not provide any insight of environmental damage from sectors, communal dependency on the reefs or links between upstream impact on downstream ecosystems.

Marine fishery dominates in the overall fishing sector, while the inland fisheries and aquaculture are mostly absent (FGS. 2021. BE National Report for Somalia). Fish is also not a primary protein source in Somalia, it is rather a source of income as most is sold to neighboring Ethiopia (Interview 16.08.2022). Fishery in Somalia is mainly concentrated in artisanal, semi- industrial and foreign license fleet. For most of the territories in the area, the fishing industry is predominantly small scale and artisanal, employing traditional gears, methods and vessels. Somalia has approximately 250 fishing villages spread long the whole coastline, accessing the Indian Ocean and Gulf of Aden. On the narrow continental shelf, a fleet of industrial trawlers operates under non-transparent agreements, licensed by FMSs, in particular Puntland, in violation of Somali fisheries law, which prohibits trawling. It has been estimated that almost 50 percent of fish caught in Somali waters were taken by foreign vessels, typically with little to no benefit to the Somali economy.

Conflicts between legal and illegal activities have created conflicts between both foreign fisheries and semi-industrial fisheries and artisanal fisheries (MoEWR, 2021a). Other challenges for the fishing industry include limited infrastructure such as fishing ports, jetties, processing facilities, cold storages and ice factories and the construction of new boats. Catch data was specially collected in 2019-2020 from 6 landing sites, there is however no long-term data to compare with. The industry needs a much more rigorous data collection system i to understand and manage the fish stocks.

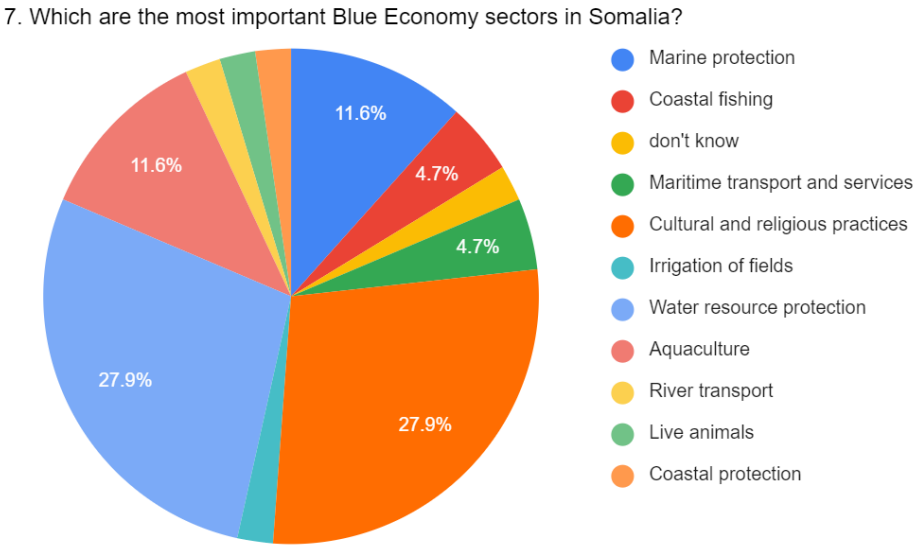
Although the agriculture sector has not been identified as a BE sector in the National Report, it is mentioned as highly important cross-cutting sector to grow the BE (MoEWR, 2021a). The FGS has identified key agriculture priorities to boost the economy and has the opportunity to tie together flood risk management and the blue economy strategy. These include;

1. Preparation of National Food Security Strategy and Action Plan;
2. Reviving Somali’s Agricultural Research and Extension System;
3. Agribusiness policy and strategy;
4. Preparation of National Irrigation Law;
5. Support Somali Agricultural Regulatory and Inspection Service(SARIS) in Mogadishu and Federal Member States (FMS);
6. MOAI Communication Strategy;
7. Promotion of Climate-smart agriculture;
8. Establishment of home gardening in Banadir region;
9. Support institutional capacity development.

FGS is currently participating and developing its own national Blue Economy Strategy (Table 3), led by the Ministry of Fisheries and Marine Resources. This Blue Economy Strategy was completed and published in February 2023. FGS representatives are also participating in regular IGAD meetings[5,6] where this strategy is being developed. The World Bank has launched a Blue Economy Development Project (US$50 million)[7] aimed to start in late 2022. The Project aims to improve the sustainable management of selected fisheries and enhance the capacity of targeted coastal communities to benefit from fisheries production. The project does not mention any links to FRM or up-steam impacts on downstream communities.

Table 3: Key blue economy sectors in Somalia (Source: (MoEWR, 2021a)

| Key blue economy sectors in Somalia | |
|---|---|
| **Marine living resources** | Fish stocks (inland, offshore, and deep seas, aquaculture, |
| **Marine non-living resources** | Deep-sea and sea-bed mining, offshore oil and gas, marine salt harvesting |
| **Tourism** | Tourism and recreation |
| **Maritime** | 4 Commercial ports and other natural ports and jetty ports |
| **Energy** | Renewable energies |
| **Rivers** | Shabelle river, Juba River, Dhawa river |
| **Underground water** | Ground water in Somalia is highly available in Somalia |




[5] https://igad.int/igad-trains-on-development-of-national-blue-economy-strategy/

[6] https://igad.int/igad-sustainable-development-through-blue-economy-2/

[7]https://documents1.worldbank.org/curated/en/099245001192238877/pdf/Concept0Projec0t0Project000P178032.pdf

Figure 10. Identified sectors important to the Blue Economy from online survey (n=43).

Integrated Water Resource Management is not explicitly articulated in the Blue Economy National Report or the Blue Economy Strategy (2023 - 2027), but it is clear from the BE sector priorities that surface, and ground water are major pressure points for the economy. The FGS and the Ministry of Energy and Water Resources (MoWER) has authored a National Water Resource Strategy (NWRS) (2021 – 2025) and a Road Map to Implementation (2021-2025) where three overarching goals and 20 sub-strategies has been identified along with respective action items and responsible institute. This will be implemented though 12 cross-sectoral flagship projects all over the country. Each flagship project includes a ToR and a lead institution to ensure accurate and targeted implementation. Figure 10 shows the most important BE sectors identified by local stakeholders, federal and state government representatives, international development partners and other key stakeholders in Somalia. Costal and water resource protection in combination with aquaculture come out strongly, together accounting for more than 55% of responses, followed by marine protection and aquaculture (23%).

The MoEWR has identified key recommendations in order to create and enabling environment for the NWRS, including a strengthened leadership and clear communication, the need to balance technical solutions with improved governance, adaptive agile management, data information management as a key building block, strengthen regulation and sector support, follow the implementation plan, link the NWRS to development objectives, cross-sectoral coordination, transparency, stakeholder management (local and international) though multi stakeholder platforms.

Box 4 summarizes the results about the Blue Economy from the interviews with key informants. The very negative impacts of pollution and waste from upstream areas on artisanal fisheries as well as on agriculture are emphasized, as well as the need for a Blue Economy strategy.

## Box 4: Blue economy challenges and opportunities in Somalia identified in interviews with local stakeholders and international development partners

A total of 44 key informants (see Annex 1) were interviewed about the Blue Economy in Somalia using the interview matrix in Table 1, Part 1. The Blue Economy was generally considered to include the ocean, lakes and rivers and the key sectors concerned are pastoralism, agriculture, fishing, and aquaculture as well as renewable and non-renewable energy, as water can be used to generate electricity and there are oil wells off the Somali coast (Figure 10). Blue biotechnology, ports and coastal tourism were also mentioned. Job creation in all these sectors is a top priority and the coastal economy should be digitized.

Waste and pollution of the river water is a major threat to the Blue Economy as well as sedimentation from upstream soil erosion. Floods have greatly affected coastal development and agriculture. Grazing has decreased significantly in recent years due to floods on the one hand and drought and lack of security on the other. The weakness of the government and security situation are major challenges for developing the Blue Economy, as well as lack of awareness of its potential. There is yet no Blue Economy strategy for Somalia and there is not enough effort in cross-sectoral planning and communication for the Blue Economy.

Fishing in the river has become almost non-existent and agriculture has become volatile due to alternating floods and droughts. To save the fishing sector, the river must be cleaned, and laws need to be enacted to reduce waste and pollution from upstream sources, which should be coupled with awareness-raising campaigns. Pollution from oil extraction at sea is also a problem and kills fish and other marine life. Artisanal fisheries could be strengthened by equipping local fishermen with modern fishing gears and boats. More commercial landing places need to be established as well as markets where fish catches can be traded. Better road infrastructure is needed to support commercialization of coastal communities and small-scale fisheries. Youth fishing training centres also need to be established. The coastal area needs to be cleaned up and stabilized through for example dune stabilization,

planting of trees, mangroves and sea grass, and protection of natural habitats, such as mangroves and coral reefs.

***The following chapter provides an overview of the impacts of flood risk management on the blue economy in Somalia and its potential conflict prevention effect.***

## d. Assessment of the impacts of flood risk management on the Blue Economy of Somalia

Based on the literature review, questionnaire survey (Annex 2) and in-depth interviews (Table 1), the study team conducted an assessment of the likely impact of different flood risk management measures on the key Blue Economy sectors identified through the different methods (Table 4). However, it is worth mentioning that the literature available around the impacts of FRM measures on the blue economy is limited, and the table below is a result of comparing the results from the review of FRM and BE with the results from the survey and interviews and identifying possible impact areas.

It is notable that most FRM measures are considered to have a positive impact on the Blue Economy. However, traditional flood reduction infrastructure can have both very positive impacts on water infiltration and storage and negative impacts in terms of ground alterations and changes to ecosystems as well as on groundwater and environmental flows. NBS and NNBF that work with nature to enhance ecosystem services were considered to only have positive impacts, although there could be flood-related challenges that they cannot address. Flood risk planning and preparedness has positive impacts on all sectors, except on marine living resources and fisheries where there is no direct linkage, although in the longer term it could be important also for this sector. New and innovative measures for conflict prevention and resolution, such as the use of serious games, can have positive impacts on planning and preparedness, especially when it comes to sector coordination, access to and allocation of both surface and groundwater, as well as on access to land for agriculture and livestock. An observation from this assessment is that the potential of NBS, NNBF and new and innovative measures in FRM has not been fully realized in the Juba-Shabelle basin and that there could be many positive impacts on the Blue Economy from scaling up these kinds of measures.

Table 4. Impact on Blue Economy Sectors from Flood Risk Management actions

| | **Structural FRM measures** | | | **Non-structural FRM measures** | |
|---|---|---|---|---|---|
| **Blue Economy Sectors** | Traditional flood reduction infrastructure | Nature-Based Solutions | Natural and NBS Features (NNBF) | Planning and preparedness | New and innovative measures |
| Marine living resources | (-) Rivers may carry more waste and pollutants downstream with improved infrastructure, potentially causing more harm to marine life. | (++) Sediment trapping upstream with introduction of wetlands preventing salinization downstream. Reseeding grasses can catch some pollutants and prevent downstream pollution. (++) Coral reefs can be protected from siltation by replanting of mangroves | (++) Revegetation of dunes and replanting of mangroves and seagrass beds can have positive impacts on fish spawning grounds and fish nurseries. (+++) Improved pollution control upstream though NNBF will decrease the risk to marine life from pollution. | | |
| Marine non-living resources | | | | | |
| Tourism | (+) Lower risks of flooding of tourism infrastructure | (+) Lower risks of flooding of tourism infrastructure | (+) Increased in areas for nature-based tourism with improved habitats and biodiversity | (+) Lower risks to lives and tourism businesses | |
| Maritime | (++) Infrastructure-controlled flood management could prevent flash floods from damaging harbours | (++) NBS-supported flood management could prevent flash floods from damaging harbours | (++) NNBF-supported flood management could prevent flash floods from damaging harbours | (++) Planning and preparedness linked to weather forecasts could support harbours and shipping planning systems in planning better routs, when to land at harbour and optimal energy efficient routs | |
| Energy | (- -) Damming of rivers can increase water tables upstream (-) Somalia is a very flat country, damming and generating hydropower could be expensive as extensive ground alteration might be needed (-) Impact on surrounding biosphere from damming | | (+) Opportunity to map wind corridors and solar PV opportunities | (++) opportunity to use planning and preparedness and flood reduction infrastructure to construct hydropower dams | |
| Rivers | (- -) New dams and infrastructure could threaten environmental flows | (+++) Improved aquatic ecosystem from NBF (+++) Decreased pollutants in river systems through NBF | (+++) Improved aquatic ecosystem from NNBF | (++) Hydrological monitoring and modelling could lead to better informed allocation of surface water resources | (++) Serious river basin games could help prevent and mitigate conflict over access to and allocation of water resources |
| Underground Water | (- -) New dams and infrastructure could threaten downstream infiltration of groundwater | (+++) Improved groundwater infiltration from improved wetland management, management of infiltration and overland flow and creation of buffer zones | (+++) Improved groundwater infiltration from improved wetland management, management on infiltration and overland flow and creation of buffer zones | (++) Hydrological monitoring and modelling could lead to better informed allocation of groundwater resources | (++) Serious river basin games could help prevent and mitigate conflict over access to and allocation of groundwater resources |

| | | | | | |
|---|---|---|---|---|---|
| Agriculture | (+++) Improved water storage capacity for irrigation needs<br>(+) Ability to better plan planting and harvest times<br>(- -) Raised groundwater table around new dams and infrastructure could lead to soil salinization and reduced production | (+++) Improved infiltration thanks to NBS could lead to enhanced soil moisture and agricultural productivity<br>(++) Reduced soil erosion from water and wind | (++) Reduced soil erosion from water and wind | (+++) Planning and preparedness linked to weather forecasts and flood preparedness can improve the agricultural calendar and agricultural productivity | (++) Serious river basin games could help prevent and mitigate conflict over access to water for irrigation of agricultural lands |
| Livestock | (++) Improved water storage capacity for livestock needs from traditional water infrastructure | (++) Improved water storage capacity for livestock needs from NBS<br>(+) Increased grazing areas or cattle feed production areas through NBS | (++) Improved water storage capacity for livestock needs from NNBF<br>(+) Increased grazing areas or cattle feed production areas through NNBF | (++) Ability to better plan herding routs or farm investments from improved planning and preparedness to floods | (+) Decrease in water related conflicts related to cattle management through planning and preparedness and innovative measures related to conflict resolution. |

# Part 4: Conclusions and recommendations

***The following chapter triangulates the findings from the literature reviews, in-depth interviews and online survey to develop recommendations for design, planning and implementation of flood risk management (FRM) measures in the Juba and Shabelle basin in Somalia and implications for developing the Blue Economy. Opportunities to implement NBS and FRM non-structural measures are identified as well as ways of strengthening source-to sea governance to support the Blue Economy.***

The interviews in Somalia highlighted a number of thematic issues related to FRM with links to the Blue Economy (Table 5). The recommendations are not directed to specific government institutions, as these mandates evolve over time. The Ministry of Energy and Water Resources is the primary stakeholder for this report, but the Ministry of Fishery and Marine Resources, the Ministry of Environment and Climate Change, the Ministry of Information, Culture and Tourism, the Ministry of Ports and Marine Transport, the Ministry of Petroleum and Minerals, the Ministry of Agriculture and Irrigation and the Ministry of Foreign Affairs and International Cooperation are also important for the implementation of the BE strategy and improved FRM measures.

The international community consulted within this case-study are all involved in various ways and degrees of intensity. A challenge that has been repeated in all consultations is the lack of coordination of water-related projects and activities, resulting in a lack of long-term goal and strategy. This coordination should be led by the government, but this function is time-consuming and requires dedication and resources, as well as capacity. The development partners active in the water sector in Juba-Shabelle basin (Table 5), such as UNDP and FAO, could play a key role in supporting the government and the Ministry of Energy and Water Resources, to build necessary capacity to coordinate and monitor water-related projects and interventions across sectors and to develop a more coherent and strategic approach to FRM and the Blue Economy.

With respect to FRM, there are many challenges related to:

- **Water policy and institutions** in Somalia. Multi-level policy implementation that links state-level and federal institutions is weak, including the involvement of local communities and civil society. This also includes the need for urban planning and ensuring that housing developments and camps for Internally Displaced People (IDP) are not blocking river canals. The National Water Resources Strategy 2021-2025 developed by the MoEWR is the foundational structure for strengthening of water management in the whole country, including flood prevention strategies. The Strategy in a thoroughly developed plan that shows Somalia's effort in strengthen water governance and the opportunities gained when strengthening the enabling environment, including water policy and institutions across sectors and scales making it more polycentric.

- **Water infrastructure**, including dams along the river, are in dire need of maintenance, as years of neglect during the civil war have taken their toll. The river must be diverted into small canals that can be closed and opened to transfer water to the farmers. The literature review also stresses the need for rehabilitation of irrigation systems in the middle Shabelle region.

- **Pollution** of the river from chemical and solid waste as well as sewage is also a major challenge, and for 95 percent of people the river is their main source of drinking water. Treatment and purification of the river water is urgently needed, as well as an action plan for cleaning the riverbed. More water outlets and sewage pipes/canals are also required.

- Flood risk management and control measures are generally of a temporary nature and a **flood risk strategy** is needed as well as more **long-term FRM projects and measures**, such as the ones discussed in Part 1 as well as in Table 5, Part 2 that are both of a structural and non-structural nature. This is also mentioned in the Strategy under sub-Strategy 10.

    - **FRM Structural measures** – this is what traditionally has been considered important to reduce flooding and are based on engineering and natural science approaches and include:
        - **Traditional flood reduction infrastructure** – dams, canals/dykes, levees, etc. These are common, but often in need of repair and maintenance.
        - **Nature-Based Solutions (NBS) –** traditional NBS exist, but there is a need to raise awareness about their role in FRM, especially in regard to management of flood plain conveyance and water storage through storage areas such as wetlands.
        - **Natural and Nature-Based Features (NNBF)** – management of landscape features, such as beaches, dunes, wetlands reefs and islands. This type of features were reported from the interviews, especially in downstream areas where dune fixation takes place, but there is scope to scale up the use of NNBF, including:
            - Wave and surge reduction by vegetation
            - Sediment trapping in wetlands
            - Vegetation stabilizing and growing dunes
            - Interaction of grey and green infrastructure systems
            - Wetland damage and recovery in storms
            - Response of NNBF to sea level rise

    - **FRM Non-structural measures** –non-structural measures are underutilized in Africa and important to reduce flood risk and resilience, including:
        - **Planning and preparedness**
            - Land-use planning and management
            - Early warning systems – which requires monitoring capacity and access to data
            - Flood prediction – which requires modelling capacity and access to data

        - Financial preparedness – which requires access to finance for emergency response as well as longer-term investments
    - **New and innovative measures**, such as use of serious games for sustainable water and land resources planning and management, as well as conflict prevention and resolution.

Community-based approaches should be used in implementing all of these FRM measures, using existing guidelines, such as the Flood Green Guide (FGG), etc., combining measures and using hybrid solutions. The National Water Resource Strategy lays a great foundation for implementation of FRM measures. Goal 2 is particularly aimed at operationalizing integrated water resource management.

- **Information, data sharing and monitoring** of water resources is another challenge in Somalia at large and in the JubaShabelle basin in particular that has only one hydrological gauging station. Most information on water levels and flows therefore comes from Ethiopia through informal information sharing using smartphones, etc. It is recommended by local stakeholders that a government information centre is set up, a water resources database is established, a flood locating mechanism is developed and a meteorological centre is established. The use of mobile technologies and devices for information sharing and monitoring should also be explored, as they are already used in an informal way to share information from Ethiopia on the flows in the Juba-Shabelle rivers (see Box 3). According to MoEWR, a National Hydrology and Meteorology Services is going to be established to respond to the inadequate baseline and real-time data and information on hydrological flows in Somalia, which may need external support. Information management is highlighted as an area in need of capacity building, which is described under Sub-strategy 13 in the strategy.

- **Security and reconciliation** mechanisms need to be set up, as there is a lack of trust in the communities and among clans. The implementation of the National Water resource Strategy can be a way of building trust when communities and clans are forced to discuss and agree on water management structures. Tools such as serious games discussed above could be tested in this context as well. Multi-level reconciliation in the community is required in order to move forward. Multi-level Reconciliation in the community together with liberation from the Al Shabab movement and ISIS (Table 5) have the opportunity to strengthen and support government building. In addition, the National Water Resources Strategy highlights that water sector interventions will be important to reduce conflicts and humanitarian disasters (Sub-strategy 8). Goal 1 can provide an entry point for trust building through cross-sectoral water cooperation. There is a risk that new government structures will be based on clan affiliations, which could result in a fragmented approach to institution building and information collection leading to a halt in development of government institutions. The new strategy should be used as an opportunity to build ministerial relations, highlight the benefits of cooperation and cement cooperation routines.

- Finally, **transboundary water diplomacy** between Somalia and Ethiopia should be strengthened to ensure cooperation on the management of the Juba-Shabelle basin, including promotion of preventive measures in upper catchments that reduce overland flow, soil erosion and transportation of sediments and waste downstream. Cooperation is also

required on information sharing on water levels, flows and rainfall, which is described under the Strategy as sub-category 4.

Table 5: Opportunities and challenges in the Juba-Shabelle basin with respect to FRM and the Blue Economy based on a synthesis of interviews made in Beledweyne (n=35).

| Thematic area | Active development partners | Opportunities | Challenges | Recommendations |
|---|---|---|---|---|
| **Institutions and policy** | UNDP, FAO, WB, IGAD, DHI, UNEP, ICG | Existing | Unenforced | • Multi-level policy implementation required<br>• Laws must be enacted for water Infrastructure, sewers must be built<br>• Water energy sharing policy<br>• Strengthen and resource the Hiram Flood Committee<br>• Policy for resources sharing needed |
| **Awareness among communities** | UNDP, FAO, WB, IGAD, DHI, UNEP, ICG | Existing | Nonexistent/ Gap between communities and the government | • More awareness campaigns regarding benefits of FRM towards sustainable BE development<br>• More collaboration between CSOs and the government |
| **Urban development and planning** | UNDP, FAO, WB, IGAD, DHI, UNEP, | | River canals are blocked by too many houses<br><br>IDP camps are located next to the River | • The houses near the river must be moved to another place with support from urban and landscape planners<br>• Relocate IDP camps |
| **Water infrastructure, including river dams** | UNDP, FAO, WB, DHI, UNEP, | Existing/ Political will | Very few/ Nonexistent | • More quality infrastructure needed, including dams<br>• The river must be diverted into small canals that can be closed and opened to transfer water to the farmers<br>• Maintenance of existing water infrastructure |
| **River water pollution** | FAO, DHI, | | 95% of people drink polluted water from the river | • River water purification<br>• Action plan for cleaning the riverbed<br>• More water outlets and there are no sewage channels<br>• Improved waste management |
| **Flood Control Measures** | UNDP, FAO, WB, IGAD, DHI, UNEP | Temporary Solutions | Unenforced | • More prevention projects<br>• Flood risk management strategy |
| **Information, data sharing and monitoring** | UNDP, FAO, WB, IGAD, DHI, UNEP | Political will<br><br>Information is obtained from upstream areas or the border | Nonexistent /Information related to the river comes from Ethiopia | • Government information center must exist<br>• Development of water databases<br>• Develop Flood locating mechanism<br>• Establish National Meteorological and Hydrological Service (NMHS) Center |
| **Security and reconciliation** | UNDP, FAO, WB, IGAD, DHI, UNEP, ICG | Political will | Lack of trust in the community | • Multi-level Reconciliation in the community<br>• Liberate from Al-Shabaab movement and ISIS<br>• Use the National Water Resource Strategy as a means of cooperation and trust building |
| **Transboundary Water diplomacy** | N/A | Political will | Nonexistent | • Support the cooperation efforts between Somalia and Ethiopia for the Juba and Shabelle river basins listed in the National Water Resource strategy |

| | | | | |
|---|---|---|---|---|
| **Blue Economy** | UNDP, WB, IGAD, DHI, UNEP | Nonexistent | Nonexistent | • Assessment of threats or opportunities for the development of the blue economy |
| **Fishing** | UNDP, FAO, WB, IGAD, UNEP, | Existing | Lack resources | • More resources needed to support small scale fishing communities and a sustainable fishing practice. |
| **Livestock** | UNDP, FAO, WB, IGAD, DHI, UNEP, | Existing | Water pollution | • River and water cleaning and management combined with improved waste management to prevent pollution. |
| **Agriculture** | UNDP, FAO, WB, IGAD, DHI, UNEP, ICG | Existing | Farmers, due to the drought of the river, are refraining from farming, | • Water well drilling |

- With respect to the **Blue Economy**, key sectors perceived important by the interviewees include fisheries, livestock and agriculture, ports and shipping as well as energy and tourism (Box 4, Table 4). Livestock and agriculture are not included among the sectors identified by the AU and IGAD in their analysis of the Blue Economy, but local livelihoods are probably based on a combination of these sectors that are difficult to disentangle at household and community level. This indicates that the Blue Economy concept needs to be used in a holistic way in Somalia to be understood and relevant:

  - Floods have greatly affected coastal development. To save the **small-scale fishery sector**, the Juba-Shabelle rivers must be cleaned, and laws need to be enacted to reduce waste and pollution of sewage and chemicals from hospitals and farms from upstream areas, which should be coupled with awareness-raising campaigns. Artisanal fisheries could be strengthened by equipping local fishermen with modern fishing gears and boats as well a better weather data. More commercial landing places need to be established as well as markets where fish catches can be traded. Youth fishing training centres could also be established. The coastal area needs to be cleaned up and stabilized through use of landscape features such as NBS and NNBF, including dune stabilization, planting of trees, mangroves and sea grass, and protection of natural habitats, such as wetlands, mangroves and coral reefs.

  - In addition, lessons for developing the Blue Economy from the literature review revealed that in similar environments, **generation of tangible economic benefits for local communities is key** and multi-stakeholder partnerships with local governments, NGOs and community members that made necessary resources and know-how available. For the Western Indian Ocean, it has been suggested that small-scale fisheries could be supported through soft loans and duty concessions, and that strengthening the Blue Economy in the region would involve a mix of cross-cutting strategies and sector-specific policies. Somalia has embarked on this process through the development of a Blue Economy Strategy where a baseline assessment has already been completed. However, the links to FRM, IWRM and the agricultural sector appear to be weak in the report that has been led by the Ministry of Fisheries and Marine Resources.

- **Governance approaches that link upstream floods with downstream impacts** are required, both to strengthen flood risk management and to develop the Blue Economy in downstream areas. Multi-level and multi-scale governance arrangements (i.e. polycentric) that can account for links across sectors and scales, as discussed in Part 1 of the report, are needed. Key steps to strengthen the governance of source-to-see flows in Somalia would include:

    - Engaging key stakeholders upstream and downstream in multistakeholder dialogues
    - Monitoring and assessment of source-to-sea flows and impacts on local communities and livelihoods as well as on the environment both upstream and downstream
    - Development of an action plan for key systems and flows (IWRM, Source-to-Sea, Ridge-to-Reef, plans, etc.)
    - Establishment of mechanisms for intersectoral collaboration and investments

- **The readiness level to adopt the source-to-sea** approach depends on familiarity with the concept, and stakeholder engagement processes and multisectoral coordination mechanisms. In general, Somalia is at the early stages of readiness and awareness raising on source-to-sea linkages and the need for a holistic approach to development challenges. However, as some progress has been made with coordination between sector and development of a shared vision for FRM through the Hiiraan/Beledweyne Flood Committee and the federal Flood Risk Management Committee, the source-to-sea approach could be piloted in the Juba-Shabelle basin for priority flows of pollutants and waste that are threatening the development of the Blue Economy, through capacity building of key stakeholders, action planning and development of monitoring and accountability mechanisms.

- In a new source-to-sea governance framework, it will also be important to consider **environmental flows** to ensure conservation of natural habitats important for regulation of water flows downstream, such as forests and wetlands, as well as for conservation of biodiversity and provision of fish spawning grounds and nurseries, such as mangroves, coral reefs and sea grass beds. Socio-economic benefits from development of the Blue Economy downstream must ultimately be balanced with upstream FRM priorities and measures. Trade-offs related to FRM and the Blue Economy need to be considered across sectors, such as fisheries, agriculture and energy. Flows of water, sediments, pollution and waste need to be assessed and monitored, across scales and information shared from the local, state, national to transboundary/regional levels to increase flood preparedness and enhance the resilience of local communities. Better information and data on floods is needed to inform future investments in the downstream Blue Economy, also taking into consideration the effects of climate change and the ongoing drought.

Key Blue Economy sectors have been affected by floods and associated pollution in Somalia and solutions need a joint approach and coordination among stakeholders. The Juba-Shabelle Rivers must be cleaned, and laws need to be enacted to reduce waste and pollution from

upstream sources in order to strengthen the development of the Blue Economy. In addition, the coastal areas need to be cleaned up and stabilized through use of landscape features and nature-based solutions, based on the work conducted by UNEP and DHI.

Governance approaches and cooperation among stakeholders that link upstream floods with downstream impacts are essential for progress on FRM. As some progress has been made with coordination between sectors and development of a shared vision for FRM through the Hiiraan/Beledweyne Flood Committee and the federal Flood Risk Management Committee, the source-to-sea approach could be piloted in the Juba-Shabelle basin to prioritize flows of pollutants that are threatening the development of the Blue Economy, building on ongoing support from FAO and the World Bank.

In conclusion, to strengthen the conditions for the Blue Economy in Somalia, there are opportunities to implement more nature-based solutions and work with landscape features, such as forests, dunes and reefs. Planning and preparedness also need to be improved and a flood risk management strategy developed. Information, data sharing and monitoring should be strengthened and transboundary cooperation with Ethiopia pursued through for example transboundary water diplomacy and other security and reconciliation mechanisms. Trade-offs need to be considered between socio-economic benefits from development of the Blue Economy downstream with upstream flood risk management priorities and measures.

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# Annex 1. Key informants and interviewees

A. Interviewees from field work (names to be deleted before publication)

| Respondent number | Age | Gender | Location | Position |
|---|---|---|---|---|
| 1. | 50 | M | Beledweyne | CSO/Clan Elder |
| 2. | 40 | F | Beledweyne | Government Officer |
| 3. | 43 | M | Beledweyne | CSO/ teacher/ Hiiraan University |
| 4. | 40 | M | Beledweyne | CSO/Deputy Director of Safa Academy |
| 5. | 35 | M | Beledweyne | LNGO |
| 6. | 22 | M | Beledweyne | CSO/ Youth |
| 7. | 44 | M | Beledweyne | LNGO/ The chairman of the Hiiraan Region Flood Committee |
| 8. | 49 | M | Beledweyne | CSO/ teacher |
| 9. | 20 | M | Beledweyne | LNGO/ Secretary of the community awareness organization of Hiiraan region. |
| 10. | 33 | M | Beledweyne | CSO/ chairman of Hiiraan Youth |
| 11. | 56 | M | Beledweyne | Deputy Governor of Beledweyne |
| 12. | 31 | M | Beledweyne | Marginalized Communities /Shabelle River Camp |
| 13. | 26 | M | Beledweyne | CSO/clan elder/ Nabadoon |
| 14. | 21 | M | Beledweyne | CSO/Youth |
| 15. | 36 | M | Beledweyne | Marginalized Communities |
| 16. | 39 | M | Beledweyne | Government Officer |
| 17. | 54 | M | Beledweyne | CSO/ Businessmen |
| 18. | 43 | M | Beledweyne | CSO/ Businessmen |
| 19. | 45 | M | Beledweyne | CSO/ Clan leader |
| 20. | 21 | M | Beledweyne | CSO/Youth |
| 21. | 44 | F | Beledweyne | Government Officer |
| 22. | 45 | M | Beledweyne | NGO |
| 23. | 25 | M | Beledweyne | CSO/ religious leader/scholars |
| 24. | 39 | M | Beledweyne | Government Officer |
| 25. | 22 | M | Beledweyne | LNGO |
| 26. | 29 | M | Beledweyne | NGO |
| 27. | 44 | F | Beledweyne | NGO |
| 28. | 31 | M | Beledweyne | NGO |
| 29. | 50 | M | Beledweyne | CSO/ Clan leader |
| 30. | 30 | M | Beledweyne | CSO/Youth |
| 31. | 21 | F | | CSO/Youth |
| 32. | 35 | F | Beledweyne | CSO/woman |
| 33. | 38 | M | Beledweyne | Government Officer |
| 34. | 60 | M | Beledweyne | CSO/Clan leader |
| 35. | 43 | F | Beledweyne | CSO/ woman |

B. Interviewees from International Development Partners

| No | Gender | Location | Position |
|---|---|---|---|
| 1. | F | Denmark/Somalia | Project Team Leader, Water Resources Engineer, DHI Group |
| 2 | F | World Bank/Kenya and Somalia | International Development Specialist Water Sector - Fragile and Conflict Affected States |
| 3. | M | Ethiopia/Somalia | IGAD/Somalia Blue Economy Project Coordinator |
| 4. | M | Italy/Somalia | Land and Water Expert<br>FAO Somalia / SWALIM |
| 5. | M | Nairobi, Kenya | The United Nations Climate Security and Environmental Advisor to Somalia |
| 6. | M | Nairobi, Kenya | Resilience & Social Protection Coordinator at FAO Somalia |
| 7. | M | Mogadishu, Somalia | Portfolio Manager<br>Resilience and Climate Change<br>United Nations Development Programme<br>Somalia Country Office<br>UN Compound, Airport Road,<br>Mogadishu, Somalia |
| 8. | F | Nairobi, Kenya | Senior Analyst, Climate and Security, Africa<br>International Crisis Group |
| 9. | F | Nairobi, Kenya | Programme Manager, Somalia<br>Embassy of Sweden |

## Annex 2. Online survey

# Somalia Flood Control and Blue Economy Survey

Thank you for participating in this quick survey regarding flood control, flood-risk management, upstream-downstream linkages and the Blue Economy in Somalia.

We at SIWI are currently taking stock of global best practices, experiences in Somalia and how to integrate solutions into relevant policies and decision-making frameworks. This work will inform future investments and policy support in Somalia.

Thank you for your support and inputs by responding to this survey.

We would also like to invite you for an individual discussion. Please tick the box at the end of the survey if you are available for a 30 minutes follow-up discussion.

*Definition: Blue economy is a term in economics relating to the exploitation, preservation and regeneration of the marine environment. Its interpretation varies among organizations. However, the term is generally used in the context of International development when describing a sustainable development approach to the management of coastal resources. This can include a wide range of economic sectors, from the more conventional fisheries, aquaculture, maritime transport, coastal, marine and maritime tourism, or other traditional uses, to more emergent issues such as coastal renewable energy, marine ecosystem services (i.e. blue carbon), seabed mining, and bioprospecting.*

**Format: Multiple Choice**

1. What are the main impacts of flooding in Somalia and the Juba and Shabelle basin?

- Impacts on infrastructure - e.g. roads. irrigation schemes, etc.
- Impacts on water and sanitation
- Impacts on housing and shelter
- Impacts on dams
- Impacts on agricultural production
- Impacts on inland fishing
- Impacts on coastal fishing
- Impacts on ecosystems
- Impacts on solid waste

2. Which traditional Flood Risk Management (FRM) Structural measures do you recommend Somalia to continue/start investing in?

- Channel Improvements
- Diversion Channels
- Levees, Floodwalls, and Seawalls.
- Movable Barriers
- Dams and Spillways

3. Which Nature Based Solutions (NBS) FRM measures do you recommend Somalia to continue/start investing in?

- Management of infiltration and overland flow through land use
- Management of connectivity and conveyance through buffer strips, etc.
- Management of flood plain conveyance and storage through water storage areas such as wetlands

4. Which Natural and Nature-Based Features (NNBF) for FRM measures do you recommend Somalia to continue/start investing in?

- Wave and surge reduction by vegetation
- Sediment trapping in wetlands
- Vegetation stabilizing and growing dunes
- Interaction of grey and green infrastructure systems
- Wetland damage and recovery in storms
- Response of NNBF to sea level rise

5. Which FRM non-structural measures do you recommend Somalia to continue/start investing in?

- Land-use planning and management
- Early warning systems – including monitoring capacity and access to data
- Flood prediction – including modelling capacity and access to data
- Financial preparedness – including access to finance for emergency response as well as longer-term investments
- Innovative measures, such as use of games for sustainable water and land resources planning and management

6. Which governance approaches that link upstream floods with downstream impacts do you recommend Somalia to continue/start investing in?

- Integrated water resources management (IWRM)
- Source-to-sea/ridge-to-reef management
- Community-base management (CBM)
- Establishment of mechanisms for intersectoral collaboration and investments in FRM

7. Which are the most important Blue Economy sectors in Somalia?

- Coastal fishing
- Inland fishing
- Mariculture
- Aquaculture
- Marine salt harvesting
- Coastal mining of sand, gravel, and other construction material
- Maritime transport and services
- Port infrastructure
- Shipbuilding and repairs
- River transport
- Tourism and recreation
- Coastal protection
- Marine protection
- Water resource protection
- Cultural and religious practices
- Research

8. Would you like to participate in an in-person interview to further discuss flood control measures and the blue economy sector opportunities and challenges (30 min)?

- Yes, please contact me to set up an appointment
- No, I don't have time
- I'd like so send additional info via email

# Could Flood Risk Management Measures contribute to a Sustainable Blue Economy in Somalia?

## Literature Review and Case Study from the Juba and Shabelle Basin

There are conditions for the blue economy in Somalia to develop further and opportunities to implement more nature-based solutions. Landscape management activities benefiting a developed blue economy strategy includes forests, dunes and reefs. Planning and preparedness between flood risk management, information, data sharing and monitoring should be strengthened in order to leverage the desired results from a blue economy strategy. This study shows that the literature linking blue economy with flood risk management strategies are limited but proposes a set of actions and activities in order to support decision makers a contribute to the nexus of blue economy, flood risk management and costal impact.

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