BORESHA

Funded by European Union

Mapping of Key Natural Resources in the Cross-Border Areas of Kenya, Somalia & Ethiopia

Building Opportunities for Resilience in the Horn of Africa

Prepared by

converge

Impact Catalysts

BORESHA Consortium Partners:

DRC DANISH REFUGEE COUNCIL

wfg

World Vision

care

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Final Report

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ACRONYMS

AS	Al Shabab
BORESHA	Building Opportunities for Resilience in the Horn of Africa
CARE	Cooperative for Assistance and Relief Everywhere
COMESA	Common Market for Eastern and Southern Africa
COOPI	Cooperazione Internazionale
DRC	Danish Refugee Council
ELMT	Enhanced Livelihoods in Mandera Triangle
ELSE	Enhanced Livelihoods in Southern Ethiopia
EU	European Union
FAO	Food & Agriculture Organisation (UN)
FGD	Focus Group Discussion
IGAD	Inter-Governmental Authority for Development
IGRAC	International Groundwater Resources Assessment Centre
ISTVS	IGAD Sheikh Technical Veterinary School
KII	Key Informant Interviews
KALDRR	Kenya Arid Lands Disaster Risk Reduction
MWA	Millenium Water Alliance
MWI	Ministry of Water and Irrigation
NDMA	National Drought Management Authority (Kenya)
NEMA	National Environment Management Agency (Kenya)
NRM	Natural Resource Management
PACAPS	Pastoralist Areas Coordination, Analysis and Policy Support Project
RELPA	Regional Enhanced Livelihoods in Pastoralist Areas
TWAP	Transboundary Waters Assessment Programme
USAID	United States Agency for International Development

WB	World Bank
WHO	World Health Organization
WRMA	Water Resource Management Authority (Kenya)
WVI	World Vision International

EXECUTIVE SUMMARY

BACKGROUND: The ***Building Opportunities for Resilience in the Horn of Africa (BORESHA)*** project is a cross-border intervention targeting community NRM management in the Mandera Triangle which covers parts of Kenya, Ethiopia and Somalia. The project is led by a consortium led by Danish Refugee Council (DRC) and comprising of CARE International, WYG and World Vision International (WVI). Under the BORESHA Consortium, CARE International is taking the lead in cross border rangeland and other shared natural resources programming to ensure they are equitably and sustainably managed.

OBJECTIVES: This NRM Mapping study was carried out as part of the inception phase of the BORESHA project so as to develop a number of GIS layers of the areas targeted by the project. These included **Infrastructure:** mapping key features (roads, rivers, mountains, urban centers, refugee camps); **Water resources and infrastructure:** existing resources water resources/sources, (dry season wells, rivers, boreholes); an infrastructure potential map to inform the 3R approach of Recharge, Retention and Reuse; **Land cover and land use:** wet and dry season grazing areas including dry season reserves, key land use types and vegetation types; **Resource use and management:** document resource uses and management, traditional systems of natural resource and management (NRM) in the area; **Human and livestock mobility:** patterns of mobility (livestock and people) within and outside the area, and **NRM related problems:** document any significant NRM related problems and issues..

The study was conducted in the cross-border area comprising Mandera county (Kenya), Doolow district in Gedo region (Somalia) and Dollo Ado district in the Somali Region (Ethiopia).

METHODOLOGY: The study design used a mixed-methods approach, incorporating both quantitative and qualitative methods. The mapping methodology included use of satellite images that were analysed in conjunction with ground truthing observations and participatory community mapping exercises. To obtain data for ground-truthing, Global Positioning System (GPS) points were obtained corresponding to the various land uses and land cover forms, location of invasive species, rainfed agriculture, irrigated agriculture, shrublands, woodlands, and water bodies/sources. The study used at least two time-period data sets to detect changes such as land use and land cover.

FINDINGS & ANALYSIS: The findings of this NRM mapping study are based on a systematic analysis of the primary and secondary data collected. The findings and analysis presented follow the six themes identified for this study.

Infrastructure #1: Existing Transportation infrastructure is poorly developed especially in key cross border towns of Suftu, Doolow and Dollo Ado which are served by non-paved road. Mandera has recently benefited from upgrading of some of the roads within the town to bitumen standard through investment by the county government of Mandera. In Ethiopia, Suftu is connected to the capital of Somali region (Jijiga) through an all-weather road. However, the connection between the Kenya/Ethiopia Daawa River crossing at Suftu and Dollo Ado, there is a loose surface road which becomes inaccessible during heavy rains resulting to residents across border to use makeshift rafts to cross along River Daawa. Roads

in Doolow, Somalia are loose surface and would pose access challenges during wet weather conditions. Air transport for the three areas is via airstrips with unpaved runways.

Mobile telephone communication is well-developed with Safaricom & Airtel (Kenya), Hormuud Telecom (Somalia) and EthioTel (Ethiopia) networks available. Communities along the border tend to use whatever network is available irrespective of the country where the service provider is domiciled.

Compared to Doolow and Dollo Ado, Mandera offers advanced health and education services in the region. This serves to attract communities from the neighbouring countries, who access health services in local hospitals in Mandera and also enroll their children in schools across the border.

Existing flood control infrastructure comprises of gabions along the river banks at certain heavily populated sections of the river bank such as Rhamu. In this respect, most investment in flood control on the River Daawa occurs on the Kenya side of the border.

Markets in Dolo Ado are well organised via a cooperative that supports trade of farm products in Mandera and Doolow in Somalia. Though this consists of poor infrastructure for the farmers' market. Most of the agricultural produce grown by communities within the triangle is supplied to local markets such as Rhamu and Mandera for Kenya, Suftu for Dollo Ado and Doolow and Belet Xaawa for Somalia.

Key livestock markets are located at Mandera and Dollo Ado. Mandera and Elwak both have slaughterhouses, while other markets offer slaughter slabs. In Mandera, livestock products are sold in Banisa, Rhamu and Mandera, as well as other Kenyan counties of Wajir and Nairobi. Livestock from Gedo are transported to markets in the Bay region, Bokol, Mogadishu and Lower Juba (specifically, Kismayo). In addition, traditional cross-border livestock markets have existed in Doolow, Mandera and Garissa in Kenya. In Ethiopia, key livestock markets are in Dollo Bay and Dollo Ado towns. In addition, small-scale livestock trading occurs within the villages.

Water resources and infrastructure #2: The cross-border area between Kenya, Somalia and Ethiopia is drained by the Laag Dheera and Genale-Dawa sub-basins. Major surface water sources are the Daawa River which begins from the Ethiopian highlands and traverses Kenya, Ethiopia and Somalia, the Genale River which runs from the Ethiopian highlands and onto the border with Somalia before joining with the Daawa River to form the Juba River. Major underground aquifers are the Juba (transboundary between Ethiopia and Somalia) and the Daawa aquifers (transboundary between Kenya, Ethiopia and Somalia).

An assessment of the condition of existing water supply infrastructure revealed that most of water infrastructure which are mainly wells and boreholes are complete and fully operational. However, there were cases of incomplete and non-operational infrastructure as well.

Water samples were obtained from both ground and surface water sources and analysed for physico-chemical parameters. For surface water, river samples tested has turbidity levels above the recommended 5 Nephelometric Units (NTU). Samples obtained from the R. Daawa had the highest turbidity levels (863-800 NTU) for the Kenya/Ethiopia section followed by R. Ganale in Ethiopia (562-670 NTU). The Doolow section of R. Daawa had turbidity values of (596-619 NTU). Total Suspended Solid (TSS) values were significantly above the recommended 30mg/l the Kenya/Ethiopia section of the R. Daawa at 812-924 mg/l but

significantly lower for the R. Ganale (20-60 mg/l) These values are evidence of high sediment attributable to upstream farming activity. The groundwater tests revealed two sites where the salinity levels exceeded acceptable drinking water standards at Eymole (Kenya) with TDS of 3794mg/l against a recommended 1000 mg/l, Af Arro (Ethiopia) with Cl of 1309mg/l against a recommended 250mg/l. Interventions to minimise sediment loading for the two rivers will be required. Regarding ground water, the two affected villages require additional investment in drinking water sources water of acceptable quality.

The major water uses in the Mandera Triangle are irrigated farming (both abstraction and are flood/ spate irrigation) and livestock watering. Spate Irrigated farming or flood recession farming is practiced on the lower reaches of the Genale and Daawa rivers of the Somali region of Southern Ethiopia and at Rhamu Dimtu, Malkamari and Harere areas of Kenya/ Ethiopia section of the Daawa river. Most of the irrigation infrastructure comprises earth canals and diesel run pumpsets. The irrigation canals in all three countries need investment to more efficient concrete canals recent flooding has damaged a significant proportion of pumping equipment and this need to be replaced.

Land cover and land use #3: Livestock production is the dominant land use pattern in the Mandera triangle. Along the riverine areas i.e. Daawa River (Mandera, Dollo Ado, Doolow), Genale River (Dollo Ado) and Juba (Doolow), agro-pastoralism is a dominant land use pattern with majority of the farmers practising irrigated farming.

Land Use Change analysis for the project area was conducted for the period 2015 to 2018 to determine Prosopsis juliflora invasion. In normal circumstances land cover analysis is done over long-time epochs (standard 20 years) for a large spatial coverage. The extent of Prosopis Juliflora invasion on the project area is small compared to overall spatial extent hence the need to shorten land cover analysis period for the purpose of demonstration on a map. Findings indicate that proliferation of invasive Prosopis juliflora has increased, largely caused by changing settlement patterns with decreasing human mobility while retaining mobile pastoralist herds, especially in along R. Dawa and Ganale. The increased spread of Prosopis juliflora is attributed to livestock movement towards watering areas. This, combined with rapid and unregulated clearing of land for farming and dry season pasture along the riverine sections creates a conducive environment for spread of the species. This rapid spread of Prosopis could cause an ecological shift, where the dominant vegetation types are displaced by Prosopis.

Resource use and management #4: A major issue with transboundary water resources management (WRM) is the conflicting assumptions on resource availability and lack of agreement by riparian states on sharing arrangements. Communities in the 3 states within the triangle are heavily dependent on surface water and shallow ground water for riverine communities and ground water for communities settled away from the river. Thus, these assumptions and lack of agreements on WRM will have a huge impact on the communities reliant on the shared water resources. For example, the Shabelle basin, lacks integrated planning efforts by both Somalia and Ethiopia administration and thus is projected to create a situation where demand surpasses available river flows in the future.

There is a slight increase in land under farming from 0.2%-3.2% on the overall land use patterns within the region could be attributed to increase in population, and increased adoption of alternative livelihoods especially agropastoralism.

Human and livestock mobility #5: This study found that livestock mobility is seasonal in nature and is influenced by availability of pasture and water for livestock. Human and livestock mobility are dependent on the grazing pattern seasons between the dry and wet seasons. In addition, other factors include trade and conflict as elements that also influence the mobility patterns of the population.

Livestock movement has significantly shifted in some areas in Mandera. Before 2016, livestock from Kenya would be moved into Somalia to access pasture at Weyel, Odha, Farda Jillow and Unsi. The construction of the security fence along the Kenya/Somalia border has restricted movement by Kenyan pastoralists to these locations. Currently, the livestock move towards Rhamu and Qalalio in search of pasture. During the long dry season, livestock are moved to 'Jilal – Oraled'. There is in-migration from the south to pastures referred to as '"badia"' with pastoralists coming to access the pasture around the River Daawa.

Movement of livestock within Somalia occurs towards the Bay/ Bakool regions and to the south towards the lower Juba. Some of the communities along the Somalia/ Ethiopia border move across the international borders in search of pasture. However, this movement only occurs during critical dry seasons.

Factors that contribute to population movement in cross-border Area of Kenya, Somalia and Ethiopia include education, trade, medical care and employment opportunities. Inhabitants from Doolow and Dollo Ado move to Kenya in access for these opportunities. movement to Somalia and Ethiopia from the Kenya side is less pronounced and could be largely attributed to security concerns and increased border controls.

NRM related problems #6:

Conflict: Conflict in the pastoralist land of the Horn of Africa has been attributed to the customary raiding for cattle, competition over natural resources such as pasture and watering-points, and the proliferation of small arms. The main drivers of conflict include extreme weather condition such as frequent and prolonged drought which force affected communities to move into areas that are not traditionally occupied by their clans; prevalence of diseases due to mobility of livestock; mushrooming settlements in Mandera from IDPs and other community members who have lost their livestock (pastoral dropouts) especially in the peri-urban centers, and instigation of local politicians. During the dry season, increased tensions between the herders and farmers along the River Daawa has been experienced as they share the same source of water.

Cross-border conflict within and between Kenya, Somalia and Ethiopia related to NRM, needs to be viewed in the broader context of the political instability in both Somalia and the Ethiopian Ogaden. Factors that contribute to broader insecurity that need to be considered in Somalia would include the segmented nature of the Somali social fabric, constituencies that benefit from armed conflict and ill-informed donor assistance and foreign policy agendas. A key threat in this area is the presence of Al-Shabaab as reported by the community around Elwak region and sometimes they move inwards towards Wargadud area. In Finno, Communities in Dolo Bay indicated that there's are potential conflict zones towards the border with Somali and within Ethiopia towards Barrey. In addition, Belet Xaawo and Doolow in Somalia were known to be potential conflict zones for a long time. Administration of these towns would change hands between Militia groups and the Federal Government of Somalia.

Several mechanisms for the mitigation of conflict have been documented for communities in the Mandera triangle including disarmament and use of inter-clan peace initiatives. Communities in the three countries mentioned the existence of traditional conflict mitigation systems through the councils of elders. The elders work closely with the decentralized government to resolve conflicts at the community level.

Gender: The gender roles in pastoral society are often biased, hindering women's access to resources and extension services and their participation in decision-making. Ownership of assets such as land, livestock and small businesses is majorly by men due to the patriarchal culture of the pastoral community. Few women own assets and majority of ownership of assets for the women was associated with their husbands, brothers or fathers. Land is managed by both men and women based on their gender roles and cultural norms though effects such as drought and flooding increase the vulnerability of women and children as they are heavily dependent on agricultural produce as their main source of livelihood.

Decentralized systems of governance in Kenya have destabilized the social organisation that were once supported by the national government such women and youth group organizations.

Social Inclusion: In the three countries the Somali bantu farming communities (Neboi, Bardale, Doolow) emerge as having lower access to opportunities including investments by government entities. Planning tends to focus most of its efforts on pastoral livelihood activities for the communities alienating the agro-pastoralists and the increasing number of pastoral dropouts affected by either drought or conflict that have migrated into the peri-urban centers.

A significant number of youths were unemployed and do not practice pastoralism. There is heavy reliance for white collar jobs among the youth though majority of them have not received tertiary education and also lack vocational skills.

CONCLUSIONS AND IMPLICATIONS FOR BORESHA PROJECT: The conclusions and implication for BORESHA project are based on the findings and analysis of the NRM mapping of data collected through interviews, focus groups, secondary data and participatory mapping are organized according to the NRM mapping criteria areas.

Policy and Institutional Environment

Cross-border NRM: institutional structures for cross-border NRM related to livestock and irrigated farming are largely informal. These will need to be enhanced and adopted into mainstream working of the three governments.

Gender and Social Inclusion: All efforts should be made to enable women and youth to be part of the formal cross border trading structures. This will require support and recognition by the formal government structures whereby their contribution will be recorded and documented.

The study identified certain vulnerable and marginalized communities such as the Somali bantu. Deliberate effort needs to be made to include them in decision-making and resource allocation processes.

Migration: at the moment migration across the three countries within the cross-border region is largely irregular. The level of interdependence of cross-border communities requires that

more investment is made in facilitating border crossings including having conveniently situated border control points and possible investment in river infrastructure e.g. Mandera and Dollo Ado.

Trade and Markets: a common policy on enhancing trade and development of markets for both livestock, livestock products and horticulture produce is necessary to enhance both pastoral and agro pastoral livelihoods.

Youth empowerment: The high proportion of youth in the cross-border region necessitates that the three countries develop strategies of meeting the aspirations of this constituent. Cross-border policy on Technical Vocational Education and Training (TVET), creating market employment opportunities, and access to capital for youth needs to be agreed upon. An additional dividend of this is that it also acts as a counter-terrorism measure and mitigates conflict.

Community Attitudes to Cross-Border NRM

The study revealed that communities living in the cross-border areas of Kenya, Ethiopia and Somalia share common social-cultural backgrounds and livelihoods. These are form the fabric of natural resource management and utilization in the area. In addition, these communities all have progressive aspirations towards (a) improving their economic situations, (b) enhanced livelihoods and coping capacities, (c) reduced conflict over utilization of shared resources.

This was evident across multiple sectors as evident in (a) the increased adoption of irrigated farming as both complementary to and as an alternative to primarily pastoralist lifestyles (b) interest in adoption of coping strategies such as investment in fodder cultivation and storage, (c) establishment of farmers marketing cooperatives, (d) a desire for youth to be engaged in income-generating activities (e) desire for marginalized and vulnerable communities to be included in decision-making and to have access to development opportunities.

Any intervention on cross-border NRM management will need to establish the necessary partnerships (or incentivize existing partnerships) to respond to, and build on the aspirations of these communities.

Potential Investments towards Resilience

Investment needs to be made in critical transport infrastructure to enhance cross-border movement and improve opportunities for resource sharing. this also calls for support to communities to diversify their livelihoods activities.

There is an apparent weak organizational base for women groups particularly with regard to trade facilitation. Concerted efforts should be placed in including funding in trade focused institutional capacity development.

More research should be conducted to document experiences of women traders at (a) key local markets in Mandera, Rhamu, Dollo Ado and Doolow, and (b) border points with a view to informing future support to enhancing access to capital, linkages to farms and access to markets for local produce.

Implications for BORESHA Project

Investment planning: the NRM mapping exercise has clearly identified opportunities for future investment in enhancing livelihoods for pastoralist communities within the Mandera Triangle. The study has also marked out investment priorities that BORESHA could incorporate in

current or future programming.

Choice of Interventions: BORESHA will need to emphasize interventions that (a) maximize impact on beneficiary populations in terms of enhancing livelihoods and promoting resilience, (b) address the root causes of conflict related to cross-border sharing of natural resources by promoting understanding amongst communities and cooperation between neighbouring governments.

Targeting: targeting of interventions under BORESHA needs to take into consideration (a) inclusion of marginalized sub-clans and other vulnerable populations who are not currently served by the dominant Garre-Degodia-Marehan Somali clan socio-politico-economic systems (b) ensuring that livelihood and economic enhancement opportunities reach the women, youth, physically challenged

Importance of establishing partnerships: it is evident from the NRM mapping study that more need to be done to enhance cross-border working relationships between state and non-state actors. BORESHA is an opportunity to build and enhance such partnerships in line with existing regional agreements (most visibly IGAD). such partnerships will need to be cross-sectoral and cross-border in nature in order to maximize on benefits to target communities and sustainability of interventions.

SECTION 1 CONTEXT

This section provides a brief background to this study, the structure of the report, methodology and the study area.

1.1 INTRODUCTION

ABOUT BORESHA

The ***Building Opportunities for Resilience in the Horn of Africa (BORESHA)*** project is a cross-border intervention targeting community NRM management in the Mandera Triangle which covers parts of Kenya, Ethiopia and Somalia. The project is led by a consortium led by Danish Refugee Council (DRC) and comprising of CARE International, WYG and World Vision International (WVI)

The project has three main outcome areas as follows:

Outcome 1: Selected communities in the Mandera Triangle are more resilient and better prepared for shocks, and response is more effective

Outcome 2: Selected individuals and communities are more self-reliant through increased skills and opportunities for cross-border employment, diversified enterprise and livelihoods

Outcome 3: Cross-border rangeland and other shared natural resources are more equitably and sustainably managed

Under the BORESHA Consortium, CARE International is leading in the delivery of **Outcome 3** to ensure that cross border rangeland and other shared natural resources are more equitably and sustainably managed.

BACKGROUND TO ASSIGNMENT

This NRM Mapping study was carried out as part of the inception phase of the BORESHA project. The mapping exercise will produce a number of GIS layers of the areas targeted by the project as listed below:

Infrastructure: map key features (roads, rivers, mountains, urban centers, refugee camps)

Water resources and infrastructure: existing resources water resources/sources, (dry season wells, rivers, boreholes). Develop an infrastructure potential map to inform the 3R approach of Recharge, Retention and Reuse. **Land cover and land use:** wet and dry season grazing areas including dry season reserves, key land use types and vegetation types, etc.

Resource use and management: document resource uses and management, traditional systems of natural resource and management (NRM) in the area,

Human and livestock mobility: patterns of mobility (livestock and people) within and outside the area.

NRM related problems: document any significant NRM related problems and issues. It is against this background that CARE would like to undertake a GIS mapping study, including key infrastructure / natural resources / issues and problems.

STRUCTURE OF THIS REPORT

This report is structured into 4 key sections:

- Context
- Results of mapping exercise
- Discussion of findings in light of BORESHA's objective of promoting cross-border NRM and resilience
- Conclusions and Implications for BORESHA Project

METHODOLOGY

The Study Area

The study was conducted in the cross-border area comprising Mandera county (Kenya), Dollo district in Gedo region (Somalia) and Dollo Ado District in the Somali Region (Ethiopia). The study area is clearly shown in the map in Figure 1 below:

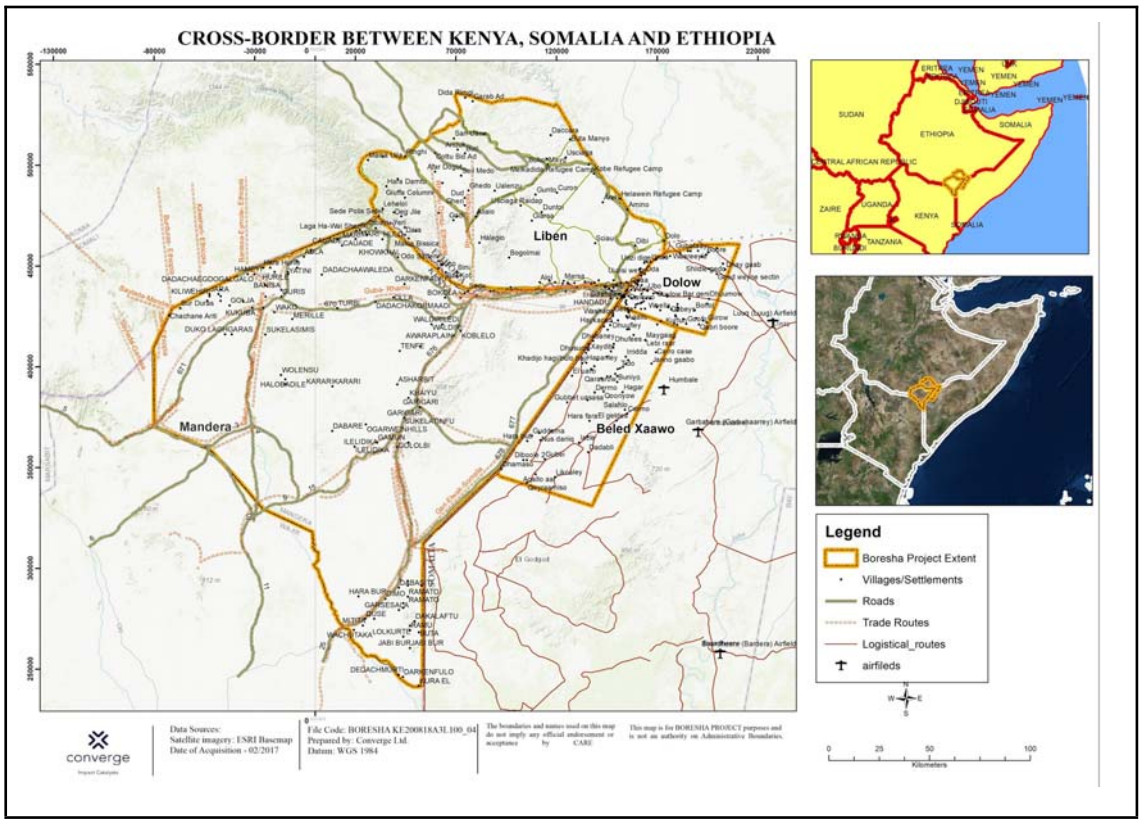

Figure 1Map of the cross-border area between Kenya, Somalia and Ethiopia showing the study area for the BORESHA NRM Mapping Study

The project intervention villages were sampled in each country as indicated in **Table 1** below:

Table 1 Project intervention villages sampled under the BORESHA NRM Mapping Study

Country	Region/ County	District/ Sub-county	Villages/ Kebeles
Kenya	Mandera	Mandera N.	Rhamu, Girisa, Ashabito, Shirshir, Yabicho
		Mandera E.	Neboi, BP1
		Banisa	Malkamari, Hulow, Kiliweheri, Banisa, Eymole, Malqaruqa, Tesoboru, Dhiribur, Derkale
Ethiopia	Somali	Dollo Ado	Bardale, Yugta, Maygag, Sigalow, Daytulu, Fikow
		Dollo Bay	Af-arro, Koraley
Somalia	Gedo	Dollo	Una, Oda, Hamare, Abore, Gawido, Malkariyey, Tolo Amin, Dollo, Unsi, Bula Xawa

Study Design

A summarized version of the study design is shown in Table 2 below:

Table 2 Study Design for BORESHA NRM Mapping Study

Document Review[1] was used to inform study design, data analysis and recommendations for the study areas indicated below						
Secondary Data & GIS Analysis			Primary Data Collection and Participatory Mapping			
Infrastructure	Water Resources (3R Mapping)	Land use & Land Cover	NRM Mapping	Infrastructure Assessment	Land use and Land cover	Mobility Markets Conflict

A more detailed description of the study design is contained in **Annex 2**.

Study Methodology

In implementing the study design, a mixed-methods approach was used, incorporating both quantitative and qualitative methods. The study methodology is shown in **Table 3** below:

Table 3 Study Methodology for BORESHA NRM Mapping Study

Quantitative	Qualitative
(a) Secondary data containing	Primary data was collected through in-person interviews using semi-structured interview guides for the following categories of respondents:

[1] Some of the key documents review included reports by the Millenium Water Alliance (MWA) KALDRR-WASH programme (2013-2014), AECOM Lowland WASH programme in Ethiopia, IGRAC's reports on the Transboundary Waters Assessment Programme (TWAP), reports from DRC's Regional Durable Solutions Secretariat (ReDDS), reports from USAID-funded PACAPS, RELPA, ELMT and ELSE programmes, reports from the Research and Evidence Facility on Migration in the Horn of Africa, reports by COMESA, FAO and IGAD among others.

population demographics was collected from existing reports (b) primary data on water quality was collected from water points at all villages that were visited as part of the study and analyzed using standard procedures analyzed for various physico-chemical parameters (see Section 2.3 of report) (c) descriptive statistics and correlations were derived using STATA and R. (d) GIS mapping using DEM (30m), topographic and remote-sensing images (Landsat 8), field GPS coordinate data and field notes				
	Community	Water Management	Implementing Agents	Govt and other Stakeholders
	Focus-Group Discussions (FGDs) were conducted with Gender disaggregated groups of 6-12 people.	KIIs were conducted with a sample of the water system operators where available	KIIs were conducted with CARE, PACT, Islamic Relief	KIIs were conducted with government officials at national and regional/ county levels

Study Sampling

Sampling (aggregated at country level). The sampling for the study is shown in Table 4 below:

Table 4 Sample Design for BORESHA NRM Mapping Study

Country	District/ Sub-county	No. Villages/ Kebeles	FGDs/ Participatory Mapping: NRM, WSS/WRM, Livestock/ Population	Key Informant Interview	Water Point Assessment	Water Quality Analysis	Soil Analysis

			Mobility, Conflict				
Kenya	Mandera North	5	6	3	6	8	1
	Mandera East	2	3	10	3	3	0
	Banisa	9	4	6	10	10	4
Ethiopia	Dollo Ado	6	8	7	9	7	0
	Dollo Bay	2	4	1	4	6	0
Somalia	Dollow	10	17	4	9	9	0

Mapping Methodology

Satellite images (multi-spectral Landsat 8 imagery from 2000 and 2018) were analysed in conjunction with ground truthing observations and participatory community mapping exercises. To obtain data for ground-truthing, Global Positioning System (GPS) points were obtained corresponding to the various land uses and land cover forms, location of invasive species, rainfed agriculture, irrigated agriculture, shrublands, woodlands, and water bodies/sources. The study used at least two time-period data sets to detect changes such as land use and land cover. Landsat 8 images used for this study were obtained from Earth Explorer (https://earthexplorer.usgs.gov/) that provides historical Land Cover analysis. Images for the period of Jan-March 2018 were downloaded and classified using the Maximum Likelihood algorithm in ArcGIS Desktop 10.3. Images were clipped for the study area. The Landsat 8 satellite payload consists of two science instruments—the Operational Land Imager (OLI) and the Thermal Infrared Sensor (TIRS). These two sensors provide seasonal coverage of the global landmass at a spatial resolution of **30 meters** (visible, NIR, SWIR); **100 meters** (thermal); and **15 meters** (panchromatic).

Image Preparation and Supervised Classification

Landsat Images covering the study area were downloaded in QGIS using the Semi- Automatic Plugin[2] and preprocessed using the plugin, for atmospheric correction, brightness and pan sharpening. The images were stacked and clipped using the study area shapefile. The images were mosaiced in ArcGIS using the Mosaic Dataset tool to create a flawless and seamless image and displayed using band combinations that best displayed the different analysis outputs of the classified image. The team used GPS coordinates to calibrate the various landcover types collected in the field. The Maximum Likelihood algorithm was used to classify the image. This algorithm is preferred because it considers variability within clusters, considers the shape of the clusters, as well as avoiding misclassification (Sisodia, Tiwari, & Kumar, 2014). The final classes were obtained and displayed using the appropriate colour scheme.

[2] https://fromgistors.blogspot.com/p/semi-automatic-classification-plugin.html?spref=sacp

Data analysis

The area of land under different land uses and cover was used to calculate percentage changes in land use and land cover using Excel software. Overall land use and cover changes were calculated from 2000 and 2018. This is possible using the EOI cloud-based imagery analytics tool, land viewer helper. The URL engine superimposes freely available sentinel imagery at any time epoch.

Limitations of the Study

Several limitations are identified which affected the study activities:

a) Access to sites in Doolow (Somalia) and Mandera East (Kenya) were not accessible due to security restrictions. To address this, local enumerators were recruited and trained to conduct the field data collection for Doolow (Somalia). Sites in Lafey (Kenya) located close to the border were not visited.
b) The time required for field work activities was limited and some of the key stakeholders were not available for interviews. This constrained the number of stakeholders that could be interviewed. To address this, discretion was exercised in the selection of KIIs and all opportunities exploited to ensure views of relevant interviewees were obtained.
c) Soil analysis was only conducted in sites with Mandera, Kenya for two reasons: (a) the extensive use of surface water catchment for both human and livestock use (b) In Somalia the field work was conducted by local RAs due to lack of access by the research team - it was not possible to train them to undertake the field analysis, and (c) in Ethiopia, the communities in the study use the river and shallow wells for livestock watering and therefore no surface water catchment sites were visited.
d) To arrive at the 3R maps, secondary data from RS analysis was utilised and no detailed hydrogeological field studies were conducted as this was beyond the scope of this assignment.

1.2 THE STUDY AREA: CROSS BORDER AREA BETWEEN KENYA, SOMALIA AND ETHIOPIA

The cross-border area between Kenya, Somalia and Ethiopia being semi-arid and arid lands share similar environmental traits. It is mostly occupied by Somalis who share similar culture and ethnic groups covering parts on North Kenya, Southern Ethiopia and East of Somalia (COOPI, 2011). Majority of the population practices nomadic pastoralism as their main source of livelihood and a small proportion of Somali bantu who are agro-pastoralists. The major clans include Garre, Degodia and Marehan clans that inhabit most parts of the cross-border area between Kenya, Somalia and Ethiopia.

The main challenge that BORESHA study area faces is the severe, frequent droughts that cause ecological stress. This poses a major risk to the population's food security, peaceful co-existence and poverty eradication. This has resulted in communities abandoning traditional mechanisms for land and natural resource management due to changing grazing patterns, colonization of formerly productive rangelands by invasive species and increased frequency in forced mobility of both livestock and population in search of pasture and water.

Another challenge facing communities in the cross-border pastoralist areas is low-levels of technology adoption, deteriorating land and herd productivity and poor economies of scale in utilization of resources. This is compounded by increasing imbalance between growing human and livestock populations and limited environmental resources. The resultant effect is seen in negative outcomes for the sustainability of pastoralist livelihoods and resilience to shocks (Sanford S. 2014). The survival of the pastoral livelihoods therefore requires adoption of scientific range management practices that ensure optimal use of shared natural resources.

The lack of diversification in economic and livelihood activities is a key risk factor when it comes to the vulnerability of cross-border pastoralist communities. Communities living within these cross-border areas show a strong interrelationship in the socioeconomic and socio-cultural characteristics. This leads to an interdependency on use and management of shared natural resources. Such shared resources are easily affected by factors such as unpredictable weather patterns, poor governance structures, conflict, inadequate infrastructure and the general remoteness of the region. Increased adoption of alternative livelihood strategies at both household and community levels would provide a much-needed buffer against recurrent shocks.

POPULATION AND DEMOGRAPHY IN MANDERA TRIANGLE

The total population of countries in Mandera Triangle is estimated for 2015 was 99.87M, 47.24M, and 13.91M for Ethiopia, Kenya and Somalia respectively[3]. Detailed country-level population figures are shown in Table 5 below:

Table 5 Country level population data.

Country	Total Population (in Millions, 2015)	Popn Growth Rate (2010-2015)	Popn Density (persons/ sq. km)	Average HH size
Ethiopia	99.87	2.5	99.9	4.6
Kenya	47.24	2.66	83.0	3.9
Somalia	13.91	2.86	22.2	5.9

For the study areas, population figures are shown in Table 6 below:

Table 6 Study level population data

Country	Study Area	Population Projections (2015)	Popn Density (persons/ sq. km)	Average HH size
Ethiopia	Dollo Ado	190,525	11-25	4.6
Kenya	Mandera	1,294,917[4]	39-51	3.9

[3] United Nations, Department of Economic and Social Affairs, Population Division (2017). World Population Prospects: The 2017 Revision, DVD Edition.

[4] Mandera County Government (2013). First County Integrated Development Plan.

Somalia	Doolow, Belet Hawa, Luuq	168,312[5]	21	5.9

The inhabitants within the Mandera triangle region are pastoralists of Somali clans. Their main source of livelihood is livestock production for both subsistence and economic needs. There is a small population of Somali Bantus who derive their livelihood from agro-pastoralism along the Daawa River. The general populace experiences frequent natural disasters such as drought and floods which affects their livelihood and increases their vulnerability to food security, conflict and poverty.

Each clan within the region has a segmented social formation, with the largest clans being Garre, Degodia and Marehan who operate and extend across national boundaries as well as having clansmen living across the borders. According to a conflict study report by COOPI (2011), each clan is associated by territory that may or may not coincide with the regional administrative boundaries.

GOVERNANCE (POLICY AND INSTITUTIONAL ENVIRONMENT)

Policy and institutional mechanisms for management of cross-border NRM in pastoralist lands are poorly developed. Past approaches to NRM at national level have viewed pastoralism and its associated livelihood as an archaic and inefficient mode of utilization of land. This explains the historical stance that has been adopted until recently by both Kenya and Ethiopia where the dominant approach to NRM in pastoralist areas has been to promote pastoralist sedentarization and stringent regulatory policies as a move towards efficient use of land and other resources (Pavanello & Levine, 2011). These approaches led to disruption of long-established customary systems of NRM sharing among cross-border communities. Current practice on cross-border NRM involves hybrid structures represented in existing national policies, partly formalised inter-governmental policy arrangements, customary community arrangements and informal government-to-government workings. The informal government-to-government arrangements are implemented by officials across different sectors such as agriculture, immigration, trade and livestock as a means of ensuring movement of pastoralist communities across borders does not compromise national sectoral interests. There are ongoing intergovernmental initiatives to enhance cross-border NRM policy and practice supported by UNDP[6], EU[7], IGAD/FAO[8], and IGAD/WHO[9]. These initiatives target different issues such as proliferation of small arms, cross-border conflict, livelihoods, climate change, irregular migration and causes of population displacements, food security, promoting alternative livelihoods, enhanced cross-border trade, promoting resilience to drought, and disease surveillance and control.

CROSS-BORDER NRM

[5] Based on UNDP 2005 and 2010 projections, cited in SOAS affiliated Research and Evidence Facility, 2016. 'Cross-Border Analysis and Mapping, Cluster 2: Kenya - Somalia - Ethiopia,' Nairobi and London: Research and Evidence Facility of the EU Trust Fund for Africa..

[6] Cross Border Programme for Sustainable Peace and Socio-Economic Development: Marsabit County, Kenya – Borana/Dawa Zones, Ethiopia

[7] European Union Emergency Trust Fund for Stability and Addressing the Root Causes of Irregular Migration and Displaced Persons in Africa (EUTF), Horn of Africa Window

[8] IGAD/FAO. IGAD-FAO Partnership Programme on Drought Resilience

[9] IGAD/WHO. Action Plan to Address Cholera/ Acute Watery Diarrhoea and Chikungunya Virus Outbreaks on the Kenya-Ethiopia-Somalia Border: 2016-2019.

Key shared natural resources in the cross-border areas between Kenya, Ethiopia and Somalia include grazing land, surface water resources such as the Daawa river and groundwater resources including the transboundary Daawa-Juba and Juba-Shebelle aquifers. Documented challenges of cross-border NRM-sharing include protracted conflict in Somalia, recurrent resource conflicts related to water and pasture, poorly developed policy environment and lack of investment in infrastructure. These are further compounded by other underlying factors such as negative ethnicity/interclan politics, proliferation of small and light arms, disease transmission, illegal migration and trade. In addition to cross-border sharing of natural resources, communities also share access to critical public services and related infrastructure such as health, education, transport, communication and security.

SECTION 2: RESULTS OF MAPPING EXERCISE

2.1 INFRASTRUCTURE

This section discusses the nature of existing infrastructure related to transport and communication, social amenities and flood control. Key infrastructure data related to roads, airports, wetlands, water and school resources were mapped and availed through credible information source, Food Security Analysis Unit Somalia, UNDP, IGAD and IUCN databases. Water point data were collected using GPS's during field exercises conducted in this study and compared with available secondary data. Land use types were also validated during the field trips to ensure for accuracy. These were used to construct baseline and infrastructure maps.

TRANSPORTATION & COMMUNICATION

Existing Transportation infrastructure is poorly developed. The key cross border towns of Suftu, Doolow and Dollo Ado are served by non-paved road. Mandera has recently benefited from upgrading of some of the roads within the town to bitumen standard through investment by the county government of Mandera. In addition, there is ongoing work to upgrade the Rhamu-Lafey road to all-weather standard. In Ethiopia, Suftu is connected to the capital of Somali region (Jijiga) through an all-weather road. However, the connection between the Kenya/Ethiopia Daawa river crossing at Suftu and Dollo Ado, there is a loose surface road which becomes inaccessible during heavy rains. Roads in Doolow Somalia are loose surface and would pose access challenges during wet weather conditions. Air transport for the three areas is via airstrips boasting basic infrastructure comprising unpaved runways. The Mandera airstrip is located inside the military airbase and is shared by military and civilian air traffic. Travel across the River Daawa is done on a bridge for the Doolow/ Dollo Ado route and using improvised rafts for Mandera/Suftu - Dollo Ado route. In addition, there are numerous unregulated border crossing points along the river that are utilised by cross-border communities with documented instances located at Rhamu and Girisa.

Mobile telephone communication is well-developed with Safaricom & Airtel (Kenya), Hormuud Telecom (Somalia) and EthioTel (Ethiopia) networks available. Communities along the border tend to use whatever network is available irrespective of the country where the service provider is domiciled. There is however an emerging preference for mobile telephone

services provided by Hormuud Telecom along the Ethiopia/ Somalia and Somalia/ Kenya borders due to the strong network coverage, reliability and affordability of their services.

Social Amenities (Immigration, Schools, health facilities)

Immigration control points are located in Mandera and Dollo Ado towns. In Somalia immigration issues are handled from Mogadishu. The Ethiopia border point is located at Dollo Ado. The Kenya-Somalia border point has been closed since 2014 following repeated incursions by Al Shabab (AS) insurgents into Kenya.

In 2016 the Kenya government decided to construct a fence along the shared border with Somalia to curtail movement across the porous and unmanned extensive border. This was intended as a measure to control irregular migration and combat incursions by Al-Shabaab (AS) across the Kenya-Somalia border. The fence construction exercise begun in 2016 but was temporarily halted in March 2018 following a disputed boundary between the two countries. This followed contestation of the border by communities whose properties were marked for demolition because they are located on the no-man's land of the border. In addition, there has been concern about the socio-cultural, socio-economic and political implications of permanently restricting movement for the border communities. Erecting a physical security barrier between the two countries carries the risk of altering traditional livestock movement patterns (critical for access to pasture and water), hindering cross- border trade and breaking social-economic connections that have existed for generations of cross-border communities. This is already happening with communities living in the town of BP1 indicating that whereas previously they would move their livestock into Weyel, Odha, Farda Jillow and Unsi areas of Somalia for pasture, this has changed and they are now restricted to the Kenya side of the border. However, the communities also indicated that construction of the fence has contributed to a reduction in Al Shabab activity along the border.

Ongoing conflict and measures adopted by governments to deal with armed insurgency for countries within the Mandera triangle has had mixed effects especially on livestock trade which is a key economic activity in the region. It has been documented that the highest livestock sales in the region were recorded in 2002 and 2008, the highest increase of 32% recorded in 2006-07. This was at the same time as the Ethiopian invasion of Somalia and could be explained by herders off-loading the stocks in anticipation of losses and poor market conditions due to the conflict (Mahmoud, 2010). Measures by the Kenyan government to pursue Al Shabab into Somalia in *Operation Linda Nchi* have however been reported to have had a negative effect on the local economy in Mandera County due to increased transportation costs, and traders resorting to smuggling of imports from Somalia leading to falling tax revenue for the county government[10].

Compared to Doolow and Dollo Ado, Mandera offers more advanced health and education services in the region. This serves to attract communities from the neighbouring countries who access health services in local hospitals in Mandera and also enroll their children in schools across the border. Primary and secondary data collection indicate a

[10] Article in Business Daily, 25 June 2018, *Mandera County pays the economic cost of Somali border closure* (https://www.businessdailyafrica.com/news/counties/Mandera-County-pays-the-economic-cost-of-Somali-border-closure/4003142-4630170-hahkxx/index.html). Accessed on 1 November 2018.

verifiable data gap on the number of people that access the local hospitals and schools in Mandera from across the border.

FLOOD CONTROL

Flood control infrastructure is critical for management of flood flows on the River Daawa during the wet season. Most of the existing infrastructure comprises gabions along the river banks at certain heavily populated sections of the river bank such as Rhamu. In this respect, most investment in flood control on the River Daawa occurs on the Kenya side of the border.

Existing infrastructure is shown on the map in **Figure 2** below:

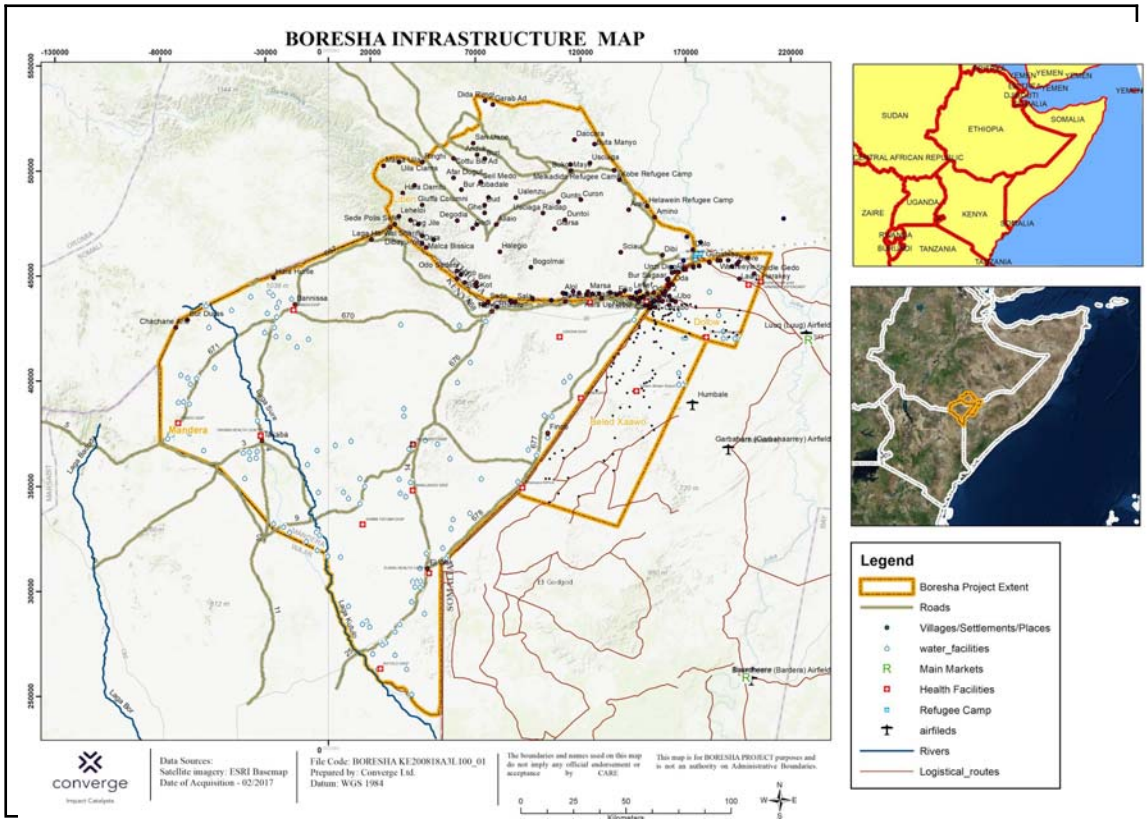

Figure 2 BORESHA Infrastructure Map

2.2 Water Resources

Available Water Resources

The cross-border area between Kenya, Somalia and Ethiopia is drained by the Laag Dheera and Genale-Dawa sub-basins (Mohamed, 2014). Major surface water sources are the Daawa River which begins from the Ethiopian highlands and traverses Kenya, Ethiopia and Somalia, the Genale River which runs from the Ethiopian highlands and onto the border with Somalia before joining with the Daawa River to form the Juba River.

Major underground aquifers are the Juba (transboundary between Ethiopia and Somalia) and the Daawa aquifers (transboundary between Kenya, Ethiopia and Somalia).

The transboundary water resources are shared by a human population of approximately 800,000 and an estimated livestock population of 200,000 livestock units (LUs) based on existing reports[11]. Additionally, a recent increase in irrigated farmland has further exerted pressure on limited water availability. Recurrent droughts exacerbated by prolonged dry seasons caused by changing climate have led to water resource variability compounding pressure on constrained water resources. Uncertainty about location and availability of groundwater resources has further pushed competition for existing surface water sources creating opportunities for conflict about access to water resources. Geo-hydrological studies need to be conducted to quantify the added pressure on both surface and ground water resources, while looking at seasonal trends.

Management of Transboundary Water Resources

A major issue with transboundary water resources is the conflicting assumptions on resource availability and lack of agreement by riparian states on sharing arrangements. In the Shabelle basin for example lack of integrated planning efforts by Somalia and Ethiopia is projected to create a situation where demand surpasses available river flows (2035 and 2055 time horizons) by 200 cm/h and 3500 cm/h in the medium and high growth scenarios (Michalscheck, Petersen, & Gadain, 2016). Instances of unilateral action by countries are common with several examples in the Mandera Triangle, for instance the proposed Baadhere Dam by Somalia on the river Juba shared between Ethiopia, Somalia and Kenya (Salman, 2011). On the R. Daawa, Kenya has also proposed construction of a dam at Malkamari for flood-control and irrigation (Mutuku & Abdille, 2012)

The two major drainage sub-basins of the BORESHA project area represented in the Map in **Figure 3** below:

[11] Mutuku, J., & Abdille, A. A. (2012). *Rapid Transboundary Diagnostic Assessment: Dawa River basin* (IGAD Inland Water Resources Management Programme). Nairobi, Kenya: Inter-Governmental Authority on Development (IGAD).

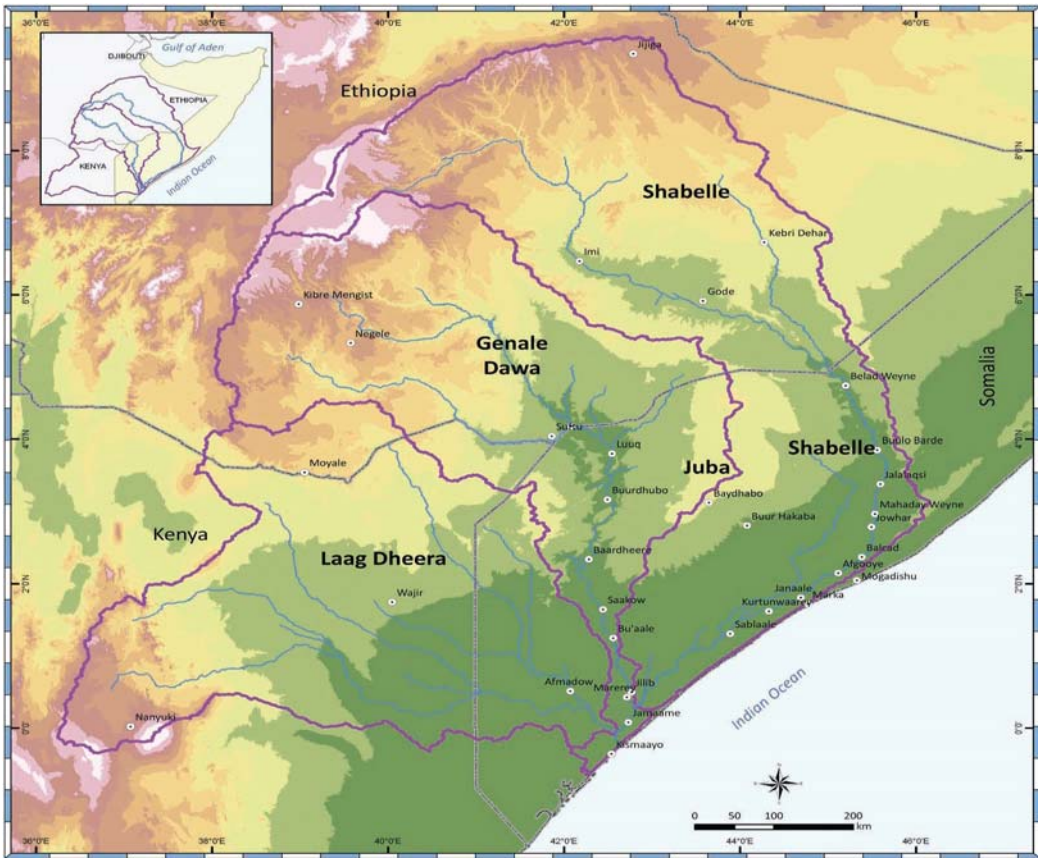

Figure 3 Map showing drainage sub-basins covering the cross-border region between Kenya, Ethiopia and Somalia. Source: (Mohamed, 2014)

WATER SUPPLY INFRASTRUCTURE

Communities in the 3 states within the triangle are heavily dependent on surface water and shallow ground water for riverine communities and ground water for communities settled away from the river. In addition, surface water storage in water pans is used for livestock. During times of severe water stress, this water is also used for human consumption.

An assessment of the condition of existing water supply infrastructure revealed that most of water infrastructure are complete and fully operational. However, there were cases of incomplete and non-operational infrastructure as well. A summary of the operational status of water supply infrastructure is shown **Table 7** below:

Table 7 Operational Status of Water Supply Infrastructure for BORESHA Target communities

	Complete		Incomplete	
	Fully Operational	*Partly/ Not Operational*	*Partly Operational*	*Not Operational*
Mandera	BH: Ashabito, Hullow,	WP: Derkale, Malkaruqa, Girisa	SW: Tesoboru, SW+piped	SW: Yabicho Village C

	SW+piped: Rhamu Water Supply, BP1 SW: Shafshafey WP:Ashabito, Kiliweheri, Eymole, Dhiribur, Banisa, Tarama	BH+piped: Girisa Shirshir, SW+piped: Yabicho Village B	: Yabicho Village B	Neboi
Dollo Ado	SW+piped: Yugta, Maygag Daytuli, Fikow, Bardale SW: Af-arro, Koraley	RWH: Af-arro Birkat	n/a	n/a
Doolow	SW +piped: Doolow, Una, Unsi, Tolo Amin, Hamare			
Key	SW - Shallow Well, RWH - Rainwater Harvesting, BH - Borehole, WP - Water pan			

Available surface and groundwater resources and water infrastructure are shown on the map in Figure 4 below:

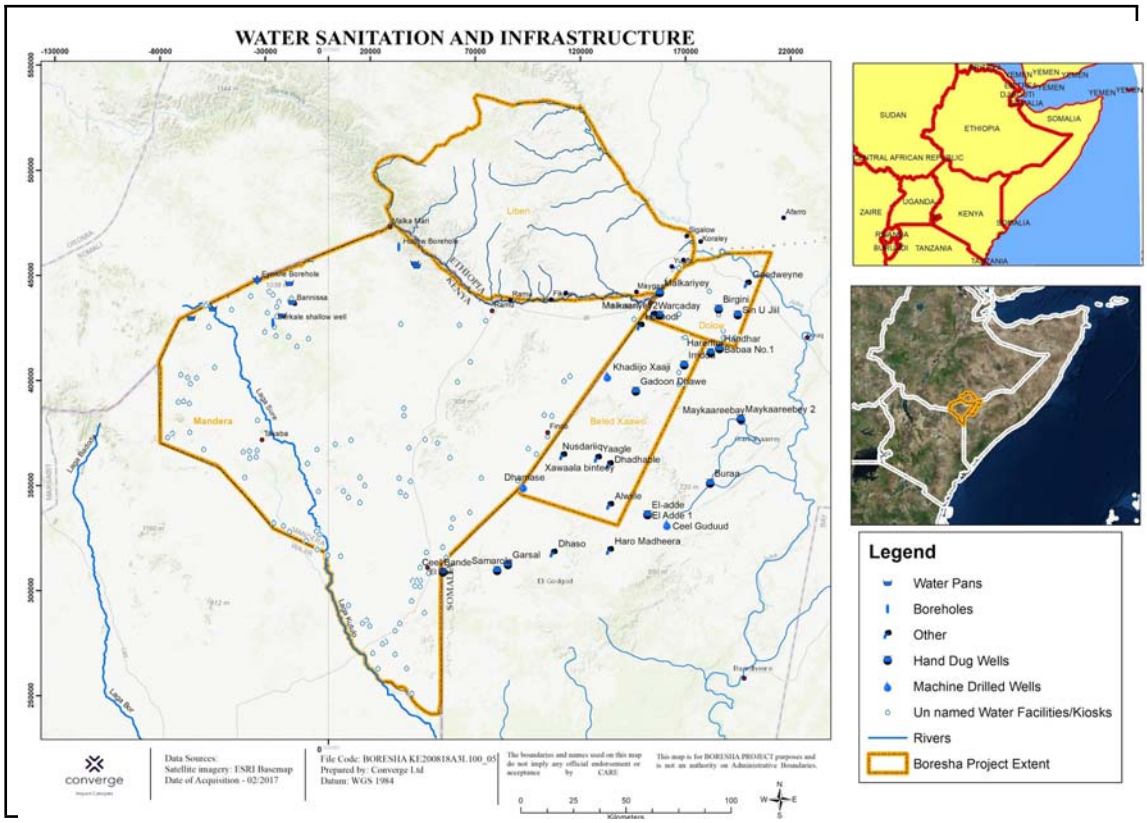

Figure 4 Map showing location of existing water resources and water infrastructure

WATER QUALITY

Water samples were collected from both ground and surface water sources from all villages included in this study and analysed for public health and irrigation sector physico-chemical indicators (indicated in table below). The samples were analyzed by an accredited water specialist laboratory in Nairobi. The results of the water quality testing for samples obtained from sites in Mandera, Dollo Ado and Doolow for the different parameters are summarised the **Table 8** below (A detailed analysis is contained in annex 11):

Table 8 Water Quality Analysis Results for Water sources in Mandera, Kenya

Type of Source	Surface Water	Ground Water
Parameters	*TSS, Phosphates, Turbidity*	*Pb, Fe, Mg, Ca, Na, Cl, NO_3, pH, TDS, Alkalinity*
Mandera, Kenya	All samples apart from the Eymole and Ashabito water pans had values of Total Suspended solids (TSS) above the recommended 30 mg/l, Phosphate levels were within the recommended 30 mg/l but with some samples with high	Most of the samples were within the acceptable levels for human consumption for the different parameters as recommended by NEMA and WHO. The sample from the Eymole borehole exceeded recommended Chloride of

	levels e.g. Dhiribur water pan (14.89mg/l) and Daawa River at Neboi (19.28mg/l) possibly attributable to contamination by animal waste and fertiliser respectively. All samples tested has turbidity levels above the recommended 5 Nephelometric Units (NTU) with the river samples showing the highest levels>800 NTU evidence of high sediment load due to soil erosion.	(440/250 ppm), Total Dissolved Solids (TDS) of (3794/1000 ppm) and had a pH slightly out of range (8.1) but within acceptable limits as stipulated by WHO Drinking Water standards[12].
Doolow, Somalia	TSS values ranged between 120.27ppm and 60ppm with one site (Unsi) above the recommended value of 60ppm. Phosphates 3.02mg/l and 1.59mg/l within the recommended 30mg/l. Turbidity ranged between 92 NTU and 692 NTU all above the recommended 5NTU.	Iron values ranged between 0.04ppm and 38.58ppm above the recommended 0.03 ppm for drinking water. Mg values ranged between 0.06ppm and 38.58ppm. within the recommended 200 ppm. Ca values ranged between 41.18ppm and 71.43ppm all within the recommended 200ppm. Sodium values ranged between 102.31ppm and 106.81ppm. Cl levels ranged between 50.45ppm and 3014.77ppm. One sample had values above the recommended 250ppm - Oda Gawido shallow well (3014.77). Nitrate (NO3) levels ranged between 0.26ppm and 41.15ppm. One site had values above the recommended 30ppm - Gawido & Malkariyyey shallow wells (41.15ppm) pH values ranged between 7.1 and 7.48 within the recommended 6.5 - 9.2). TDS values ranged between 48.3ppm and 98.85ppm within the recommended value of 1000ppm.

[12] WHO (2011). Guidelines for drinking-water quality. 4th Edition. *WHO chronicle*, *38*(4), 104-8

		Alkalinity values ranged between 70ppm and 120ppm within the recommended 500ppm.
Dollo Ado, Ethiopia	Phosphate values ranged between 0.06 mg/l and 4.81 mg/l within the recommended 30 mg/l. Turbidity values were highest on the R. Ganale (670-424 NTU) above the recommended 5 NTU. TSS values varied between 20 mg/l at River Daawa (Bardale, Dollo Ado) and 130 mg/l at Daytuli in the sampled surface water sources. All the samples tested for TSS were twice above the recommended levels set by both NEMA (2006) and WHO (2004) at 30 mg/l, except for one (Bardale).	Iron values ranged between 0.71ppm and 2.71ppm above the recommended 0.03 ppm for drinking water. Mg values ranged between 8.12ppm and 27.4ppm within the recommended 200 ppm. Ca values ranged between 28.89ppm and 323.6ppm. Two samples had values above the recommended 200ppm - Af arro shallow well (323.66ppm) and Af arro Health center(307.6ppm) both located at Af arro in Dollo Bay. Sodium values ranged between 38.42ppm and 506.0ppm. One sample had value above the recommended 200ppm - Afa arro shallow well (506.0ppm). Cl levels ranged between 29.99 and 1309.67. Two samples had values above the recommended 250ppm - Af arro shallow well (1309.67ppm) and Maygag (394.9ppm) Nitrate (NO3) levels ranged between 0.03ppm and 20ppm. One site had values above the recommended 20ppm - Af arro shallow well (20ppm) Ph values ranged between 6.94 and 7.38 within the recommended 6.5 - 9.2). TDS values ranged between 40ppm and 140ppm within the recommended value of 1000ppm - Af arro shallow well recorded the highest value of 140ppm. Alkalinity values ranged between 40ppm and 120ppm within the recommended 500ppm.

The detailed analysis results for each sample are shown in **Annex 11**.

Water Use and Demand

Apart from domestic use, the major water uses in the Mandera Triangle are irrigated farming (both abstraction and are flood/ spate irrigation) and livestock watering.

Spate Irrigated farming or flood recession farming is practiced on the lower reaches of the Genale and Daawa rivers of the Somali region of Southern Ethiopia and at Rhamu Dimtu, Malkamari and Harere areas of Kenya/ Ethiopia section of the Daawa river. (Embaye, Alemu, & Mekelle, 2015).

Water Resources Potential (including 3R Mapping Potential)

Riverine communities in the three border areas are heavily dependent on both river and shallow groundwater to meet human, livestock and irrigated crop farming demand. Communities located further away from the river depend on deep groundwater and surface water runoff catchment to meet their water needs.

Water resources use for these communities is summarised in **Table 9** below:

Table 9 Water resource use for BORESHA target communities in the Cross Border Area of Kenya, Somalia and Ethiopia

	River and Shallow Wells	Boreholes	Rain Water Harvesting (water pans, Birkat etc)
Mandera	BP1, Shafshafey, Neboi Girisa, Rhamu, Yabicho, Derkale, Tarama, Girisa	Eymole, Yabicho, Girisa, Shirshir	Eymole, Banisa, Dhiribur, Kiliweheri, Tesoboru, Shabito, Neboi, Shashafey
Dollo Ado	Sigalow, Maygag Bardale, Daytuli, Fikow, Yugta, Af-arro		Af-arro, Koraley
Dollow	Tulo amin, Gawido, Malkariyey, Oda, Unsi, Una, Hamare, Abore, Doolow		

Existing water resources potential using the 3R approach is shown on the map in Figure 7 below:

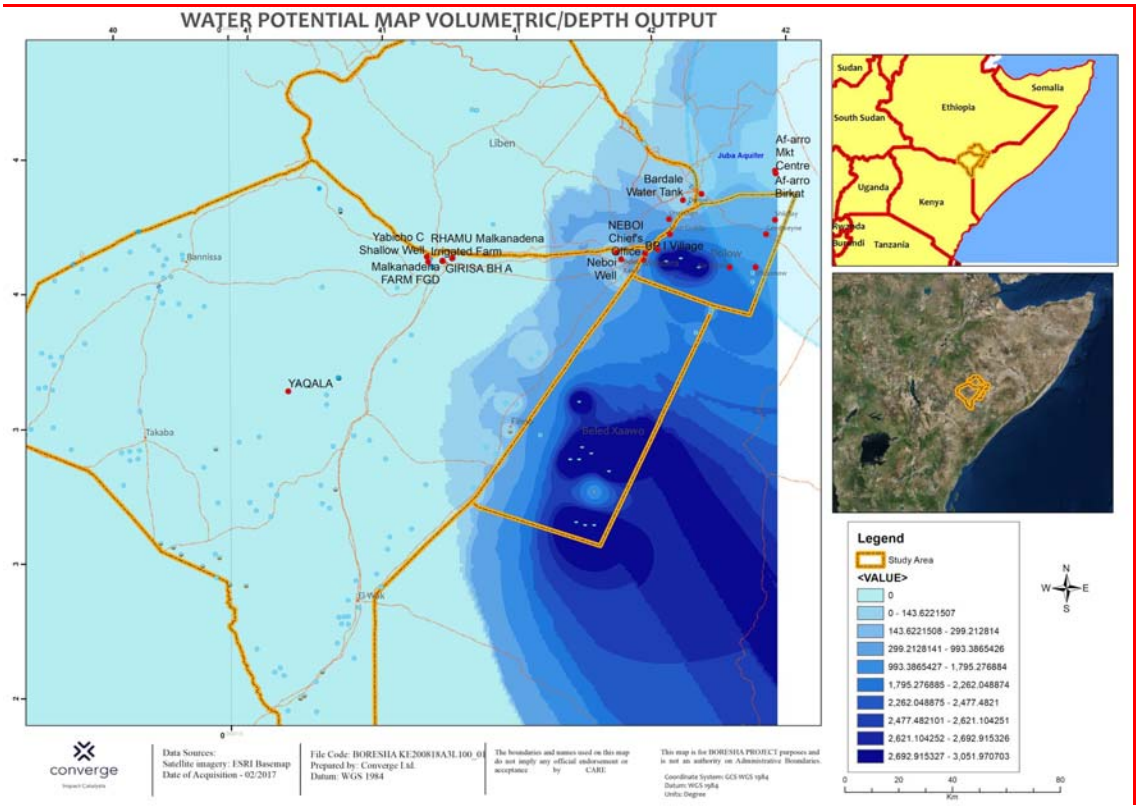

Figure 5 Map showing Water Resources potential of the BORESHA project area using 3R Approach

2.3 Land Use and Land Cover

In this report, Land Cover refers to the biophysical and biological cover of the land surface. This includes all attributes of the land surface such as vegetation, water, bare soil or other material that "covers" the land (Lambin & Geist, 2006). Land Use on the other hand already includes an active determinant by the added term "use" and is referring more to how humans impact the land (Meyer & Turner, 1994). This includes land use activities such as irrigation or rainfed agriculture, pastoralism areas dominated by livestock or urban areas.

Existing Land Use Patterns

Livestock production is the dominant land use pattern in the Mandera triangle. Along the riverine areas i.e. Daawa R. (Mandera, Dollo Ado, Doolow), Genale R. (Dollo Ado) and Juba (Doolow), agro-pastoralism is a dominant land use pattern with majority of the farmers practising irrigated farming. Crops grown include watermelon, chilies, mangoes, onions, tomatoes, coriander, bananas spinach and kales.

Existing land use patterns highlighting the some of the areas under irrigated farming are shown on the map in **Figure 6** below:

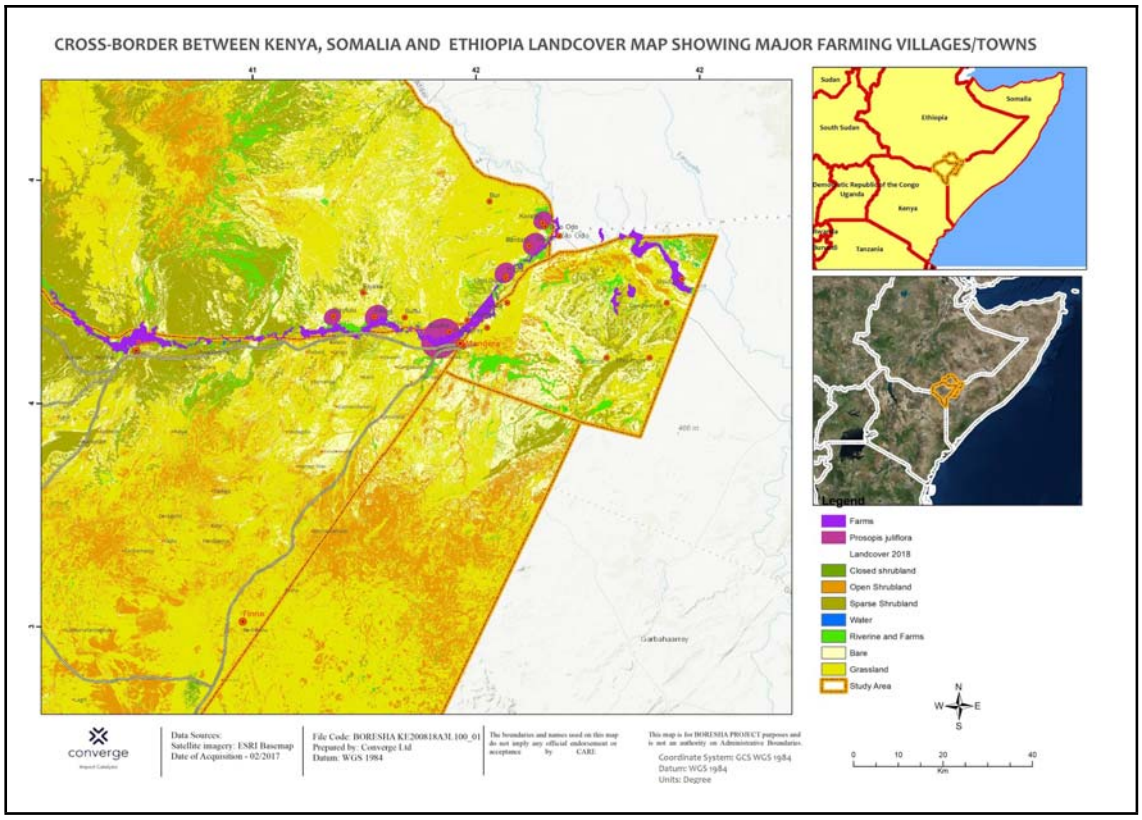

Figure 6 Map showing land-use patterns in the cross-border Area of Kenya, Somalia and Ethiopia (pastoralist grazing lands and irrigated farming land are highlighted)

CHANGES IN LAND USE AND LAND COVER

Grasslands and open shrubland are the dominant land cover types within the cross-border area of Kenya, Somalia and Ethiopia. See Table 10.

Table 10 Land use cover types in 2000 and 2018

	2000	2018
Bare	15.4%	6.9%
Closed Shrubland	19.3%	5.5%
Grassland	22.4%	42.0%
Open Shrubland	28.2%	32.0%
Sparse shrubland	14.2%	10.2%

Riverine/Farms	0.2%	3.2%
Water	0.2%	0.1%

Along the riverine areas of the Daawa in Doolow and both the Daawa and Ganale in Dollo Ado dense riparian forest comprising predominantly of *Acacia Senegal* (local name, *Cadaad*; english name, Gum Arabic) and in some locations *Acacia Tortillis* (local name, *Seyal*; english name, Umbrella Thorn). These are shown in Figure 9 below:

Figure 7(a) Closed shrubland in Bardale, Dollo Ado, and (b) Riverine vegetation in Una, Doolow

Dense riverine and farm land change was analysed for the period 2000 to 2018. The results show that land under farming activity has increased from 0.2% to 3.2% during the period. Increase in farm activities could be as a result livelihood diversification due to the extreme losses of livestock due to the extreme prolonged droughts that have been experienced in 2011/12 and recently 2016/17.

Closed shrubland decreased from 19.3% to 5.5%, which could be an effect of overutilization and degradation. Most of the closed shrublands have transitioned to open shrublands (increased from 28.2% in 2000 to 32% in 2018) and grasslands (increase from 22.4% in 2000 to 42% in 2018). Sparse shrubland has decreased from 14%-10%.

Invasive Species

Dense invasion of *Prosopis juliflora* was noted along the riverine, close human settlements, and along roads and cattle tracks. This was noted in villages across the three countries. It is however difficult to calculate the extent of the area captured under this vegetation species using remote-sensing analysis. However, by using high-resolution remote-sensed imagery it is possible to identify areas where expansion of vegetation has occurred probably due to invasive species. To ascertain a quantitative assessment of the extent spread of Prosopsis would require extensive ground-truthing which was beyond the scope of the study. Spot visits in the villages were used to verify a small section of the findings from the imagery.

A comparison was made for a sub-set of the land use types of the project area was made for the period 2015 to 2018 to determine *Prosopsis juliflora* invasion. 2000 imagery used to

understand baseline extent of Prosopsis indicated that the extent was too small to show any significance. Because the crop is hard to distinguish from healthy vegetation cover, bare ground detected in 2015 imagery was used to detect the spread of the invasive species. The same sections are now covered in bright green characteristic due to the invasion by *Prosopis juliflora* and verified during field data collection.

Change in land cover specific to invasion of formerly bare land by the species *Prosopis Juliflora* are shown in the map on **Figure 8 and 9** below:

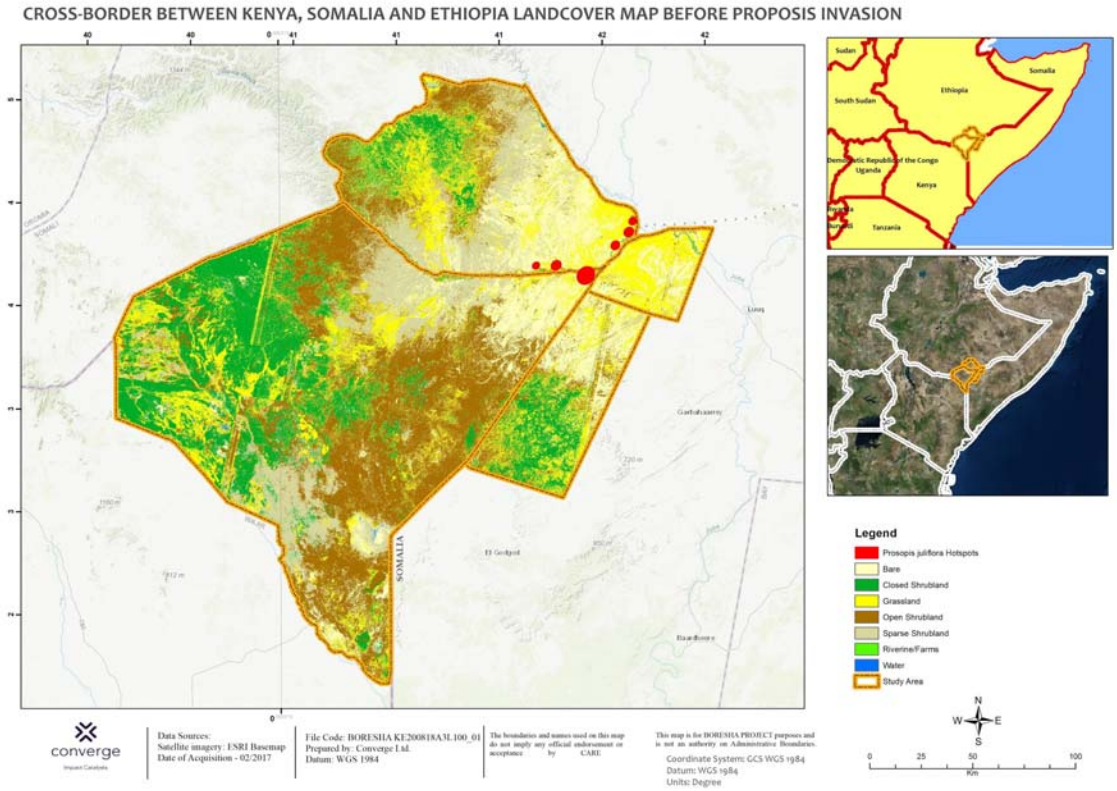

Figure 8 Landcover Map indicating bare ground or "Prosopsis Hotspots".

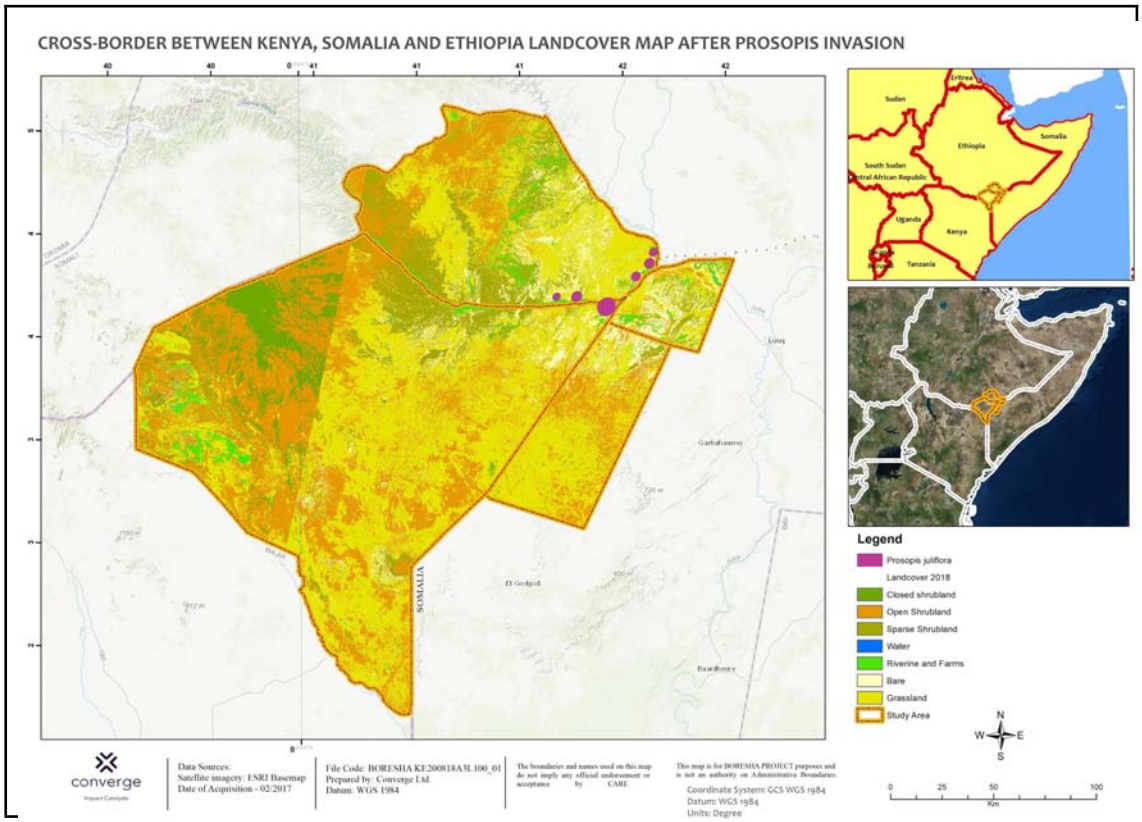

Figure 9 Land cover type after Prosopsis invasion (2018)

The proliferation of invasive *Prosopis juliflora* has increased, and is *attributed to* livestock movement towards watering areas. In addition, changing settlement patterns with decreasing human mobility while retaining mobile pastoralist herds, especially in along R. Dawa and Ganale is another key factor. This, combined with rapid and unregulated clearing of land for farming and dry season pasture along the riverine sections creates a conducive environment for spread of the species. Another cause is overgrazing that was evident in most parts that were visited during the study. This rapid spread of *Prosopis* could cause an ecological shift, where the dominant vegetation types are displaced by *Prosopis*. In some places, it has completely displaced the herbaceous layers in the areas where it is rampant (Muturi, 2012). There is less undergrowth in the bushland as validated during this study. some of the areas under Prosopis invasion are shown in Figure 10 below:

Figure 10 Invasion of Prosopis juliflora (a) seen in the background of irrigated farmland at Malkanadena, Rhamu (b) in the village of Bardaley, Dollo Ado

Agriculture

The increase in land under farming from 0.2% to 3.2% within the region could be attributed to increase in population, and adoption of alternative livelihoods especially agropastoralism. This was reported extensively during the FGD's within the Mandera triangle.

In Mandera, there are five major irrigation schemes located at BP1, Kalemo, Harele, Rhamu Dimtu and Shantole. There are an approximately 287 registered group farms with the Ministry of Agriculture within the five irrigation schemes though the community reported approximately 380 group farms. The governance of this irrigation schemes is under the Ministry of Agriculture (MoA). Irrigation sites that are located away from the river (e.g. Fino, Lafey, Dabasiti and Elele in Mandera East)tend to rely on boreholes for their water supply. This requires collaboration between MoA and NEMA in licensing for the construction of boreholes at the irrigation sites.

However, for the irrigation sites visited, the shallow wells used were not functional in areas such as in Neboi, Yabicho and Derkale. Most of the irrigation farming used pumped water from River Daawa into the canals. Farmers make contributions of USD 7.5 (Ksh 750) to maintain the pumps on a monthly basis. However, the community reported they experience severe challenges of farming during the dry season as the river dries very quickly.

The county government support in Mandera, Kenya, has been lacking since 2014. While it has been reported that they supported the distribution of 10 piston pumpset to the irrigation schemes, this offers a very minimal investment to support agriculture interventions. According to the county director for the irrigation department, the current county response plans do not include any interventions to address damage incurred from recent flooding. This is contrary to its neighboring region across the border as the Ethiopian government supports farmers based in Dolo Ado through specialised training programs for farmers, provision of water pumps and other equipment.

In Somalia, other partners such as IGAD have trained farmers in 2016 and included three MoA staff at the farmers field school[13]. Additionally, in Kenya, IGAD working closely with ACTED and MoA have an ongoing project whereby USD 120,000 (Kenya shillings 12 Million) will be utilised to construct raised concrete canals for irrigation in 6 communities within Mandera County. Most of the canal systems have been destroyed by the recent floods, for example, in Shantole, Yabicho A & B, and Neboi. In addition to river flooding, BP1 has recently experienced floods due to the deep trench dug by the military along the erected fence between Somali and Kenya. This may become an additional recurrent problem in addition to the seasonal flooding caused by downstream water flows from the River Daawa.

Also, worth noting is that other villages such Ashabito and Shirshir in Mandera are dependent on rain fed agriculture. They do not practice irrigated farming and the available water from the earth pans and boreholes is largely used for domestic and livestock use. There is some limited potential for some irrigated agriculture using the available surface water catchments.

in Dollo Ado, all the villages along the R. Daawa and the R. Ganale practice irrigated farming. This has however been derailed following recent heavy flooding which has

[13] IGAD school for SITVS in Hargeisa, Somalia

rendered farmlands inaccessible and also damaged critical irrigation infrastructure such as canals and pumping equipment.

Crop Market Trade Routes

Crops grown in Dollo Ado include tomatoes, bananas, pawpaw, mangoes, watermelons, maize, onions and sesame. Markets in Dolo Ado are well organised via a cooperative that supports trade of farm products in Mandera and Dolow in Somalia, though the infrastructure for farmers' market is poor in this location.

Crops grown in Mandera include maize, beans, bananas, mangoes, onions, pawpaw, pepper, watermelon, sesame, tomatoes and fodder. The major markets for crops in Mandera include Mandera and Rhamu town centers. The communities along the River Daawa also sell their produce in Ethiopia and Bula Hawa, Somalia.

The key farming areas and the crop market routes for farm produce are shown in **Figure 11** below:

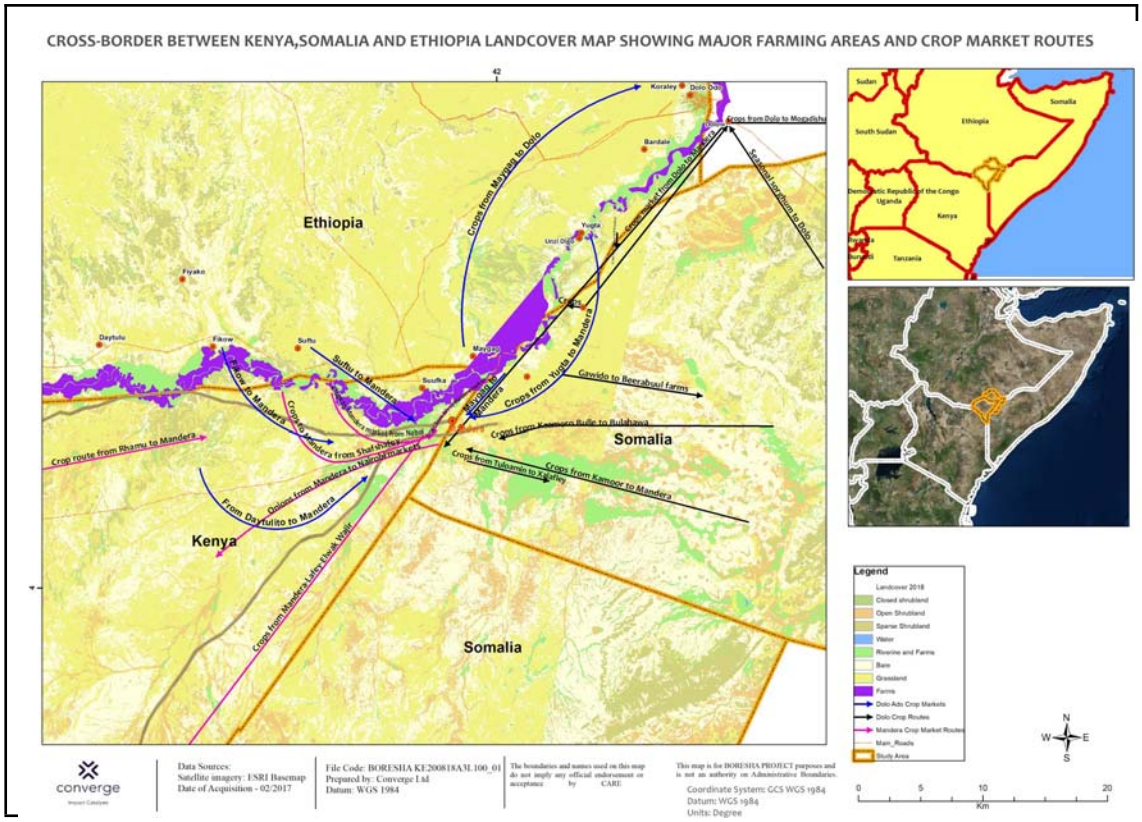

Figure 11Map showing major farming areas and crop market routes

2.4 Human and Livestock Mobility

To a large extent, the cross-border Area of Kenya, Somalia and Ethiopia has an uncontrolled population and livestock movement due to the social (i.e the nomadic nature of pastoralists) and economic activities practised by the population within the region. Over the last two decades, there has been an increase in population, political tensions and terrorism, inter-clan clashes, exacerbated climate change shocks and collapse of grazing corridors for the wet and dry season that has hampered both population and livestock movement.

Drivers of Human and Livestock Mobility

This study found that livestock mobility is seasonal in nature and is influenced by availability of pasture and water for livestock. These findings are similar to those of other studies conducted in Northern Kenya and Southern Ethiopia which found that migration of pastoralist communities in these areas is largely tied to access to natural resources such as water and pasture for grazing (Wamugi & Muchemi, 2011). Consequently, Human and livestock mobility are dependent on the grazing pattern seasons between the dry and wet seasons. In addition, other factors include trade and conflict are elements that also influence the mobility patterns of the population. These human and livestock movements are shown in **Figure 12** below:

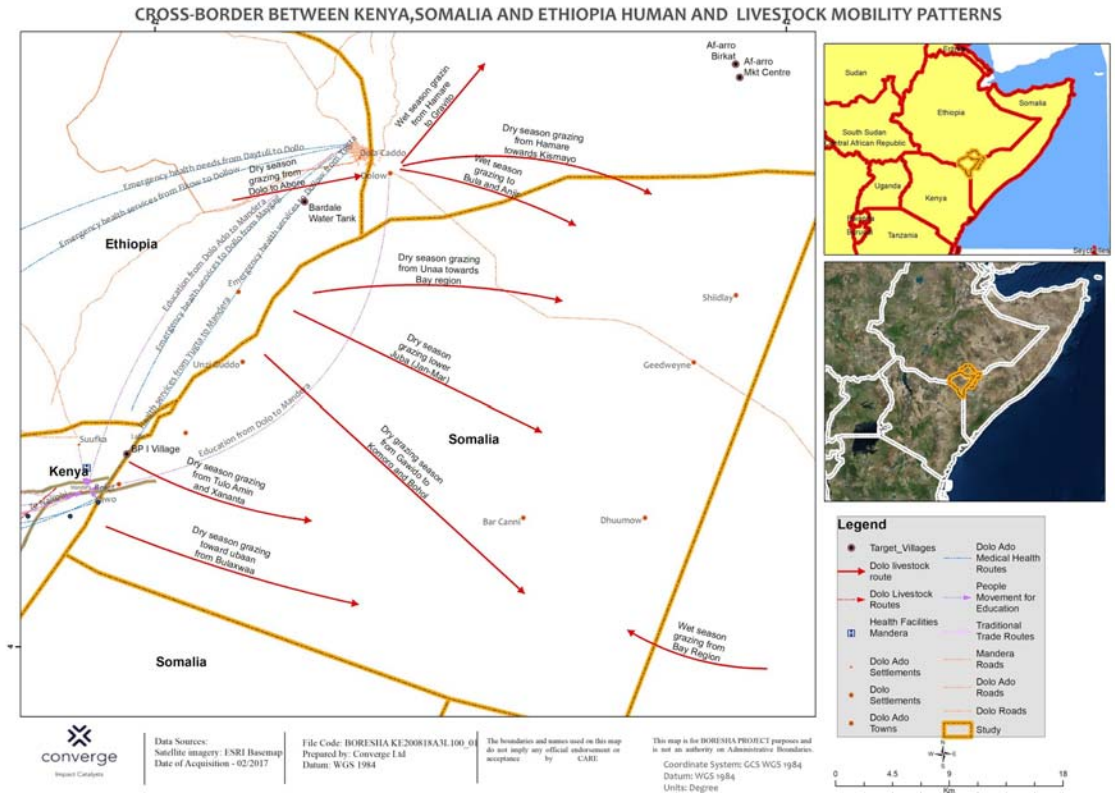

Figure 12 Human and livestock mobility patterns in Doolow, Somalia

LIVESTOCK MOBILITY PATTERNS

Livestock movement has significantly shifted in some areas in Mandera. Before 2016, livestock from Kenya would be moved into Somalia to access pasture at Weyel, Odha, Farda Jillow and Unsi. The construction of the security fence along the Kenya/Somalia border has restricted movement by Kenyan pastoralists to these locations. Currently, the livestock move towards Rhamu and Qalalio in search of pasture. During the long dry season, livestock are moved to 'Jilal – Oraled'. There is in-migration from the south to pastures referred to as '"badia"' with pastoralists coming to access the pasture around the R. Daawa. These livestock movements are shown in **Fig 13** for the dry season and Figure **14** for the wet season respectively as shown below:

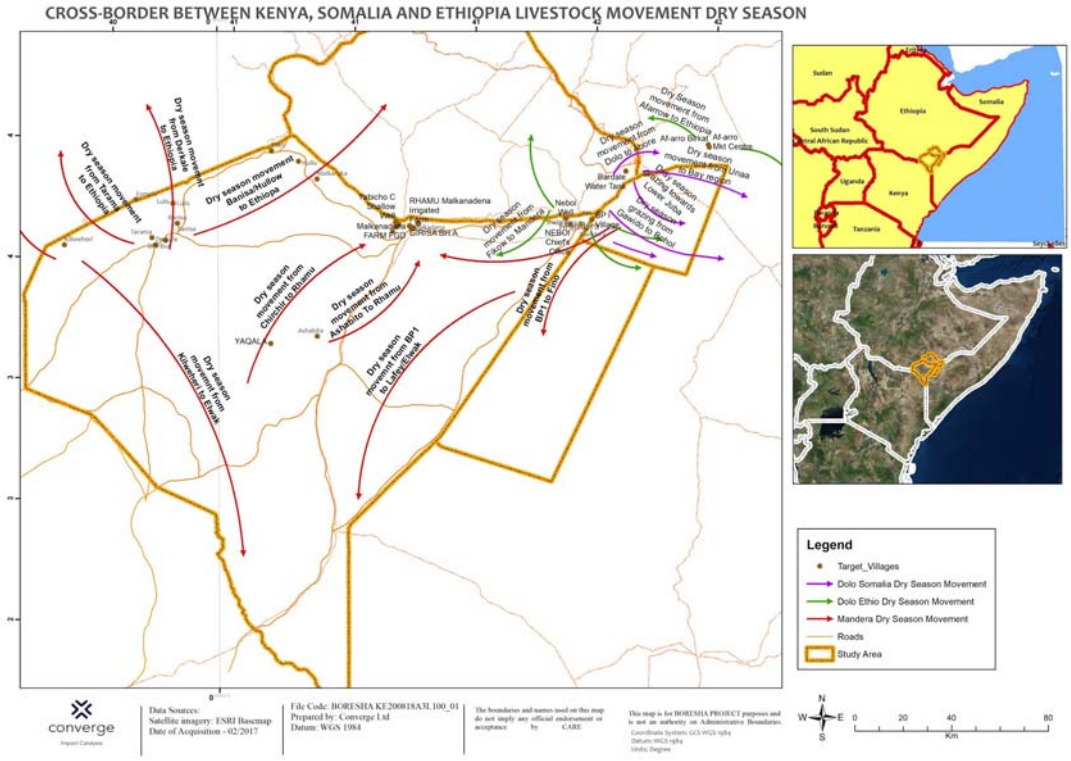

Figure 13 Dry season livestock mobility patterns for communities within the cross-border region

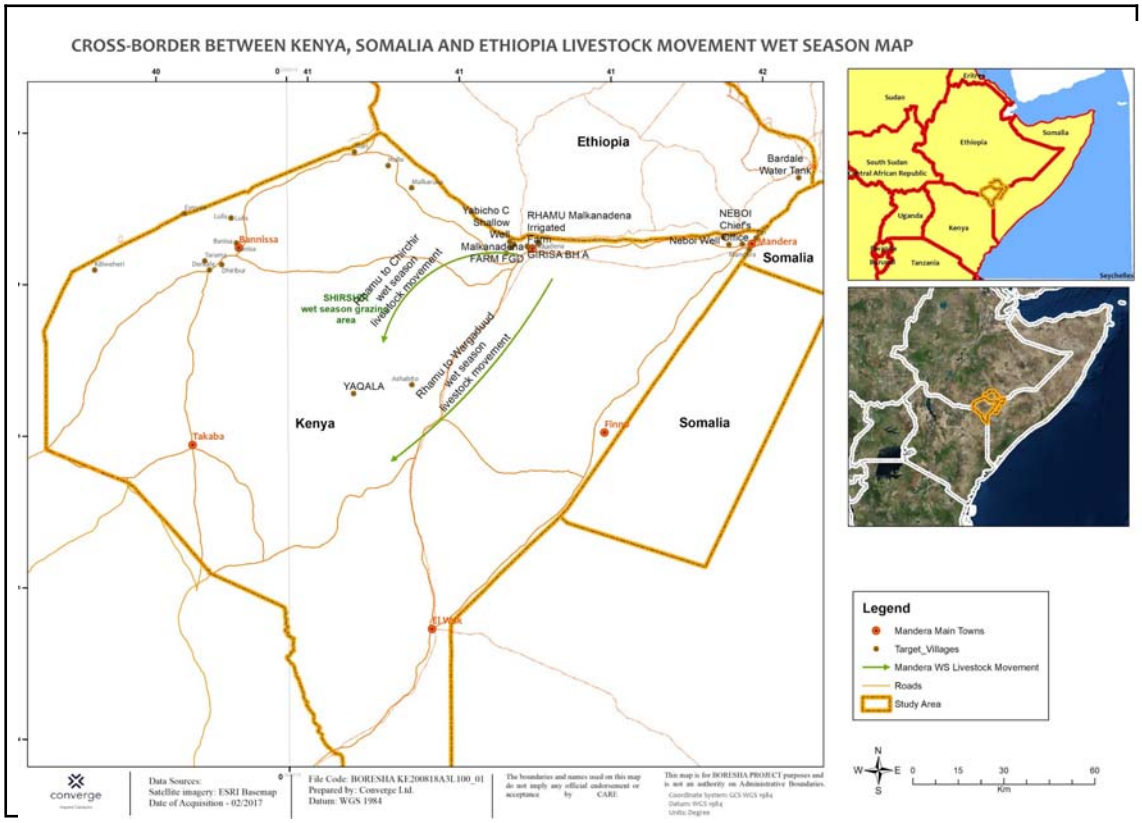

Figure 14 Wet season livestock mobility patterns for communities within the cross-border region.

HUMAN MOBILITY PATTERNS

Factors that contribute to population movement in cross-border Area of Kenya, Somalia and Ethiopia include education, trade, medical care and employment opportunities. A lot of the inhabitants from Doolow and Dollo Ado move to Kenya in access for these opportunities. It should be noted that human mobility patterns are different from livestock mobility patterns, mainly determined by movements to health and school infrastructure. The human mobility patterns are shown in Figure 15 below:

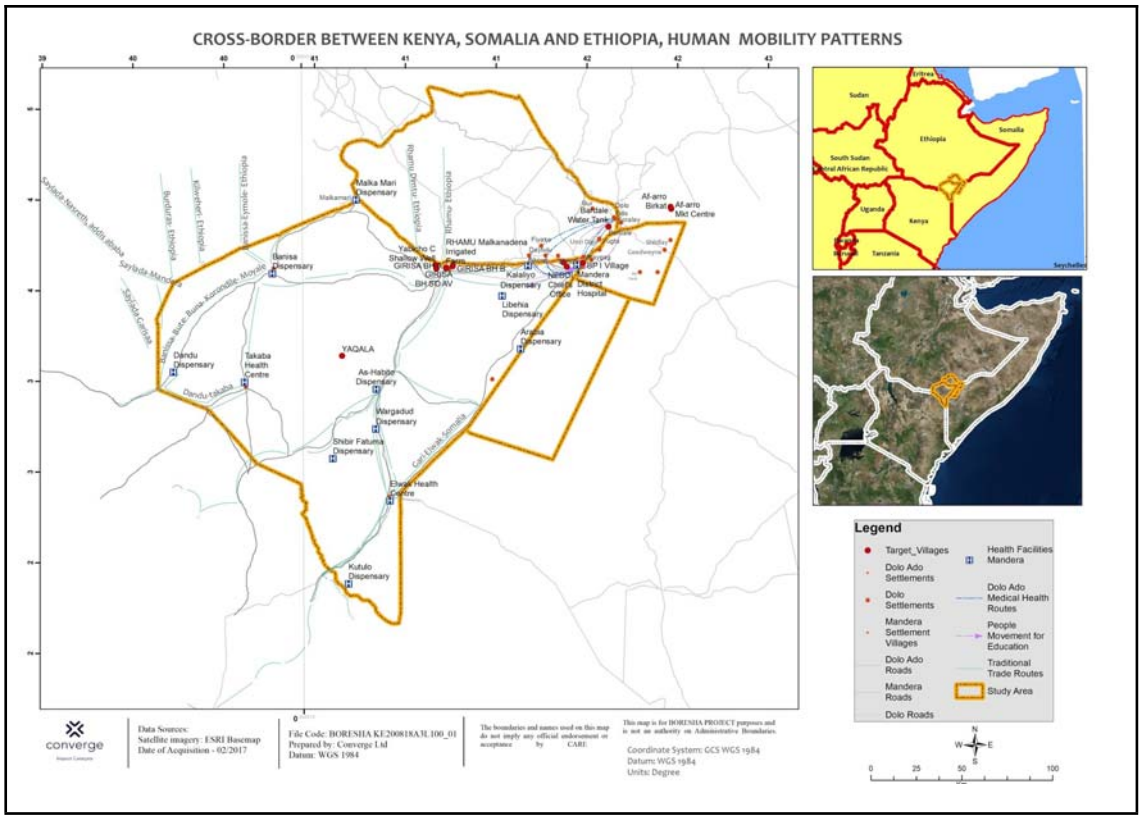

Figure 15 Map showing patterns of human mobility for communities living within the cross-border area between Kenya, Somalia and Ethiopia.

2.5 Livelihoods, Commerce and Markets

Cross-border area between Kenya, Somalia and Ethiopia is a dynamic trade zone supporting thousands of people thus the high population movement within the region.

Livelihoods Analysis of Mandera Triangle

The major source of livelihood for communities is livestock rearing through a nomadic and semi-nomadic way of living. There are designated pastures for both the dry and wet seasons. Pasture availability is a key determinants of livelihood vulnerability. Communities are also heavily dependent on the availability of access to water for livestock. Riverine communities' practice agro pastoral way of life rearing both livestock and carrying out farming along the river banks. irrigated farming is carried out along the banks of the Daawa River (Mandera, Doolow, Dollo Ado) and Ganale River (Dollo Ado). Another related livelihood activity is bee keeping done by communities living in the riverine forests.

Other forms of livelihoods include salaried work in various sectors (for government and NGO workers), trading in both manufactured and farm produce, and transportation.

Cross-border Trade and Commerce

Livestock are also transported across the border to markets in Bula Xaawa, Somalia from Kenya and from Banisa to Ethiopia via Madurass and Kadalduma. Some of the trade routes previously used by the communities in Kenya to access Somalia have been closed off by the

recent construction of a border fence. This has affected trade across the border though the communities also cited there has been improved security and more local business have thrived in Kenya since then.

Existing Market Infrastructure

In Kenya, the major markets are located in Mandera, Elwak, Rhamu, Banisa and Takaba. In Ethiopia, Dollo Ado host one major market, and Belet Xaawa the main market in Doloow Somalia. There has been investment in market infrastructure by governments and development agencies however this has not translated into increased cross-border trade since adoption of most of these facilities is quite low (COMESA, 2009). This would imply that communities are more comfortable conducting their trade under the traditional informal systems.

Markets for Livestock and Livestock Products

Key livestock markets are located at Mandera and Dollo Ado. Mandera and Elwak both have slaughterhouses and the other markets slaughter slabs. In Mandera, livestock products are sold in Banisa, Rhamu and Mandera including other counties such as Wajir and Nairobi. However, in 2016 they were not able to sell any products outside their county as they experienced heavy losses during the drought period.

Livestock from Gedo are transported to markets in the Bay region, Bokol, Mogadishu and lower Juba (specifically, Kismayo). In addition, traditional cross-border livestock markets have existed from local markets in Doolow to Mandera and Garissa in Kenya. A significant proportion of livestock exports serves the Middle East market. Studies have shown that approximately 50 - 60 percent of the livestock exported from Somalia to the Middle East is informally sourced from the Ethiopian market (Little, 2005). More recent market assessments show that at least 75 percent of the cattle sold at the Garissa markets were sourced from Bay, Gedo and Juba Valley regions of Somalia(Farmer & Mbwika, 2012).

In Ethiopia, key livestock markets are Dollo Bay and Dollo Ado towns. In addition, small-scale livestock trading occurs within the villages.

Markets for Agricultural Products

Most of the agricultural produce grown by communities within the triangle is supplied to local markets such as Rhamu and Mandera for Kenya, Dollo Ado and Suftu for Dollo Ado and Doolow and Belet Xaawa for Somalia. There is a high level of cross-border trade in commodities such as grains (e.g. beans, maize) and a significant portion of this trade occurs using irregular border crossings.

There is a huge market for livestock fodder. Crops grown for fodder include maize stover, cowpeas, sorghum stover, weep bundles (a type of weed), sweet potato vines and a variety of grass species (Sudan, Boma Rhodes, Columbus, Napier). In addition there has been a recent introduction of velvet beans, leucaenia, and Lucerne grass. Market for fodder is mainly concentrated the urban centers such as Dollow, Rhamu and Mandera.

Crop market supply routes for the three countries are shown in **Figure 16** below:

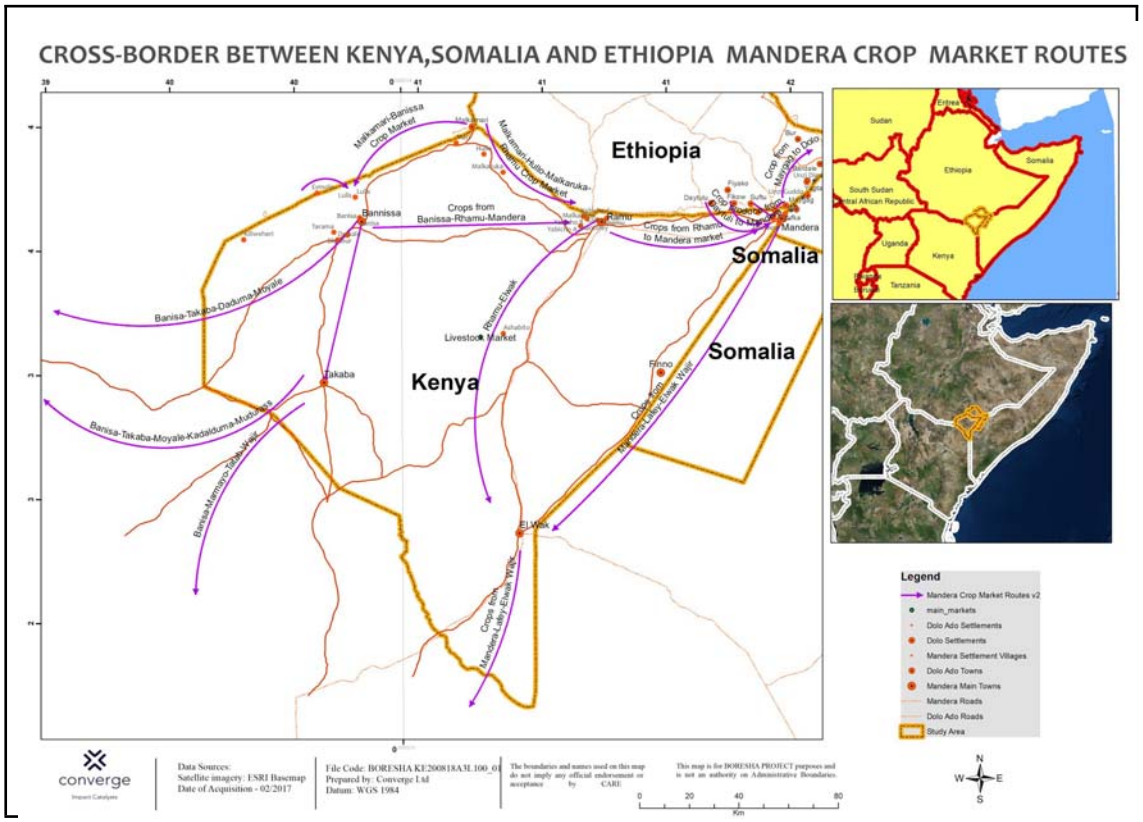

Figure 16 Map showing location of markets and crop market supply routes for agricultural products in the Mandera Triangle. Major cross-border commerce routes are highlighted.

Cross-border trade in agricultural produce between Dollo Ado and Doolow is more pronounced due to the ease of access created by the Daawa River bridge crossing along the border. The crop market routes for the two countries are shown in **Figure 17** below:

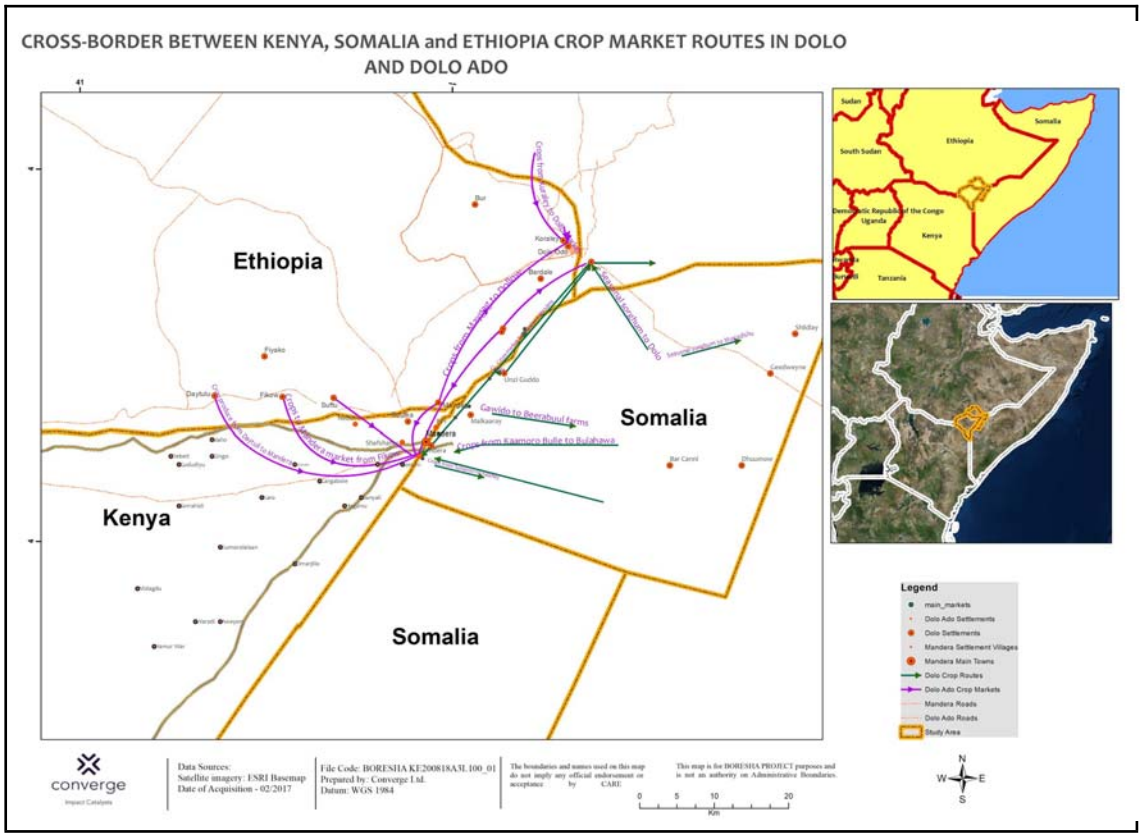

Figure 17 Map showing location of markets and trade routes for agricultural products in Doolow and Dollo Ado. Major cross-border commerce routes are highlighted.

2.6 CONFLICT

Conflict in the pastoralist land of the Horn of Africa has been attributed to the customary raiding for cattle and competition over natural resources such as pasture and watering-points (Amutabi, 2010), the proliferation of small arms (Haji, 2014; Wepundi, Ndung'u, & Rynn, 2011).

DRIVERS OF CONFLICT

Despite the strong relationships that Somalis have along the Mandera triangle, there are known limits as to how far each clan can migrate to during conflict (Muchemi G & Wamugi K. 2011). During severe droughts as experienced in 2016/17 within the region, affected communities move into areas that are not traditionally occupied by their clans. The Degodea clan that resides in West of Mandera move towards Lafey constituency at the Gafa and Damadag grasslands occupied by the Murule clan which has been identified as a hotspot for conflict.

A new perspective of conflict has arisen due to increased disease prevalence caused by mobility of livestock from other regions such as Elwak and Lafey towards Ashabito at the Yaqala water pan that pastoralists use during the dry season. In April 2018, there was a smallpox (furuq) outbreak which the community reported was transmitted by livestock that had migrated from Mongoblo, Farade, Shandar Mod and Gofa in Lafey constituency causing a major conflict between the pastoralists.

In addition, there are mushrooming settlements in[14] Mandera from IDPs and other community members who have lost their livestock (pastoral dropouts) especially in the peri-urban centers. These members have been settled in the communal lands that has also caused conflict. This has further been exacerbated by the increased individual land-ownership, that once was regarded as communal land by individuals.

During the dry season, increased tensions between the herders and farmers along the River Daawa has been experienced as they share the same source of water. The farmers are most affected as the animals eat or trample on their cultivated crops and they also destroy the semi-permanent canals constructed by the farmers.

In Kenya, conflict in some parts of Mandera are associated with local politics often instigated by the local leaders. The most intense conflict was last experienced in 2013 which was later resolved by the community elders. The complex attacks and counterattacks between the clans especially between Garre and Degodia has been majorly influenced by the recent interest in politics by Degodia clan which has been mainly dominated by Garre clan.

Cross-Border NRM and Conflict

In the cross-border area between Kenya, Somalia and Ethiopia any conflict related to cross-border NRM, needs to be viewed in the broader context of the political instability in both Somalia and the Ethiopian Ogaden. The various factors that contribute to broader insecurity need to be considered. In Somalia, these would include the segmented nature of the Somali social fabric, constituencies that benefit from armed conflict and ill-informed donor assistance and foreign policy agendas (Hagmann, 2016.) Whereas in the Somali Region of Ethiopia this would include the long continued marginalization of the region (Hagmann, 2014; Lister, 2004).

Communities in Mandera indicated there was conflict between the Degodia and Garre clan around Rhamu, along River Daawa, especially during the dry season. This is the similar to Fino area where inter-clan conflicts are experienced. Other potential conflict zones include Wargadud during the dry season between pastoralists from Mandera East and Lafey. Also a key threat in this area is the presence of Al-Shabaab as reported by the community especially around Elwak region, Finno and sometimes they move inwards towards Wargadud area. Communities in Dollo Bay indicated that there's are potential conflict zones towards the border with Somalia (and within Ethiopia towards Barrey.

In addition, Belet Xaawo and Doolow in Somalia were known to be potential conflict zones for a long time. Administration of these towns would change hands between Militia groups and the Federal Government of Somalia. Whereas this has now changed and the situation has been stable for some time, there are movement curfews in place and the border between Kenya/Somalia remains closed since 2011.

Potential conflict zones and the population movement triggered by conflict within the cross-border area between Kenya, Somalia and Ethiopia are represented in the map shown in Figure 18 below:

[14] Mandera County Note, 2016. Voices of the People: Challenges to Peace in Mandera County. INTERPEACE. https://www.interpeace.org/wp-content/uploads/2017/07/2017-ECA-Kenia-Mandera-County-Note.pdf

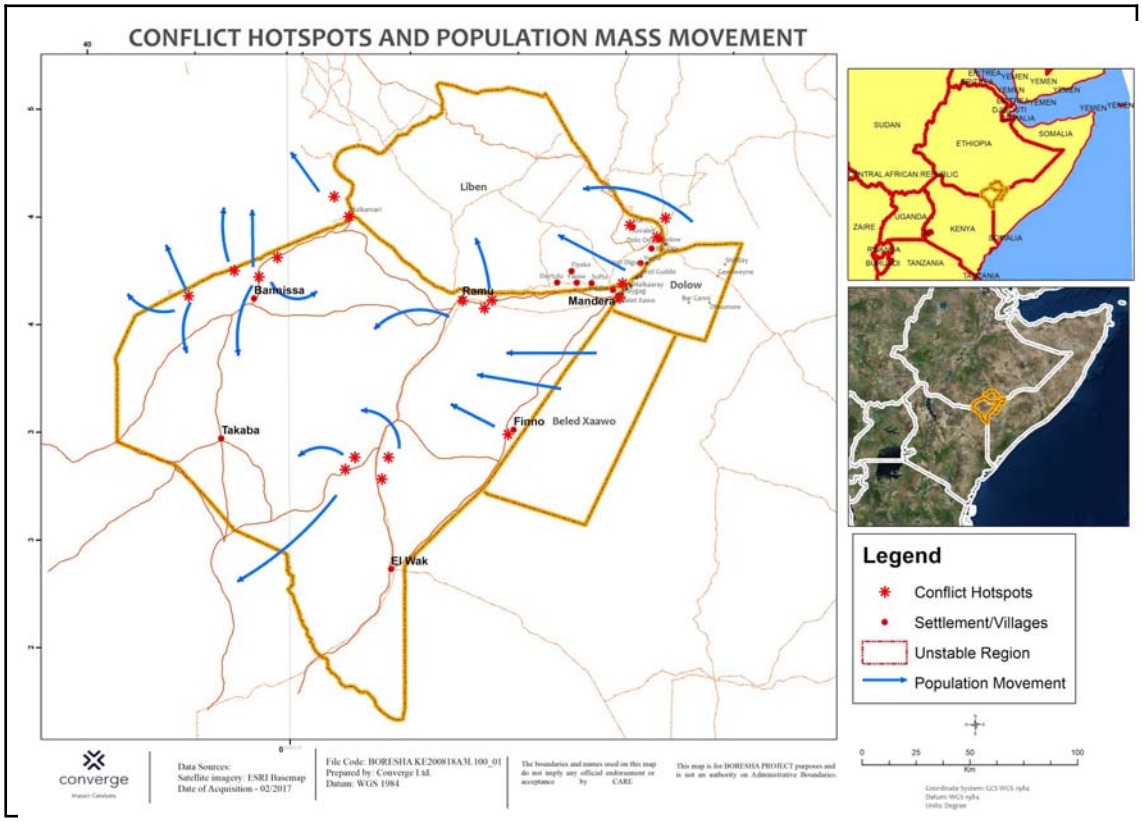

Figure 18 Conflict hotspots and indications of routes taken by populations during conflict

CONFLICT MITIGATION MECHANISMS

Several mechanisms for the mitigation of conflict have been documented for communities in the Mandera triangle including disarmament (Wepundi, Ndung'u, & Rynn, 2011), use of inter-clan peace initiatives (Haji, 2014). Studies carried out among pastoralist communities in Northern Kenya have shown that involving communities in natural resource management can mitigate resource conflicts and promote positive economic and ecological change (Haro, Doyo, & McPeak, 2005).

During discussions with the communities in the three countries, they mentioned the existence of traditional conflict mitigation systems through the councils of elders. The elders work closely with the decentralized government to resolve conflicts at the community level.

2.7 GENDER AND SOCIAL INCLUSION

Gender equality has multiple implications in the economic, social and cultural spheres (EASSI 2012). The social relations between clans and ethnic groups play a critical role on how resources are shared due to pastoralists mobility from one area to another in search of pasture and water.

Gender Dimensions of Cross-border NRM

The gender dimensions in the cross border boundaries are dynamic due to the evolving influences such as education, climate change and politics that have transpired livelihood transformation within the pastoralist communities.

Ownership of assets such as land, livestock and small businesses is majorly by men due to the patriarchal culture of the pastoral community. Few women own assets and majority of ownership of assets for the women was associated with their husbands, brothers or fathers. A few women in Yabicho, Mandera East were allowed to sell assets without consultation of the husbands though areas of trade were restricted to Rhamu town which was within their vicinity.

There are several dimensions in which land is managed by both men and women based on their gender roles and cultural norms. Both women and men cultivate land, though women utilise their produce for household consumption. Effects such as drought and flooding increases the vulnerability of women and children as they are heavily dependent on agricultural produce as their main source of livelihood.

Women in the cross border region of Mandera triangle are mostly small-scale business women for agricultural and livestock products. The gender roles in pastoral society are often biased, hindering women's access to resources and extension services and their participation in decision-making (Mbo'o-Tchouawou et al., 2016; UNECA 2011). Thus due to limited access to information, credit facilities and no governing systems to support cross border trade in Mandera triangle, they are not able to access the various trade opportunities that mostly target large scale business which are mostly run by men.

Kenya and Ethiopia have decentralised the government systems to increase access to development initiatives and resources. In Kenya, the transition has had challenges in several counties including Mandera, which has destabilized the social organisations once supported by the national government. The women in BP1 in Mandera reported that they were provided with training on business skills and farming and also received small grants to start businesses and buy seeds for their farms. These groups were disbanded after the County Government system was established. Consequently, due to the recent extreme drought followed by floods early in the year, their small businesses have collapsed and are heavily dependent on the food rations they receive for the national government.

Social Inclusion and Marginalized Populations

The issues affecting socially excluded communities in this geographic region for this study were based on identity, that is, unemployed youth, displaced persons, marginalized women, clannism and ethnic minorities. There was a general perception that the poor people felt alienated for any development opportunities which were only accessible to the well to do in the community.

In the three countries the Somali bantu farming communities (Neboi, Bardale, Doolow) emerge as having lower access to opportunities including investments by government entities. Discussions with the communities revealed that they are not consulted during planning of interventions since they do not fall within any of the majority clans. Planning tends to focus most of its efforts on pastoral livelihood activities for the pastoral communities alienating the agro-pastoralist and the increasing pastoral dropouts affected by either

drought or conflict that have migrated into the peri-urban centers. This could also be attributed to the under appreciation of the wider clan based identity and social networks that would determine their vulnerability and resilience (Maxwell et al., 2016)

A significant number of youths were unemployed and do not practice pastoralism. There is heavy reliance for white collar jobs among the youth though majority of them have not received tertiary education and also lack vocational skills (Interpeace, 2016). This poses a risk element of the youth being coerced to join extremist factions such as Al Shabab to able to support their families.

SECTION 3 PROMOTING CROSS-BORDER NRM AND RESILIENCE

3.1 EXISTING INSTITUTIONAL MECHANISMS AND INTERVENTIONS

Water resources: due to the prevalence of transboundary water resources in the Horn of Africa region, IGAD started developing a water policy and legal framework in 2012 with limited success for most basins apart from the Nile Basin (Nanni, 2016). The need for collaboration in management of the Daawa river catchment area is recognised by national legislation in some of the riparian states for instance, Kenya (Ministry of Environment and Mineral Resources, 2012)

Trade: significant volumes of irregular trade are documented across the three countries. at the moment however, a clear regulatory gap exists in terms of cross-border trade. Of the three countries Kenya has the most developed market economy followed by Ethiopia and Somalia. However formal trade cooperation is lacking. This needs to be addressed to attract increase potential investments by communities along the border, create a revenue stream for the three government and attract potential investment.

Rangeland resources: Policies exist is both Kenya and Ethiopia for management of rangeland resources, but less so for Somalia. These policies are mostly restricted to national boundaries. Cross-border rangeland management has been elusive despite concerted effort under IGAD to promote transnational policy. at the moment informal relationships between governments are more prevalent when it comes to issues affecting rangelands. this needs to be addressed so that the cross-border rangeland economy can be brought into the mainstream, regulated and supported.

Climate Change: Whereas both Kenya and Ethiopia have well-articulated policy to address climate change issues concerns there is a clear gap on implementation and little or no emphasis on the cross-boundary effects of climate change. The shift towards a cross border approach to planning is an opportunity to ensure climate change issues are addressed in a manner that captures the needs of the communities living in the border areas of the three countries.

3.2 GAPS AND OPPORTUNITIES FOR CROSS-BORDER NRM

The lack of a legal cross-border institutional framework through which access to pastoral and agro-pastoral common property can be negotiated, settled and sustained has been documented for the Somali Region of Ethiopia (Beyene, 2009), Mandera in Kenya and more obviously for Gedo Region of Somalia.

To address, cross-border NRM issues, it is necessary to review the root causes of emerging issues such as conflict over resources, resource degradation and depletion. The study findings indicate that this will be hinged significantly on livelihoods enhancement activities and supporting socio-political-economic infrastructure. In this regard, emerging gaps and opportunities may be classified under key sector-specific intervention areas that are elaborated in **Table 11** below:

Table 11 Analysis of gaps and opportunities for enhancing cross-border NRM under BORESHA

Pastoralist Livelihoods	Agro-pastoralist Livelihoods	Development of Markets	Youth empowerment
Shrinking rangelands and increasingly restricted movements across borders call for (a) an innovative range management regime that incorporates involvement of governments and cross-border communities, (b) increased capacity to cultivate and store fodder for livestock as a compliment to mobile pastoral activity, (c) addressing cross-border disease surveillance and management, (d) invest in rehabilitation of water supply infrastructure	Increasing adoption of agro pastoralist livelihoods presents an opportunity to (a)develop institutional capacity to support irrigated farming, (b) provide knowledge to farmers on improved farming practices especially adoption of irrigation techniques that conserve water, (c) invest in rehabilitation of irrigation infrastructure, (d) cultivation of high-value horticultural crops and (e) increased capacity for processing and storage of produce	Traditional livestock markets have changed. Formerly lucrative export markets for livestock and meat products e.g. Yemen and Saudi Arabia have shrunk over time and this calls for (a) enhancement of existing local markets, (b) development of new value chains (including value - addition on livestock and agricultural products).	The huge population of youth, both educated and uneducated, will need support to acquire, develop and utilise livelihoods enhancing skills. This will involve: (a) development of technical and entrepreneurial skills, (b) provision of support to access capital and mentorship, (c) necessary investment in tertiary and vocational training infrastructure

In addition, emerging cross-cutting issues relating to gender and social inclusiveness, addressing social-political causes of conflict, investment in essential services (such as health, education, transportation and communication infrastructure) and developing cross-border institutional capacity for collaboration will need to be addressed.

3.3 PROPOSED INTERVENTIONS

Based on the NRM mapping exercise and assessment of various categories of shared resources for communities living in the Mandera triangle, this report will provide indicative opportunities for intervention to promote resilience of communities across the four key areas identified above: pastoralist livelihoods, agro-pastoralist livelihoods, development of markets and youth employment. These are shown specific to the BORESHA target communities for each of the countries as indicated in **Table 12** below:

Table 12 Proposed interventions for enhancing cross-border NRM for communities in the Mandera Triangle under BORESHA

Intervention Area	Pastoralist Livelihoods	Agro-pastoralist Livelihoods	Development of Markets	Youth empowerment
Across the 3 countries	(a) promote cross-border range management; (b) develop cross-border disease surveillance and management	(a) develop capacity for processing and storage of horticultural produce, (b) invest in flood control & mitigation	develop new value chains for livestock and horticultural products	(a)investment in cross-border tertiary and vocational training; (b) incentivise and stimulate market for capital to youth & women
Mandera	(a)improve fodder cultivation and storage - Rhamu, Yabicho, Malkamari (b)rehabilitate Water supply infrastructure - Yabicho, Shirshir, Ashabito, Hullow, Tesoboru, Derkale	(a)Improve irrigation infrastructure - Yabicho, Neboi, Malkamari; (b)adoption of efficient irrigation technology - Rhamu, Girisa, BP1	develop market access for horticultural produce from BP1, Rhamu,	Invest in technical and vocational training for youth in Rhamu, Mandera, Banisa, Lafey
Dollo Ado	(a)Invest in fodder cultivation storage: Sigalow, Bardale, Fikow (b)rehabilitate Water supply infrastructure - Af-arro, Yugta	(a)Improve Irrigation infrastructure - Bardale, (b)Adoption of efficient irrigation technology - Fikow,	develop market access for (a) livestock and produce - Af-arro, Koraley, (b) horticultural produce - Sigalow, Bardale, Maygag, Daytuli support women market cooperatives - Dollo Ado	invest in technical and vocational training for youth - Dollo Ado
Doolow				Invest in technical and vocational training for Youth - Doolow

SECTION 4 CONCLUSIONS AND IMPLICATIONS FOR BORESHA PROJECT

4.1 POLICY AND INSTITUTIONAL ENVIRONMENT

Cross-border NRM: institutional structures for cross-border NRM related to livestock and irrigated farming are largely informal. These will need to be enhanced and adopted into mainstream working of the three governments.

Gender and Social Inclusion: All efforts should be made to enable women and youth to be part of the formal cross border trading structures. This will require support and recognition by the formal government structures whereby their contribution will be recorded and documented.

The study identified certain vulnerable and marginalised communities such as the Somali bantu. Deliberate effort needs to be made to include them in decision-making and resource allocation processes.

Migration: at the moment migration across the three countries within the Triangle is largely irregular. the level of interdependence of cross-border communities requires that more investment is made in facilitating border crossings including having conveniently situated border control points and possible investment in river infrastructure e.g. Mandera/ Dollo Ado.

Trade and Markets: a common policy on enhancing trade and development of markets for both livestock/ livestock products and horticultural produce is necessary to enhance both pastoral and agro pastoral livelihoods.

Youth empowerment: The high proportion of youth in the Mandera Triangle necessitates that the three countries develop strategies of meeting the aspirations of this constituent. Cross-border policy on Technical Vocational Education and Training (TVET), creating market employment opportunities, and access to capital for youth needs to be agreed upon. an additional dividend of this is that it also acts as a counter-terrorism measure and mitigates conflict.

4.2 COMMUNITY ATTITUDES TO CROSS-BORDER NRM

The study revealed that communities living in the cross-border areas of the Mandera Triangle share common social-cultural backgrounds and livelihoods. These are lived within an environment of shared natural resources. In addition, and most important these communities all have progressive aspirations towards (a) improving their economic situations, (b) enhanced livelihoods and coping capacities, (c) reduced conflict over utilization of shared resources.

This was evident across multiple sectors as evident in (a) the increased adoption of irrigated farming as both complementary and as an alternative to primarily pastoralist lifestyles (b) interest in adoption of coping strategies such as investment in fodder cultivation and storage, (c) establishment of farmers marketing cooperatives, (d) a desire for youth to be engaged in income-generating activities (e) desire for marginalised and vulnerable communities to be included in decision-making and to have access to development opportunities.

Any intervention on cross-border NRM management will need to establish the necessary partnerships (or incentivise existing partnerships) to respond to, and build on the aspirations of these communities.

4.3 Potential Investments towards Resilience

There is a weak organizational base for women groups to participate in trade. Concerted efforts should be placed in including funding in trade focused institutional capacity development.

More research should be conducted to document experiences of women traders at (a) key local markets in Mandera, Rhamu, Dollo Ado and Doolow, and (b) border points with a view to informing future support to enhancing access to capital, linkages to farms and access to markets for local produce.

4.4 Implications for BORESHA

Investment planning: the NRM mapping exercise has clearly identified opportunities for future investment in enhancing livelihoods for pastoralist communities within the Mandera Triangle. The study has also marked out investment priorities that BORESHA could incorporate in current or future programming.

Choice of Interventions: BORESHA will need to emphasize interventions that (a) maximise impact on beneficiary populations in terms of enhancing livelihoods and promoting resilience, (b) address the root causes of conflict related to cross-border sharing of natural resources by promoting understanding amongst communities and cooperation between neighbouring governments.

Targeting: targeting of interventions under BORESHA needs to take into consideration (a) inclusion of marginalized sub-clans and other vulnerable populations who are not currently served by the the dominant Garre-Degodia-Marehan Somali clan socio-politico-economic systems (b) ensuring that livelihood and economic enhancement opportunities reach the women, youth, and physically challenged.

Importance of establishing partnerships: it is evident from the NRM mapping study that more need to be done to enhance cross-border working relationships between state and non-state actors. BORESHA is an opportunity to build and enhance such partnerships in line with existing regional agreements (most visibly IGAD). such partnerships will need to be cross-sectoral and cross-border in nature in order to maximise on benefits to target communities and sustainability of interventions.

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Contact Information:
BORESHA Consortium
Danish Refugee Council Regional Office,
East Africa and Great Lakes
Lower Kabete Road (Ngecha Junction)
P.O Box 14762 – 00800
Nairobi, Kenya
Office: +254 709 867 000
Email: Boresha@drckenya.org
Twitter: BORESHA_HoA

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