ECOSYSTEM BASELINE REPORT

ECOSYSTEM BASELINE ASSESSMENT FOR THE "BUILDING RESILIENT COMMUNITIES IN SOMALIA (BRCIS) III" PROGRAMME

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I. EXECUTIVE SUMMARY

Building Resilient Communities in Somalia (BRCiS) is a consortium of seven national and international organisations operating in Somalia including Action Against Hunger (ACF), Concern Worldwide (Concern), Gargaar Relief Development Organization (GREDO), the International Rescue Committee (IRC), KAALO Aid and Development (KAALO), the Norwegian Refugee Council (NRC) and Save the Children International (SCI).

The BRCiS III programme, funded by the Foreign, Commonwealth and Development Office (FCDO), aims to increase the resilience of Somali communities to climate change-induced shocks and stressors. Climate change intensifies droughts and floods while reducing the capacity of ecosystems to absorb such shocks. The underpinning assumption of BRCiS III is that by promoting social, economic and ecosystem measures, communities are better able to absorb shocks through enhanced social organisation, increased economic buffers and increased ecosystem productivity and resilience.

This ecosystem baseline assessment aims to provide a comprehensive and quantitative analysis of land health across 37 BRCiS III project areas, delineated based on the shared use of natural resources. Through an extensive ecosystem field data collection campaign, in combination with remote sensing and machine learning approaches, this assessment considers a variety of soil, vegetation, climate and social indicators to assess the ecosystem health from multiple dimensions. The objectives of this report are to:

1. Provide a field-based assessment of the current state of ecosystem health at several BRCiS III project areas in Somalia.
2. Assess ecosystem health at the project area level based on vegetation, soil, climate and soil health indicators.

Note: During the writing of this report, the lab analysis of the collected soil samples was still ongoing. The results of the soil analysis will be incorporated in the subsequent version of this report.

Key findings from the data collection at the LDSF sites (n = 845) include:

- **79% of the sampled plots in Somalia were severely eroded.** Except for the sampling locations at *Belethawa* and *Jowhar*, erosion was extremely prevalent throughout the sites surveyed. At the locations of *Baydhabo (Baydhaba)*, *Dhardhar (Galkayo)*, *Gacmafale (Galkayo)*, *Guriel (Dhuusamareeb)* and *Yeed (Rabdhure)*, severe erosion was observed at almost all sampling locations.
- **About one-third of the sampled plots (33%) had a woody cover rating between 15-40% while herbaceous cover was much lower with most plots (31%) recorded to have less than 4% cover.** Low herbaceous cover probably partly explained the high erosion prevalence. Without a healthy herbaceous vegetation layer, the soil lays bare and is more prone to erosion.
- **Average tree density was 10 trees ha^{-1}. Shrubs were more prevalent with an average density of 48 shrubs ha^{-1}.** Trees were relatively scarce in the sampled landscapes, partly due to the arid environment. The climate lends itself better to smaller shrubs which require fewer resources.
- **Median hydraulic conductivity (soil infiltration capacity) was low across the sampled plots: 34 mm h^{-1}**. This indicates that, across the sampling locations in Somalia, the soil was able to absorb up

to 34 mm per hour. When rainfall exceeds these levels, runoff is likely to occur which can lead to increased erosion. Particularly in *Yeed (Rabdhure), Jowhar (Jowhar), Kismayo (Kismayo),* and *Dhardhar (Galkayo)*, the infiltration capacity was low with median Kfs values below 50 mm h^{-1}. In *Gacmafale (Galkayo)* and *Guriel (Dhuusamareeb)* median Kfs was well above 100 mm h^{-1}. Hence, the soil in *Yeed, Jowhar, Kismaayo,* and *Dhardhar* sites is less able to absorb weather-related shocks such as heavy rainfall than *Gacmafale* and *Guriel.*

- **The collected data indicated lower erosion prevalence when grazing management practises were implemented compared to when not implemented.** While this effect has been established in other Eastern African countries, the data suggested that grazing management can reduce erosion in the Somalia context. Further studies would be important to better understand the interactions between management interventions such as grazing management on land degradation processes and recovery.

Key findings at the BRCiS III programme areas include:

- **Overall, soil and vegetation indicators showed high levels of degradation across the project areas indicated by low median soil organic carbon contents (5.2 g/kg), low average tree and grass cover (13% and 15%) and a high average erosion prevalence (67%).** In other words, ecosystem health is a challenge across the project areas. SOC contents vary from ~3 g/kg in northern Somalia to ~12 g/kg at the higher altitude central parts of the country. Average erosion prevalence exceeded 50% in most project areas which is considered high relative to median erosion in East Africa (~50%) (Vagen and Winowiecki, 2019). Only four project areas had a median erosion prevalence below 50%. Vegetation cover was generally low which is expected given the arid environment and high erosion rates. Particularly, herbaceous cover was sparse compared to reference areas in northern Kenya (Figure 29).

- **Alkaline soils (pH > 7.5) occurred relatively frequently while acidic soils (pH < 5.5) were rare across the project areas.** Seven project areas had median pH values above 7.5 and are considered alkaline. Vegetation growth in these areas can be difficult due to a reduced availability of nutrients.

- **Medium-term trends in the Enhanced Vegetation Index (EVI) showed considerable loss in vegetation cover in the project areas around *Kismaayo*.** The coastal areas around *Kismaayo* have experienced high levels of urbanisation in the last two decades due to internal migration causing the vegetation cover to decline.

- **Annual precipitation at the project areas ranged between 100-300 mm yr^{-1}.** This is regarded as very low and exemplifies a state of general aridity.

- **Access to key ecosystem services declined during dry season and even more in periods of drought and flood.** While there were few access restrictions to key ecosystem services during the wet season. This is to be expected. This indicates a precarious situation for many communities as a single dry or adverse year can have considerable impacts on ecosystem service accessibility

- **Goat, sheep and camel migration numbers were higher in the arid, relatively northern, regions of Somalia (e.g. Jariiban, Galkayo) compared to the more central and southern parts.** Average community livestock migration numbers showed a preference of more drought-tolerant livestock in the arid north while cattle migration numbers were higher in higher altitudes and more vegetated areas.

Integrated ecosystem health in the project areas:

- **BRCiS III project areas were classified into three degradation levels based on soil, vegetation and climate characteristics.** We developed predictive models based on LDSF field data and remote sensing to generate maps for soil organic carbon (SOC), erosion prevalence, tree cover, and grassland for the 37 BRCiS III project areas. Rainfall was assessed using Global Precipitation Measurement (GPM) satellite data. Based on these data, the project areas were clustered into three degradation levels (Figure 1). Our analysis shows moderate levels of degradation in the central part of Somalia (e.g. *"Baidoa: GREDO_6"*) while the northern regions showed high levels of degradation (e.g. *"Galkacyo: IRC_3"*). It is acknowledged that some of the observed degradation across the project areas represents a state of natural aridity while some represent a state of actual degradation. While it is difficult to untangle these two processes, through understanding the natural state of the ecosystem or the degraded state, we can formulate potential restoration pathways as done in section V.

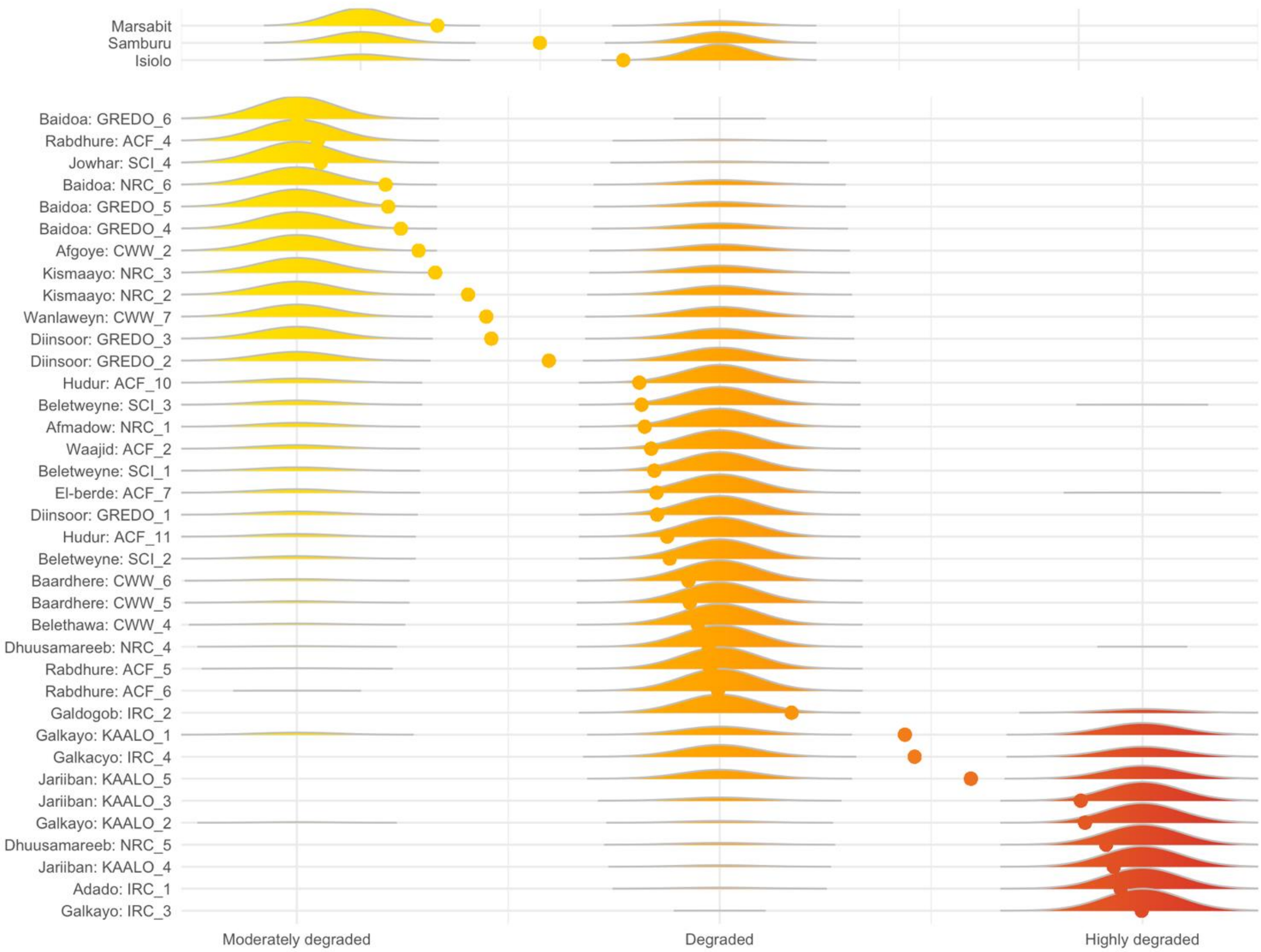


FIGURE 1: OCCURANCE OF THE THREE DEGRADATION GROUPS AT EACH PROJECT AREA. THE DOTS INDICATE THE AVERAGE DEGRADATION LEVEL PER PROJECT AREA (YELLOW = MODERATELY DEGRADED, ORANGE = DEGRADED, RED = HIGHLY DEGRADED).

II. PROJECT BACKGROUND

Building Resilient Communities in Somalia (BRCiS) is a consortium of seven national and international organisations operating in Somalia including Action Against Hunger (ACF), Concern Worldwide (CWW), Gargaar Relief Development Organization (GREDO), the International Rescue Committee (IRC), KAALO, the Norwegian Refugee Council (NRC) and Save the Children International (SCI). Initiated in the aftermath of the 2011 famine in Somalia, BRCiS aims to capacitate vulnerable people at the margins of the Somali society to engage with and influence their institutions, so that their needs are served in a more inclusive and sustainable way.

Against this background, the BRCiS III programme, funded by the Foreign, Commonwealth and Development Office (FCDO), was initiated with the aim to increase the resilience of Somali communities to climate change-induced shocks and stressors. Climate change intensifies droughts and floods while reducing the capacity of ecosystems to absorb such shocks. The underpinning assumption is that by promoting social, economic and ecosystem measures, communities are better able to absorb shocks through enhanced social organisation, increased economic buffers and increased ecosystem productivity and resilience.

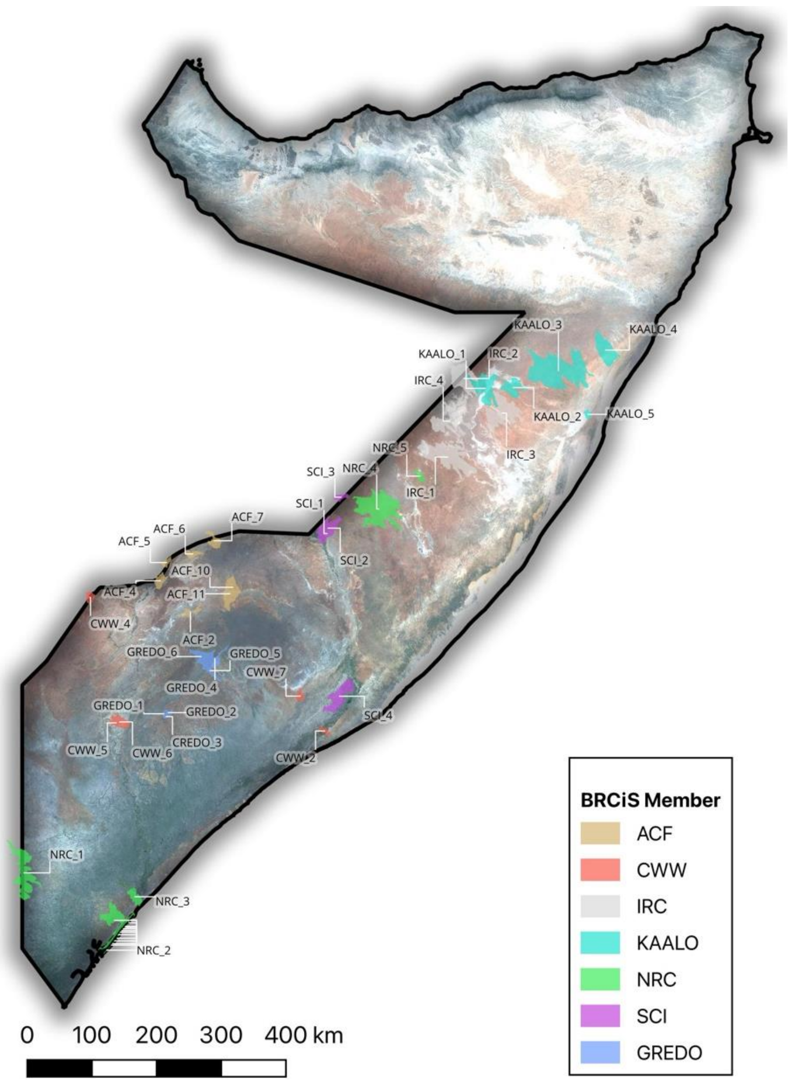


FIGURE 2: MAP SHOWING THE BRCIS III PROJECT AREAS BY PER CONSORTIUM MEMBER. BACKGROUND IS A LANDSAT 8 MEDIAN COMPOSITE IMAGE FOR 2023.

Increased ecosystem resilience can be achieved through restoration. Land restoration aims to restore ecological functions, enhance ecosystem service delivery, and increase resilience to future shocks. Restoration measures can include tree planting, soil and water retention measures, invasive species removal, grazing management practices and more. This assessment provides an ecosystem baseline at the project areas to better understand the current state of the ecosystems and to make informed decisions regarding the restoration approach.

CIFOR-ICRAF and the BRCiS Consortium collaborated on the implementation of the BRCiS III programme under *Activity 2.1.* with support in technical advice and evidence-based recommendations to target interventions based on ecosystem dynamics. An area-based targeting of interventions was utilised (Appendix A). In this way, all residents of participating areas could benefit from project activities. As part of the area-based targeting, 37 project areas were delineated across Somalia based on natural resource dependency and the topographically defined watersheds (Figure 2). By delineating the project areas based on shared natural resource dependency and topographical features, the areas were believed to represent a more homogenous region, which can increase the chances of a positive adoption of the interventions. The project areas were divided amongst the seven BRCiS Members depending on their region of operation. The project regions and districts are detailed in Table 1.

TABLE 1: OVERVIEW OF THE DISTRICTS INCLUDED IN THE PROJECT. *REFERS TO DISTRICTS THAT ARE NEW IN BRCIS III COMPARED TO BRCIS II

Member Organization	Project Location (Region)	Project Location (District)	Project Area Name (Figure 2)
ACF	**Bakool**	Hudur Wajid El Barde *Rabdure**	ACF_10, ACF_11 ACF_2 ACF_7 ACF_4, ACF_5, ACF_6
Concern	**Gedo**	Baadhere Belet Hawa	CWW_5, CWW_6 CWW_4
	Lower Shabelle	Afgoye Wanla weyn	CWW_2 CWW_7
Kaalo	**Mudug**	Jariiban*, Galkacyo	KAALO_3, KAALO_4, KAALO_5 KAALO_1, KAALO_2
IRC	**Mudug**	Galkacyo Galdogob	IRC_3, IRC_4 IRC_2
	Galgaduud	Adado	IRC_1
GREDO	**Bay**	Dinsoor Baidoa	GREDO_1, GREDO_2, GREDO_3 GREDO_4, GREDO_5, GREDO_6
SCI	**Hiran**	Beletywene	SCI_1, SCI_2, SCI_3

	Middle Shabelle	Jawhar*	SCI_4
NRC	**Lower Juba**	Kismayo, Afmadow	NRC_2, NRC_3, NRC 1
	Galgaduud	Dhusamareb	NRC_4, NRC_5
	Bay	Baidoa	NRC_6

The regions cover various agro-ecological and social zones which are described briefly below:

- **Bakool** is located in southwestern Somalia and is predominantly semi-arid, with limited rainfall making it challenging for agricultural production. The semi-arid conditions result in sparse vegetation with soils prone to erosion, further diminishing the region's productivity. Most of the livelihoods in this area are centred around livestock keeping.
- **Gedo**, situated along the Kenya-Somalia border in Southwestern Somalia, is a significant region for cross-border trade, with goods ranging from livestock to imported consumer products passing between Kenya and Somalia. The region has vast pastoral lands, supporting livelihoods primarily based on livestock and small-scale farming. However, the area has been a hotspot for conflicts, particularly along the border zones, due to tensions over resources, inter-clan activity and insurgent group activities with reoccurring security challenges.
- **Lower Shabelle** is in Southern Somalia around the Shabelle River. Hence, it is one of Somalia's most fertile regions; it plays a vital role in the nation's agricultural economy. However, its productivity has also made it a contested zone, with various actors competing for control over its resources.
- **Mudug** is strategically located in north-central Somalia. Galkacyo, divided into North and South, has been a focal point for internal displacement due to recurrent droughts and conflicts. Successive droughts have led to competition between pastoralist communities over scarce natural resources such as water and pasture. The division of the town reflects historical conflicts and ongoing tensions between different clan-based factions (IOM, 2023).
- **Galgaduud's** terrain is a mix of agricultural land and semi-desert in central Somalia. Clan dynamics influence the region, and periodic droughts have affected its populace. Additionally, the region has experienced battles between governmental forces and insurgent groups.
- **Bay** region lies to the east of Bakool and is characterized by a combination of fertile agricultural lands and pastoral areas. Baidoa, its administrative capital, has often found itself at the centre of humanitarian efforts, especially during times of drought or displacement caused by conflict.
- **Hiran** is largely an agricultural zone in central Somalia. Beletweyne, by the banks of the Shabelle River, often faces flood risks. Hiran, too, has seen its share of conflicts, particularly around control of strategic locations and resources.

- **Middle Shabelle**, located in South-Central Somalia, has rich agricultural lands suitable for growing crops such as maize and bananas. Food security is relatively better in this region than in others due to reliable water access from River Shabelle. However, at the same time, the region's proximity to the river makes it prone to recurrent floods during the rainy seasons leading to displacement crises and crop damage (SAWLIM, 2024). The region's social dynamics, like many other parts of Somalia, are influenced by clan affiliations

- **Lower Juba** is endowed with both fertile lands and rich marine resources and is located in the southernmost part of Somalia, along the coastline. Kismayo, its major port city, has been historically significant for trade. Clashes for control of the port and the surrounding resources have made it a contentious region.

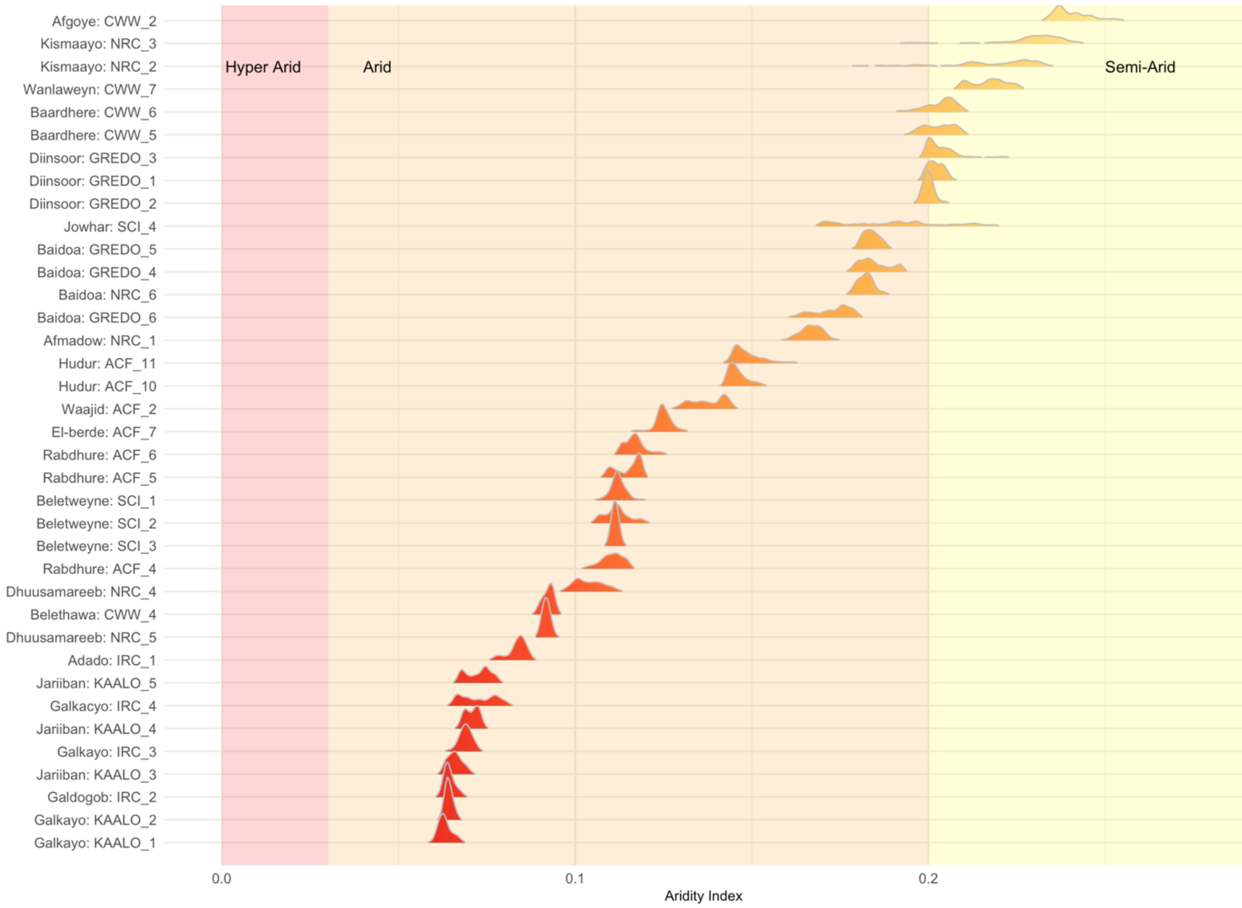


FIGURE 3: DISTRIBUTION OF THE ARIDITY INDEX BY THE 37 PROJECT AREAS. ARIDITY CLASSIFICATION IS BASED ON (ZOMER AND TRABUCCO, 2022).

The BRCiS III project areas are spread out throughout Somalia and cover a range of climatic and ecological zones. However, the whole project area is characterized by limited precipitation all year round. These climate properties indicate an arid ecosystem with limited vegetation presence. Out of the 37 project areas, 28 can be classified as largely arid while nine are considered semi-arid (Figure 3).

This ecosystem baseline assessment aims to provide a comprehensive and quantifiable analysis of the current state of the ecosystem across the 37 BRCiS III project areas. Through an extensive ecosystem field data collection campaign, in combination with remote sensing and machine learning approaches, the assessment includes a variety of soil, vegetation, climate and social indicators which explain ecosystem health from multiple dimensions. From this perspective, the main aims of this report can be formulated as the following:

1. *Provide a field-based assessment of the current state of ecosystem health in Somalia.*
2. *Assess the ecosystem resilience at the project area level based on vegetation, soil, climate and social indicators.*

Parts of the remote sensing-based soil and vegetation analyses can be explored interactively HERE.

III. METHODOLOGY

The ecosystem assessment utilised the Land Degradation Surveillance Framework (LDSF) to collect field data covering a range of ecological indicators through a rigorous sampling design. In addition, household surveys were conducted to collect data on social indicators to better understand people's dependency on the ecosystems. A large variety of vegetation and soil health indicators were considered to provide a comprehensive assessment of ecosystem health. Using LDSF ground truth data, remote sensing and machine learning, predictive models were developed to assess soil and vegetation properties across the project areas under BRCiS III (Figure 2). Additionally, a community-level survey was conducted to better understand each community's accessibility to natural resources and their dependency on these resources.

A. DATA

The in-field data functioned as an accurate benchmark to understand the complex dynamics on the ground while the remotely sensed data was used to scale up the analysis and to perform comparative analyses between the project areas. Especially the combination of in-field and remotely sensed data is valuable, as both accuracy and generalisability can be preserved.

Biophysical ecosystem indicators were collected at eight LDSF sites in Somalia, corresponding to 848 sampling locations (Figure 4). Though, due to financial constraints, soil samples were collected and analysed in the CIFOR-ICRAF soil lab for two sites (*Guriel* and *Kismaayo*). *Note: The results of the lab soil analysis are not yet included in this report but will be added to a later version of the report.* To ensure high data quality, officers from each BRCiS Member were trained on the LDSF methodology during a three-day training in Kalama, Kenya, in February 2024 led by CIFOR-ICRAF experts. One LDSF site was established per BRCiS

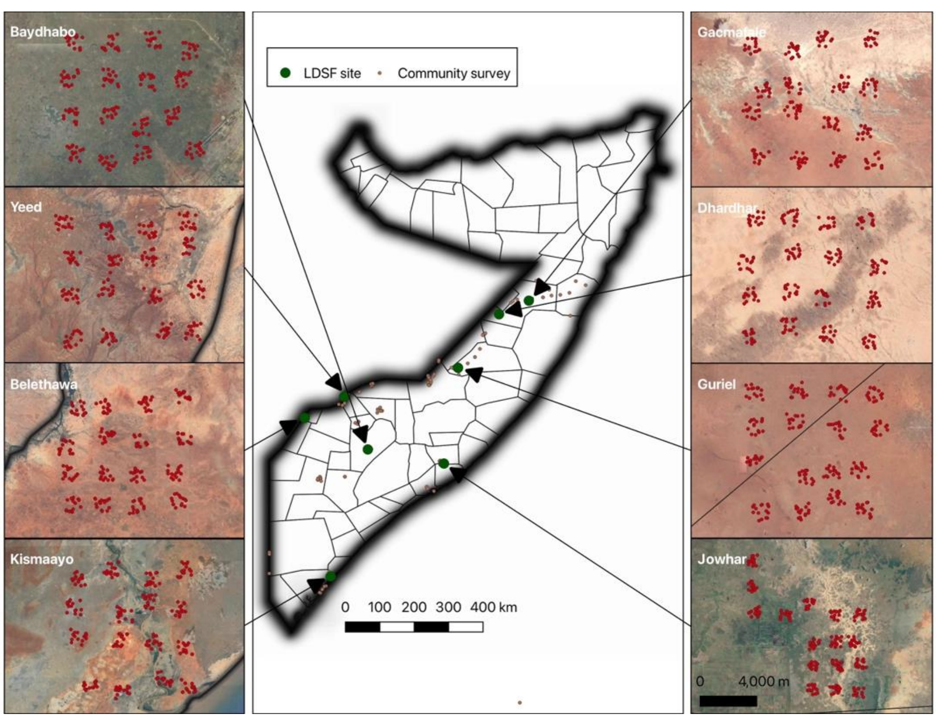


FIGURE 4: OVERVIEW OF THE LDSF AND COMMUNITY SAMPLING LOCATIONS IN SOMALIA.

Member (7), and one initial LDSF site was done with all members together (*Guriel*). The LDSF locations were selected in close collaboration with BRCiS Members to ensure safety and accessibility in areas that were prone to insecurity and flooding, for example. On several occasions, sampling locations were changed during the data collection campaign as a result of the changing security landscape. These adjustments were always conducted in close communication with the field teams via WhatsApp and on email. Field data collection was performed between June-September 2024.

As mentioned, existing LDSF data from outside Somalia, was used in this report to predict various vegetation and soil properties across the project areas in Somalia (Figure 7). The ICRAF dataset of around 43,000 samples was used to provide a sufficiently large training dataset to perform ecosystem health predictions across Somalia, including preliminary predictions of soil health variables (see all LDSF locations HERE). The latter will be updated and locally validated once soil data analysis has been completed.

A community-level survey on natural resource accessibility and dependency was performed by BRCiS III members across the 37 project areas and at 166 communities (Figure 4). Enumerators were trained on how to use and interpret the ODK questions in December 2023 and data was collected by officers from the BRCiS Members in January 2024.

Additional remotely sensed products were used to gain a better understanding of long-term vegetation and climate conditions across Somalia. The Moderate Resolution Imagining Spectroradiometer (MODIS) sensor was used, providing long-term (2000-present) global data on vegetation productivity, for example. We used the MODIS Enhanced Vegetation Index (EVI) to look at vegetation trends across the project areas. Rainfall and temperature data were derived from the Global Precipitation Measurement (GPM) satellite mission and MODIS, respectively. Lastly, Zomer et al. (Zomer and Trabucco, 2022) combined global precipitation estimates with evapotranspiration to indicate the aridity of an area, called to Aridity Index (AI). These remotely sensed products have the advantage that they provide spatially consistent estimates across the project areas.

TABLE 2: OVERVIEW OF THE VARIOUS DATA USED IN THIS REPORT.

Source	Collection method	Resolution	Number of observations	Purpose	Collection period
LDSF – Somalia sites	In-field	Landscape level (10 x 10 km)	848 plots	Landscape assessment of vegetation and soil properties.	2024/07/01 – 2024/10/01
Community Survey – Resource accessibility	In-field	Communities in project areas	166 communities	Community information on natural resource availability, livestock numbers and conflict.	2023/12/01 – 2024/02/01
LDSF – ICRAF Database (see all locations HERE)	In-Field	Landscape level (10 x 10 km)	43,000 plots	Used to predict soil and vegetation properties in Somalia. *Note: this database does not include data from within Somalia yet.*	2012/01-01 – Ongoing

Landsat 8	Remotely sensed	Global (30 m)	-	Bi-annual median Landsat 8 composites of Somalia were used in combination with LDSF ground truth data to predict soil/vegetation properties in Somalia.	2021/01/01 – 2023/12/01
MODIS Terra – Enhanced Vegetation Index (EVI) 16-Day	Remotely sensed	Global (250 m)	-	Annual median EVI composites to display vegetation changes between in Somalia.	2001/01/01 – 2024/01/01
Global Precipitation Measurement (GPM)	Remotely sensed	Global (11 km)	-	Precipitation estimates for Somalia based on the average of the annual total precipitation between 2001 and 2023.	2001/01/01 – 2024/01/01
MODIS Terra – Daytime Land Surface Temperature	Remotely sensed	Global (1 km)	-	Temperature estimates for Somalia based on the average daytime temperature between 2001 and 2023.	2001/01/01 – 2024/01/01
Aridity Index (AI)	Remotely sensed (Zomer and Trabucco, 2022)	Global (1 km)	-	AI provides an indicator of ecosystem aridity, and hence, water deficiency by combining the potential evapotranspiration with precipitation estimates.	2022/01/01 – 2022/12/31

B. LAND DEGRADATION & SURVEILLANCE FRAMEWORK (LDSF)

The Land Degradation Surveillance Framework (LDSF) was developed by the World Agroforestry (ICRAF) in response to the need for consistent field methods and indicator frameworks to assess land and soil health across landscapes, including quantifying SOC and understanding land degradation dynamics and drivers (see full manual HERE). The LDSF is a flexible and cost-effective approach to assessing land degradation and has been applied in over 40 countries at multiple scales to build global models applied to the project areas and validated with the local data (Vågen et al., 2016, 2013; Winowiecki et al., 2016, 2018). The LDSF sampling was based on a stratified random sampling design, which allows for the assessment of soil and land health at multiple scales, from the local to the national level (Figure 5). One of the key aspects of the

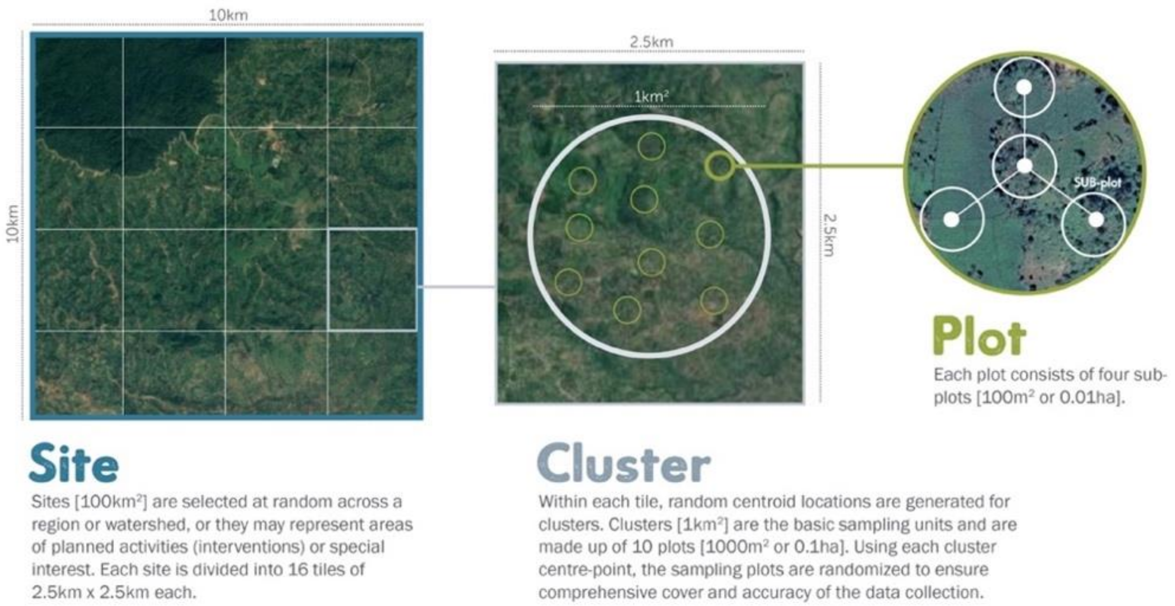


FIGURE 5: HIERARCHICAL SAMPLING DESIGN OF THE LDSF.

LDSF is the nested sampling design. For example, each site is 100 km^2, containing sixteen 1 km^2 clusters. Each cluster has ten 1000 m^2 plots, and each plot has four 100 m^2 subplots (Figure 5). This design allows for the understanding of spatial variability, across nested spatial scales. A nested hierarchical sampling design is important for developing predictive models with global coverage, while maintaining local relevance.

Specifically, field measurements were taken at the plot and subplot levels. For example, soil samples are collected at the subplot level and then composited at the plot level at two depths (0-20 cm and 20-50 cm). Land use history was recorded at the plot level. Infiltration capacity was measured using single ring infiltrometer at the centre of subplot 1. Tree and shrub diversity was measured across all four subplots as was erosion prevalence, herbaceous and woody cover. In summary, several key indicators of soil and land health were measured simultaneously, at the same geo-reference location to understand their relationships. The list of indicators measured in the LDSF are included in Figure 6.

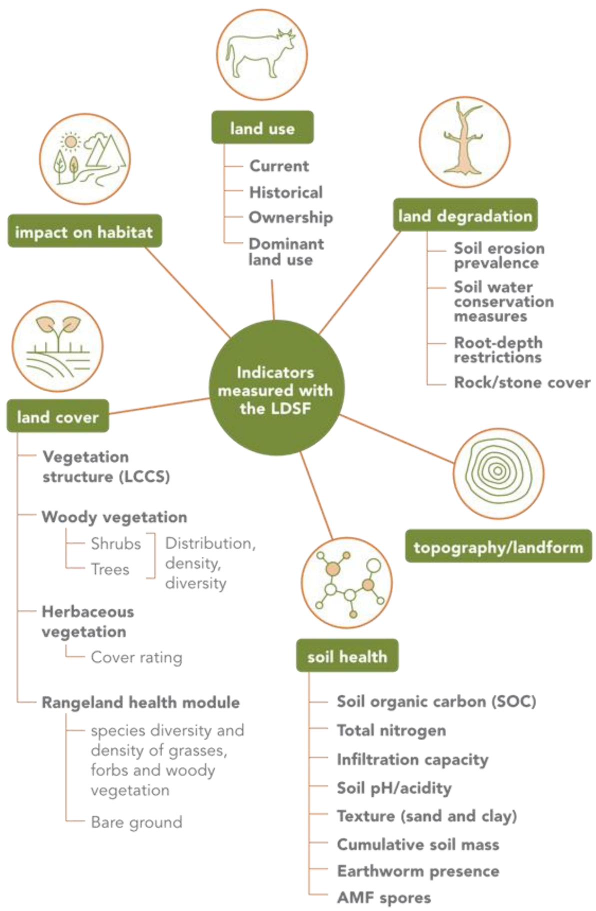


FIGURE 6: INDICATORS MEASURED IN THE LDSF.

C. COMMUNITY SURVEY

A participatory mapping of ecosystem services was conducted with community members ensuring representation from various community segments (e.g. women, young people, different ethnicities, people with disabilities). The full community survey indicators and forms can be found in Appendix VI.D.

Carried out by BRCiS Members, key objectives of this community mapping included:

1. Collecting social data across ecosystem domains to feed into the LDSF logic for assessing ecosystem health
2. Identifying and mapping the ecosystem services that communities utilise in both crisis and typical situations. Note that normal years' seasonality is considered part of the typical situation and should not be considered under crisis.

For each of the BRCiS III program areas, community ecosystem services were identified and categorized according to their uses and access groups. In addition, ecosystem services beyond the community boundaries were identified that the community members use even if only parts of the year. Finally, livestock mobility, conflict dynamics and conflict sources were identified and linked to the ecosystem services.

D. VEGETATION, SOIL AND CLIMATE MAPS

1. SPATIAL PREDICTIONS USING LDSF DATA

Soil and vegetation properties were predicted through satellite images and machine learning based on the ICRAF LDSF database containing around 43,000 soil and vegetation samples around the tropics. This dataset was used in conjunction with remote sensing data to develop predictive models that allow to make accurate spatial maps for a wide variety of soil and vegetation indicators. Soil organic carbon (SOC), tree cover, grass cover, soil pH and erosion were predicted using Landsat 8 median composites over the years 2022-2023 (Figure 7A-E). By taking the median pixel value over two years, natural fluctuations are reduced resulting in

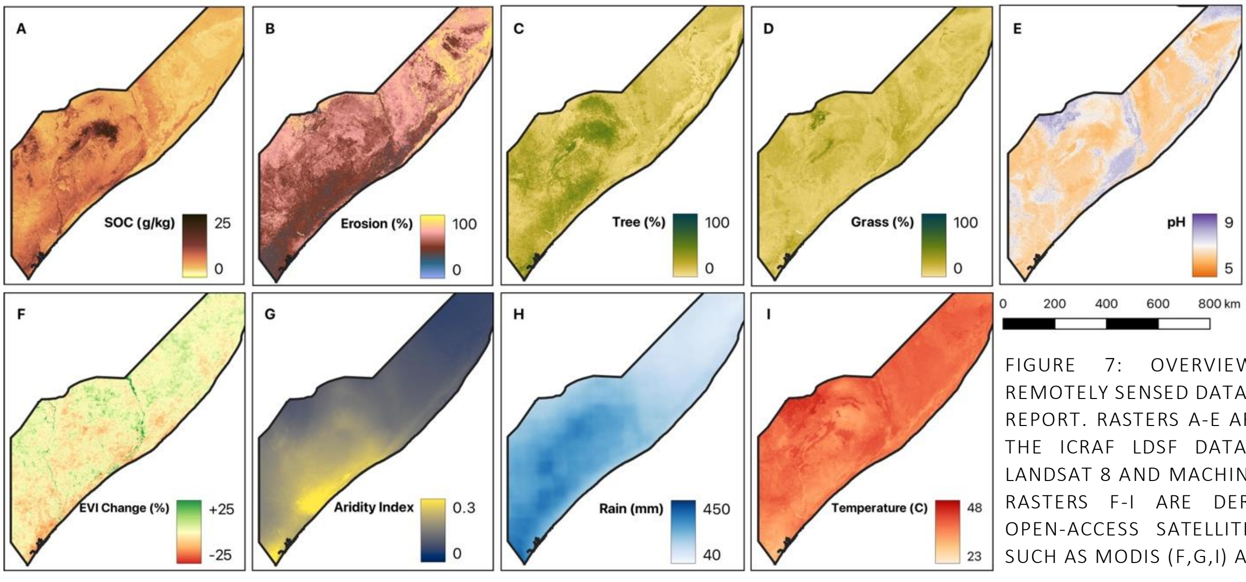


FIGURE 7: OVERVIEW OF THE REMOTELY SENSED DATA USED IN THE REPORT. RASTERS A-E ARE BASED ON THE ICRAF LDSF DATABASE USING LANDSAT 8 AND MACHINE LEARNING. RASTERS F-I ARE DERIVED FROM OPEN-ACCESS SATELLITE PRODUCTS SUCH AS MODIS (F,G,I) AND GPM (H).

a more representative image. The predictive models were trained using a random forest model which is an ensemble modelling approach that uses multiple decision trees. Random forests are generally considered as one of the strongest machine learning models and have been applied widely in advanced remote sensing studies. Besides the raw Landsat 8 multispectral reflectance values, various vegetation indices and reflectance ratios were added in the model as covariates to increase the prediction accuracy. Water bodies and build-up areas were masked out using the MODIS water mask and the LULC Dynamic World product based on Sentinel 2 imagery, respectively, as these areas contain no ecosystem information.

SOC is an important measure for soil and land health as it influences a range of different ecosystem services, from water regulation to productivity and biodiversity. Tree cover, grass cover and erosion prevalence were predicted in percentages, where 100% indicates an extremely high probability of a tree/grass/erosion occurring in a pixel and 0% indicates a low probability (Table 3).

TABLE 3: EXPLANATION ON THE SOIL AND VEGETATION INDICATORS PREDICTED FOR THE PROJECT AREAS THROUGH REMOTE SENSING AND GROUND TRUTH DATA.

Indicator	**Explanation**	**Thesholds**
Soil organic carbon (SOC; g/kg)	Soil organic carbon (SOC) is the carbon stored in organic matter within the soil, playing a critical role in maintaining soil structure, fertility, and water retention, which are essential for ecosystem productivity and resilience. In dryland systems, SOC is especially vital because it enhances the soil's ability to retain moisture and nutrients, mitigating the effects of drought and supporting vegetation in these water-scarce environments.	Low: < 5 g/kg Medium: 5–15 g/kg High: > 15 g/kg
Erosion prevalence (%)	Erosion prevalence in dryland systems is a critical indicator of land degradation, as it leads to the loss of nutrient-rich topsoil, reduced water retention, and diminished land productivity. Managing erosion is essential in fragile ecosystems to sustain vegetation, combat desertification, and support livelihoods dependent on the land.	Low: < 25% Medium: 25–75% High: > 75%
Tree cover (%)	Tree cover in dryland systems can help stabilise soils, reduce erosion, enhance water infiltration and provide shade. While tree cover in Somalia can include the presence of invasive tree species, which have a negative effect on the ecosystem, indigenous species pose considerable benefits to the landscape.	Low: < 10% Medium: 10–40% High: > 40%
Grass cover (%)	Grass cover in dryland systems is essential for protecting soil from erosion, enhancing water infiltration, and maintaining soil organic matter. It also supports grazing livestock, stabilizes ecosystems, and provides habitat for diverse species, making it crucial for both ecological balance and livelihoods.	Low: < 10% Medium: 10–40% High: > 40%
Soil pH	Soil pH is a key factor influencing nutrient availability, microbial activity, and plant growth. Acidity (low pH) and alkalinity (high pH) can both hinder these processes, making it critical to maintain an optimal pH range (5.5-7.5) to ensure productivity, support biodiversity, and facilitate land restoration efforts.	Acidic: < 5.5 Neutral: 5.5–7.5 Alkaline: > 7.5

2. PRE-PROCESSING EVI AND CLIMATE MAPS

The Enhanced Vegetation Index (EVI) served as an indicator of long-term vegetation change. Annual median EVI composites were calculated for Somalia between 2000-2023. This resulted in the median EVI value for each pixel in each year between 2000-2023. From this EVI time series, the relative change in EVI was calculated for each year relative to the 2000-2005 average. After that, the annual relative change in EVI was summed to get the overall change in EVI in the 2000-2023 period relative to the 2000-2005 average. The resulting map can be found in Figure 7F.

Rainfall data were aggregated by taking the average annual precipitation between 2001-2023 as estimated by the GPM. For the MODIS-derived temperature estimates, the average was taken for each pixel in the period 2001-2023. Lastly, the aridity index values were taken from Zomer et al. (2022) *"Global Aridity Index and Potential Evapotranspiration Database - Version 3"*. This dataset uses the ratio between precipitation and potential evapotranspiration derived from averages between 1970-2000.

IV. RESULTS

A. LDSF

1. LAND COVER

A) VEGETATION STRUCTURE

The vegetation structure was assessed across the various sampling locations. Most occurring vegetation type were bushlands which were dominant in *Dhardhar* (100% - Figure 9), *Yeed* (91%), *Gacmafale* (73%), *Guriel* (68%), *Belethawa* (51%) and *Kismaayo* (37% - Figure 9). This exemplified an extremely homogenous landscape in *Dhardhar* and *Yeed*, while *Kismaayo* showed much more variation in vegetation structure across the sampling area. Bushlands are defined as "*A mix of trees and shrubs with a canopy cover of 40% or more*". Croplands were mainly present in *Baydhabo* (91% - Figure 9), *Johwar* (77%) and *Kismaayo* (19%) and only occurred limitedly at the other sites. Furthermore, grasslands occurred at many plots in *Belethawa* (43%), *Jowhar* (17%) and *Kismaayo* (12%) and only at very few plots in *Yeed* and *Gacmafale*. Shrublands were only recorded marginally, particularly in *Kismaayo* (24%), *Guriel* (24%) and *Gacmafale* (14%).

Some sites, like *Dhardhar*, Baydhabo and *Yeed*, exemplified an extremely homogenous landscape while Kismaayo showed much more variation in vegetation structure.

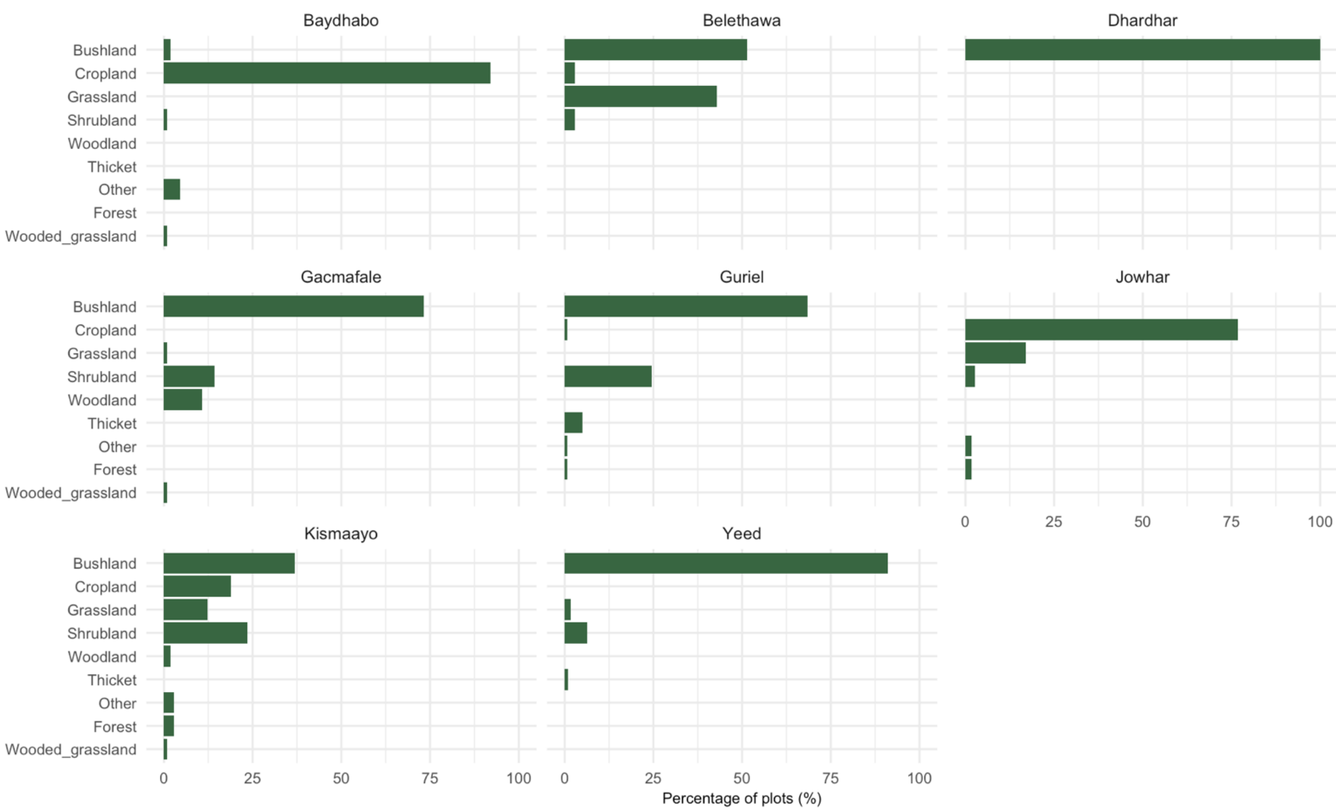


FIGURE 8: VEGETATION STRUCUTURE CLASSES AT EACH LDSF SITE GIVEN IN PERCENTAGE OF PLOTS PER SITE.

FIGURE 9: IMAGES FROM THE FIELD TAKEN DURING THE LDSF SAMPLING SHOWING, LEFT: CROPLAND IN *BAYDHABO*, MIDDLE: BUSHLAND IN *DHARDHAR* AND BUSHLAND IN *KISMAAYO*.

B) WOODY COVER

Woody cover was assessed at each LDSF plot as a percentage of coverage. It can be seen as an indication of shrub and tree presence. Low woody cover was observed at *Jowhar* and *Baydhabo* where 86% and 91% of the plots, respectively, had less than 4% woody cover (Figure 10). Also, *Belethawa* and *Yeed* showed low woody cover with 63% and 43% of plots having less than 4% woody cover. Higher coverage was seen at *Dhardhar* and *Guriel* where most plots, 75% and 45% respectively, had between 15-40% woody cover. Woody coverage in *Kismaayo* was normally distributed with the majority (54%) between 4-40% and a

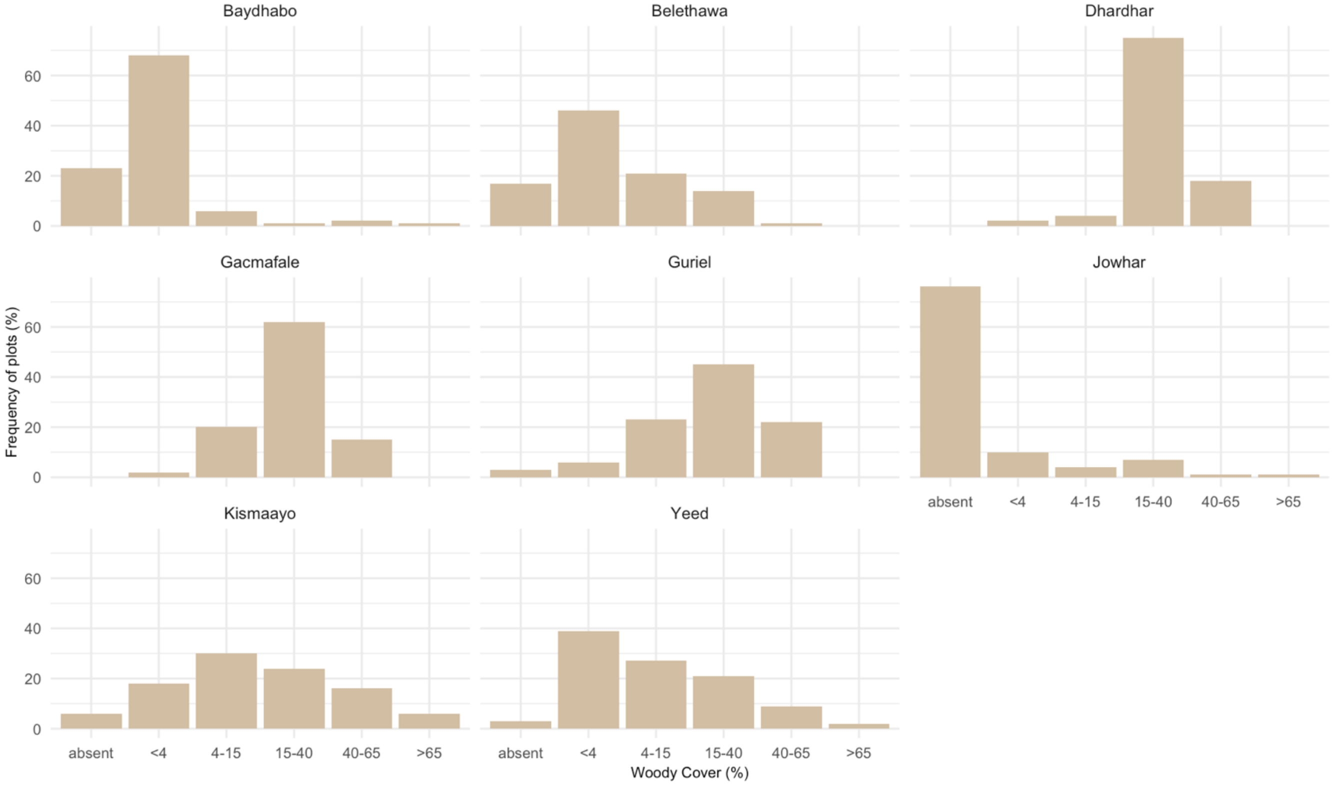


FIGURE 10: WOODY COVER RATING AT THE PLOT LEVEL DISPLAYED BY LDSF SITE.

similar number of positive and negative outliers. Generally, the coverage of woody species varied a lot between the sites with extremely low coverage in *Jowhar* and *Baydhabo* and relatively high coverage in *Dhardhar*.

Woody cover (tree and shrubs) was generally low across the sites with extremely low coverage in Baydhabo and Jowhar.

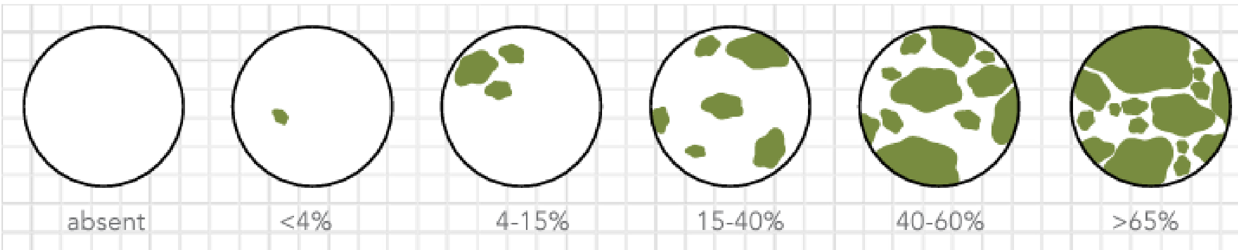


FIGURE 11: GRAPHICAL REPRESENTATION OF VEGETATION COVER RATINGS USED IN THE LDSF.

Tree and shrub density was recorded at each sampling plot and provided in the number of trees per hectare. From Figure 12, we can tell that most of the woody vegetation is comprised of shrubs. Only in *Yeed* and *Belethawa*, trees were consistently recorded with a median density of 25 trees/ha across the sites. Across all sites, the highest tree densities were seen in wooded grasslands and forests (both median of 25 trees/ha). Compared to tree density, shrubs density was higher across the sites and vegetation structures. Besides *Jowhar*, *Dhardhar* and *Baydhabo*, all sites had a 75th percentile shrubs/ha above zero. Highest shrub densities were seen in *Kismaayo* (median: 80 shrubs/ha; 75th percentile: 200 shrubs/ha). Additionally,

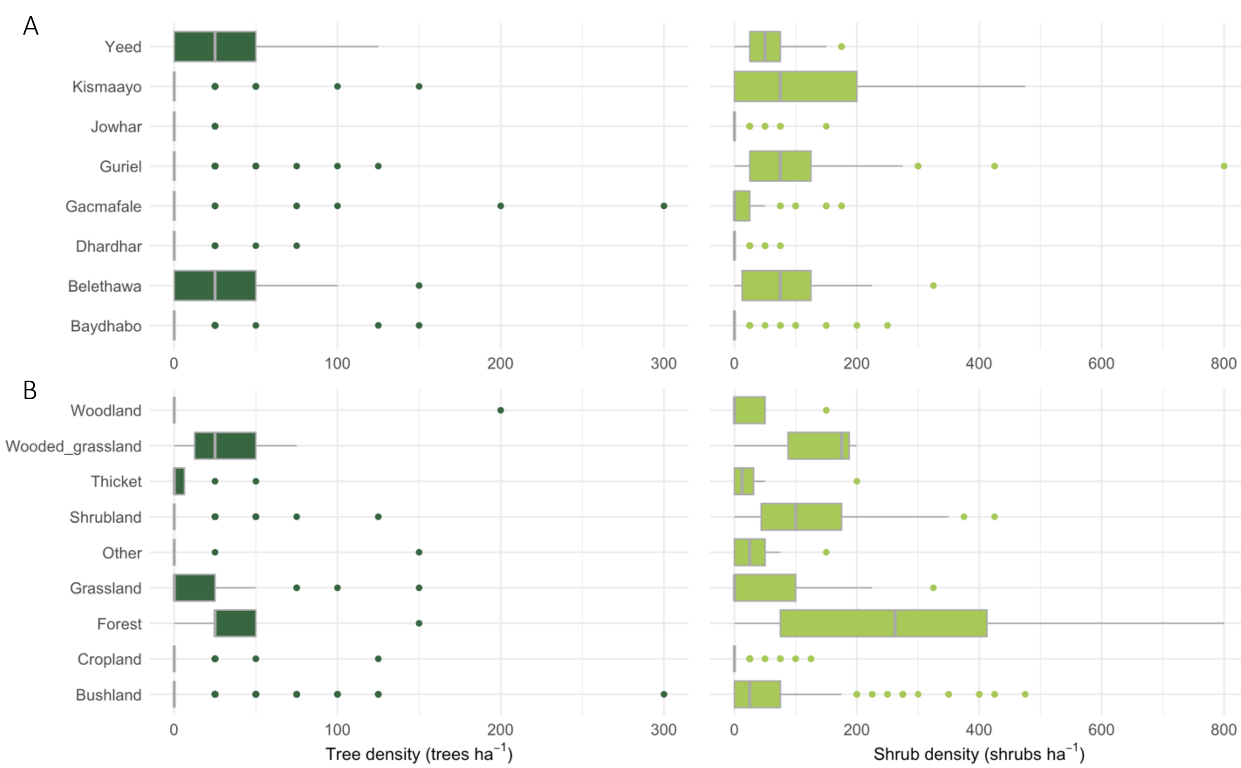


FIGURE 12: TREE AND SHRUB DENSITY RECORDED AT THE SAMPLING PLOTS BY (A) LDSF SITE AND (B) VEGETATION STRUCTURE.

forests, wooded grasslands and shrublands were reported to have the highest median shrub presence of 280, 190 and 100 shrubs/ha, respectively. The other vegetation structures showed a median shrub density below 100 shrubs/ha.

Across sites and vegetation structures, shrub density was higher than tree density. Forests showed the highest median number of shrubs of 280 shrubs/ha.

(1) TREE AND SHRUB SPECIES

Due to the difficulty of finding an appropriate botanist, the field teams were not able to identify many of the trees and shrubs. Hence, 40% of the recorded trees and 69% of the recorded shrubs could not be identified. Nevertheless, from the tree and shrub species that were identified we can draw some insights (Figure 13).

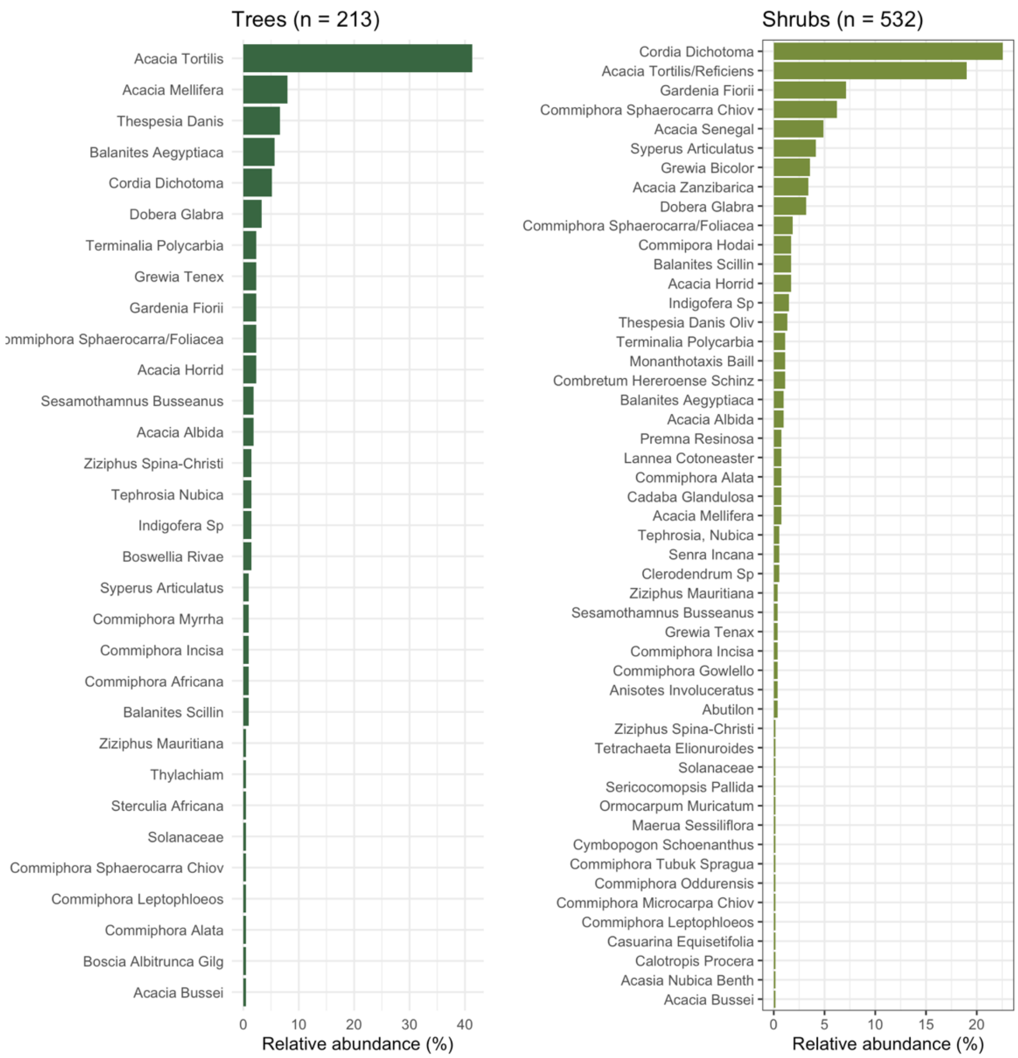


FIGURE 13: RELATIVE ABUNDANCE OF THE TREE AND SHRUB SPECIES IDENTIFIED AT THE EIGHT LDSF SITES.

Across the eight LDSF sites, a total of 31 trees species (357 trees) were identified of which the *Acacia Tortilis* occurred most frequently (25%). Other tree species were recorded considerably less often such as the *Acacia Mellifera* (4.8%), *Thespesia Danis* (3.9%), *Balanites Aegyptiaca* (3.4%) and the *Cordia Dichotoma* (3%). The relative abundance of the other tree species was each lower than 2%.

A total of 50 shrubs species were recorded. The most occurring species was the *Cordia Dichotoma* (7%), followed by the *Acacia Tortilis/Reficiens* (5.8%) and the *Gardenia Fiorii* (2.2%).

The difference between trees and shrubs was determined by the height. We considered woody vegetation above 3 m as trees and below 3 m as shrubs.

C) HERBACEOUS COVER

Herbaceous cover provides information of the presence of grasses and forbs at the sampling plots. Very low herbaceous cover was recorded in *Baydhabo* and *Belethawa* with 95% and 81%, respectively, of the plots having less than 4% herbaceous cover. Also, *Jowhar* (66%) and *Guriel* (63%) had a high percentage of plots with low (<4%) herbaceous cover. Plots with an herbaceous cover above 15% were observed more often in *Yeed* (26%), *Kismaayo* (41%) and much more in *Dhardhar* (69%). In most sites, we saw that the plot-level herbaceous cover was relatively evenly distributed, although *Baydhabo* and *Belethawa* displayed a strong dominance of low cover, and *Dhardhar* showed a strong dominance of high cover.

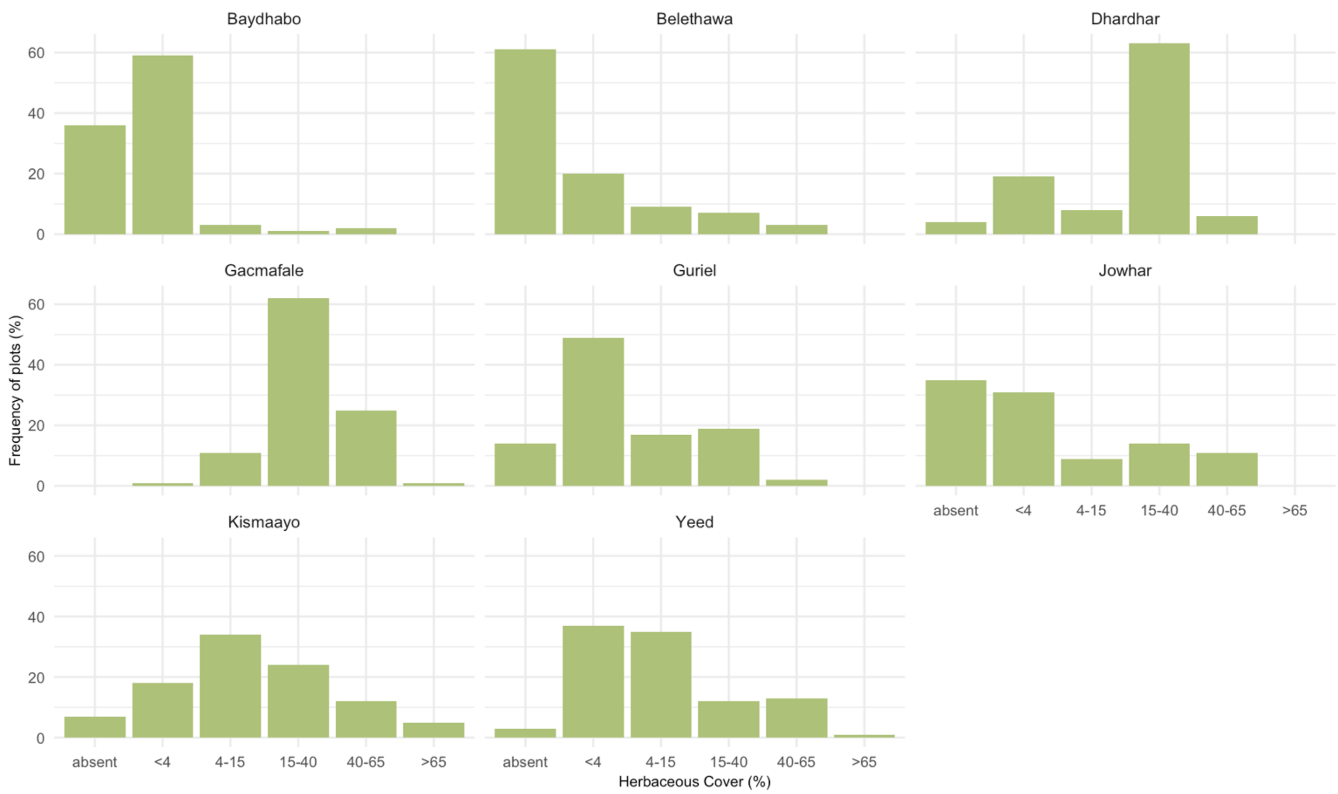


FIGURE 14: HERBACEOUS COVER RATING AT THE PLOT LEVEL DISPLAYED BY LDSF SITE.

Herbaceous cover was low across the LDSF sites, particularly, at the plots surveyed in *Baydhabo* and *Belethawa*.

(1) PERENNIAL GRASS SPECIES

Given that grasses were dominant in large parts of Somalia (Figure 7D), it is important to assess the diversity in grass species. Unfortunately, due to the difficulty of identifying grasses, and the unavailability of an appropriate botanist, around 90% of the identified grasses were not identified. We are currently still working with the BRCiS Members to improve this number by having experts translate the identified local names of the species into the scientific names. Though, this process takes time, so an updated species list will be provided in a next version of this report.

From the limited data that is available, we can tell that the species *Cyberus Rabicundus Vahal* occurred relatively frequently (Figure 15). The other identified grass species only occurred marginally.

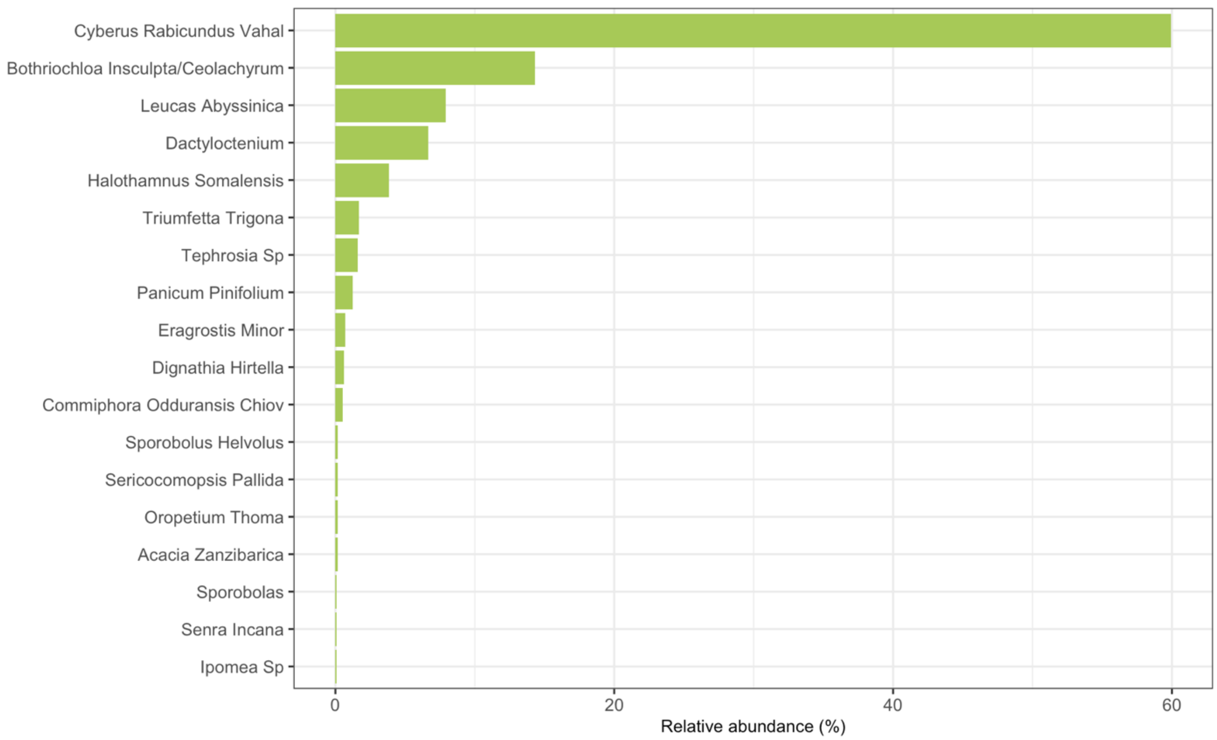


FIGURE 15: RELATIVE ABUNDANCE OF PERENNIAL SPECIES RECORDED.

2. LAND DEGRADATION

A) SOIL EROSION PREVALENCE

Overall, soil erosion prevalence was high in the LDSF sites surveyed, except for *Jowhar* (Error! Reference source not found.). In *Baydhabo*, *Dhardhar*, *Gacmafale* and *Guriel*, erosion was very high as almost all plots were severely eroded at these sites. **This means that the implementation of soil and water conservation measures will be critical for land restoration in most of the sites.** In *Belethawa* and *Kismaayo*, and to a lesser degree *Yeed*, the erosion prevalence varied widely across the sampling site. Five clusters at *Belethawa* showed high erosion while the other clusters showed no erosion at all. In *Kismaayo*, erosion at the cluster level ranged between 0-100%, though, most clusters experienced at least some level of severe erosion. A recent study estimated the median erosion prevalence in east Africa around 50% and erosion prevalence higher than 80% were rare (Vagen and Winowiecki, 2019). Hence, erosion levels in Somalia can be regarded high, also in comparission on other east African regions.

As shown in Figure 18, erosion prevalence was particularly high in plots with thicket (100%), bushland (91%), woodland (86%) and shrubland (81%) vegetation structure types. Least erosion was recorded in forests, grasslands and croplands with 50%, 54% and 56% of the plots, respectively, showing erosion in these vegetation structures. The lower erosion prevalence in grasslands makes sense as a healthy herbasceous layer keeps the soil together and prevents runoff as it increases water infiltratration. Hence, these results provide the evidence that the restoration of grasslands in Somalia is an important step to decrease erosion in the landscape.

Plots were classified as severely eroded when three or more (>= 3) of the sub-plots showed any form of erosion (sheet, rill or gully).

FIGURE 16: EXAMPLE OF EROSION IN BAYDHABO.

FIGURE 17: EXAMPLE OF EROSION IN DHARDHAR.

FIGURE 18: PERCENTAGE OF PLOTS WITH SEVERE EROSION BY LDSF SITE AND CLUSTER.

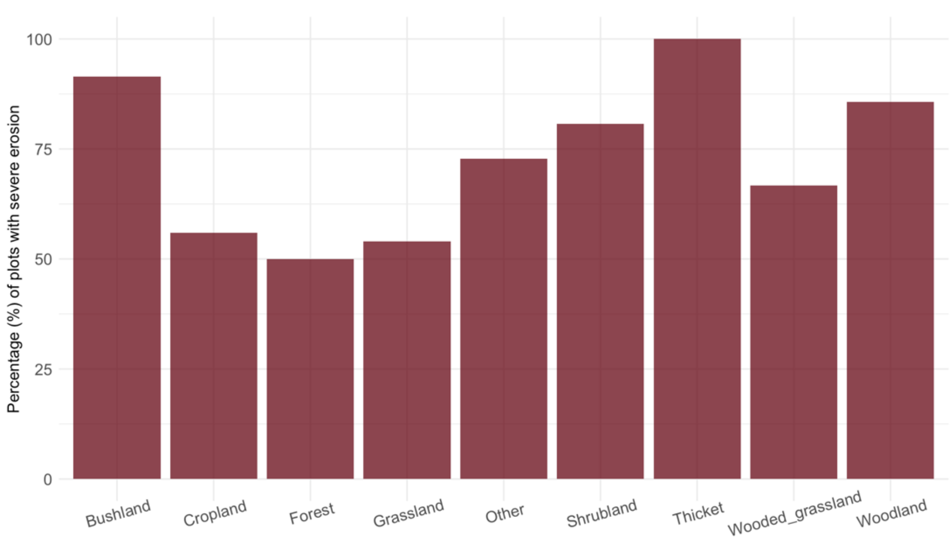


FIGURE 19: EROSION PREVALENCE AT THE SAMPLING LOCATIONS PER VEGETATION STRUCTURE.

B) SOIL INFILTRATION CAPACITY

Soil infiltration capacity is a critical soil property controlling the partitioning of water at the soil surface into surface runoff and subsurface water recharge. The soil infiltration capacity thus governs the replenishment of soil moisture required to sustain primary production and rainfed agricultural systems and is thus critical to support food security and the provision of other vital ecosystem services, including mitigation of floods and droughts, erosion control, and water purification and regulation. The soil infiltration capacity is controlled by the soil saturated hydraulic conductivity (Kfs).

Median Kfs in the eight LDSF sites ranged from 13 mm h^{-1} in *Yeed* to 135 mm h^{-1} in *Guriel* (Figure 20). This means that, in *Yeed*, the soil can only absorb 13 mm of water per hour when the soil is saturated making the area prone to high runoff rates after a rain event. Saturated hydraulic conductivity was low in *Yeed, Jowhar, Belethawa, Kismayo, Baydhabo,* and *Dhardhar* sites, with median Kfs values below 50 mm h^{-1}, whereas in *Gacmafale* and *Guriel,* the median Kfs was well above 100 mm h^{-1}. *Yeed, Jowhar, Belethawa, Kismayo, Baydhabo, and Dhardhar* sites thus have a lower resilience to climate change-induced shocks and stressors such as droughts and heavy rainfall than *Gacmafale* and *Guriel.* In the context of sub-Saharan Africa, median Kfs values exceeding 100 mmh^{-1} are regarded high while median values below 50 mmh^{-1} can be regarded as low (Bargués-Tobella et al., 2024).

Based on soil infiltration capacity, *Yeed*, *Jowhar*, *Belethawa, Kismaayo*, *Baydhabo* and *Dhardhar* sites had a lower resilience to climate change-induced shocks (droughts/floods) than *Gacmafale* and *Guriel*.

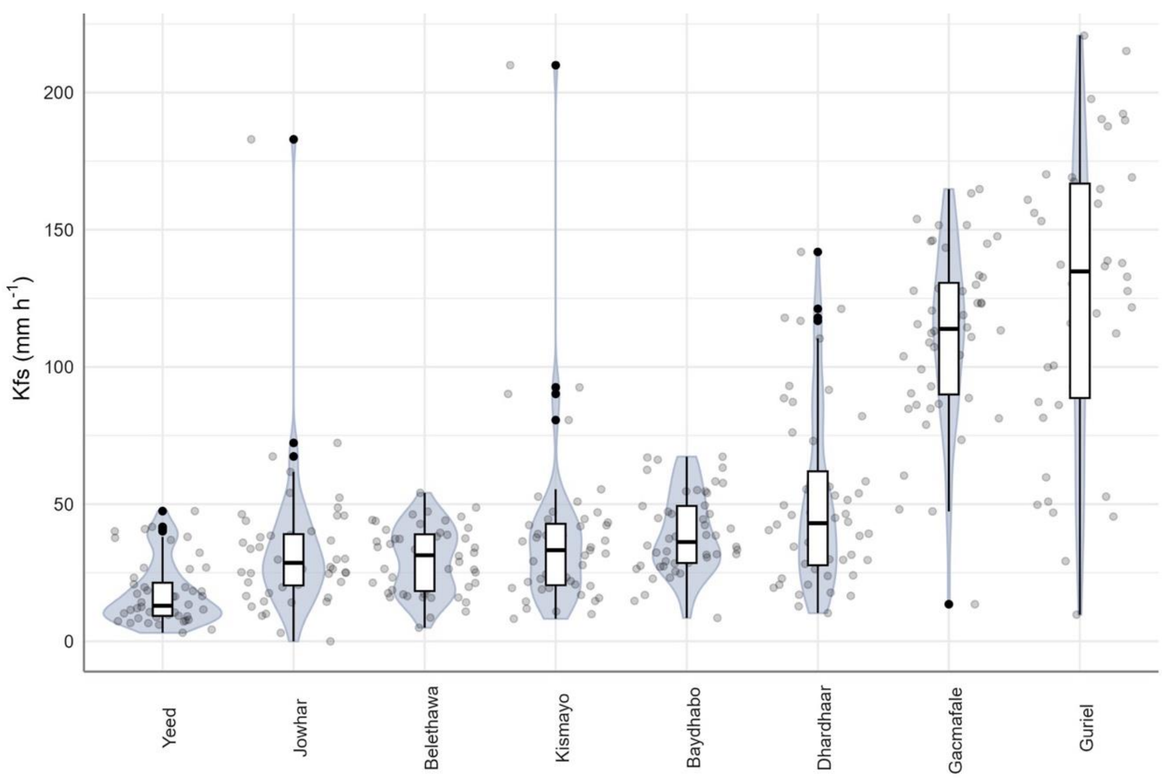


FIGURE 20: TOP-SOIL FIELD SATURATED HYDRAULIC CONDUCTIVITY AT THE LDSF SITES.

C) EFFECT OF GRAZING MANAGEMENT ON EROSION

Besides erosion levels, rangeland management practises were recorded at the LDSF sampling plots. Grazing management was implemented at only 15 plots, spread out over seven LDSF sites (Figure 21), making it difficult to draw causal conclusion from its effect on erosion. Nevertheless, Figure 22 shows a considerable difference in erosion prevalence for plots without grazing management compared to plots with grazing management. This does provide an indication that grazing management decreases erosion in the Somalia context. Additionally, this trend was reported at several LDSF sites, indicating that grazing management was tied to reduced erosion prevalence across Somalia. This relationship has been well-established in other East African countries (Denboba, 2022; Oduor, 2018) and, hence, these data provide additional support for grazing management implementation as a suitable restoration practise in Somalia.

LDSF data indicates lower erosion prevalence in Somalia when grazing management practises was implemented.

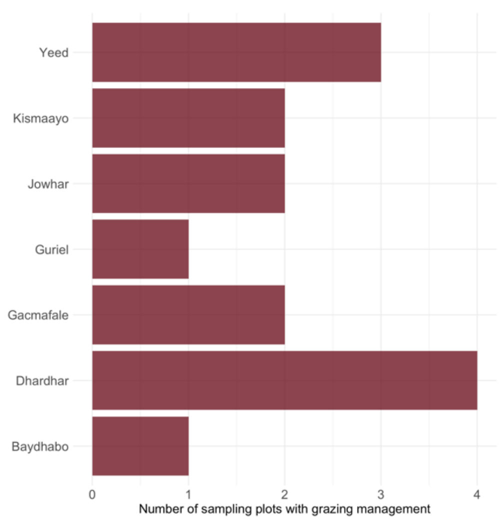


FIGURE 21: NUMBER OF PLOTS WHERE GRAZING MANAGEMENT WAS APPLIED PER LDSF SITE.

FIGURE 22: DISTRIBUTION OF LDSF PLOTS WITH SERVERE EROSION PLOTTED AGAINST LDSF PLOTS WHERE GRAZING MANAGEMENT WAS IMPLEMENTED YES/NO.

3. SOIL ANALYSIS

Note: During the writing of this report, the lab analysis of the collected soil samples was still ongoing. The results of the soil analysis will be incorporated in the subsequent version of this report.

Soil samples were collected at two LDSF sites in *Guriel* and *Kismaayo*. In total, 252 soil samples were transported to the soil spectroscopy lab in Nairobi, Kenya. The soil samples are currently being analysed on a number of properties including soil organic carbon, pH, nitrogen, phosphores, sand/clay content and more. These analyses are conduceted using mid-infrared spectroscopy which can predicted soil properties at high accuracy using the light reflection of the soil across the electro-magnetic spectrum.

B. COMMUNITY SURVEY

1. ACCESS TO ECOSYSTEM SERVICES

Ecosystem services are the benefits people derive from natural ecosystems (e.g. grazing areas, forests, wetlands). These include provisioning services such as collected or cultivated foods as well as water. There are also regulating services such as moderating the micro-climate in a landscape, cultural services or simply the provision of shades for recreation, and supporting services such as nutrient cycling, water filtration and carbon sequestration. Through these services, ecosystem health is directly related to the resilience against shocks of an ecosystem and the communities within this ecosystem. Amongst BRCiS III communities, for example, healthy rangelands and forests reduce the vulnerability to desertification and soil degradation. Ecosystem services also provide essential buffers to people during climate-induced hazards. Examples include healthy, drought-tolerant vegetation for grazing during dry periods.

The most obvious driver explaining the reduced availability of ecosystem services is the degree of deforestation, overgrazing and unsustainable farming along riverines. These factors reduce the soil and land health and are known practices that reduce the ability of this system-"function". These drivers are compounded by droughts, flood events, and temperature rise.

However, access to ecosystem service is not only dependent on the location but is further moderated by social dynamics. In this regard, access to an ecosystem service by a person, household or community is not a binary variable but a continuum of interrelated factors. Along the social dimension, social status, gender, age or even occupation can moderate access to or agency over ecosystem services – or specific components of these. In areas where land tenure or resource rights are disputed, vulnerable groups have difficulties in accessing critical ecosystems or sustainably managing them.

Across the BRiCS III communities, access to ecosystem services is further mediated by a range of conflict-related processes, be it the temporally or permanent presence of Al-Shabab, IS-Somalia or disputes between clans or sub-clans. Conflicts over ecosystem services (e.g. water, grazing areas, fuel wood etc) tend to create corridors of access to ecosystem services for some while depriving access to others.

As a result, communities are often confronted with a catch-22 - a dilemma. On the one hand, they are relying on ecosystem services for survival, but their access to these services is limited by the very factors that degrade ecosystems (i.e. overuse, climate change, conflict). On the other hand, their reliance on these services can unintentionally contribute to ecosystem degradation when pressures to fulfil basic needs (survival) lead to unsustainable use, extractive behaviours and thus creating or at least supporting a negative self-perpetuating cycle.

Based on the survey conducted at 166 communities across the 37 project areas (Table 2), water and grazing land were the two most frequently mentioned ecosystem services by the communities (Figure 23). In many of the BRCiS III project areas, these two services were mentioned in 100% of the communities. In addition, about half of the communities (clustered in specific regions) mentioned farming land as one of the priority resources they relied on. Furthermore, a few communities prioritized non-timber forest products or construction materials derived from batches of forests. Interestingly, other services identified by the

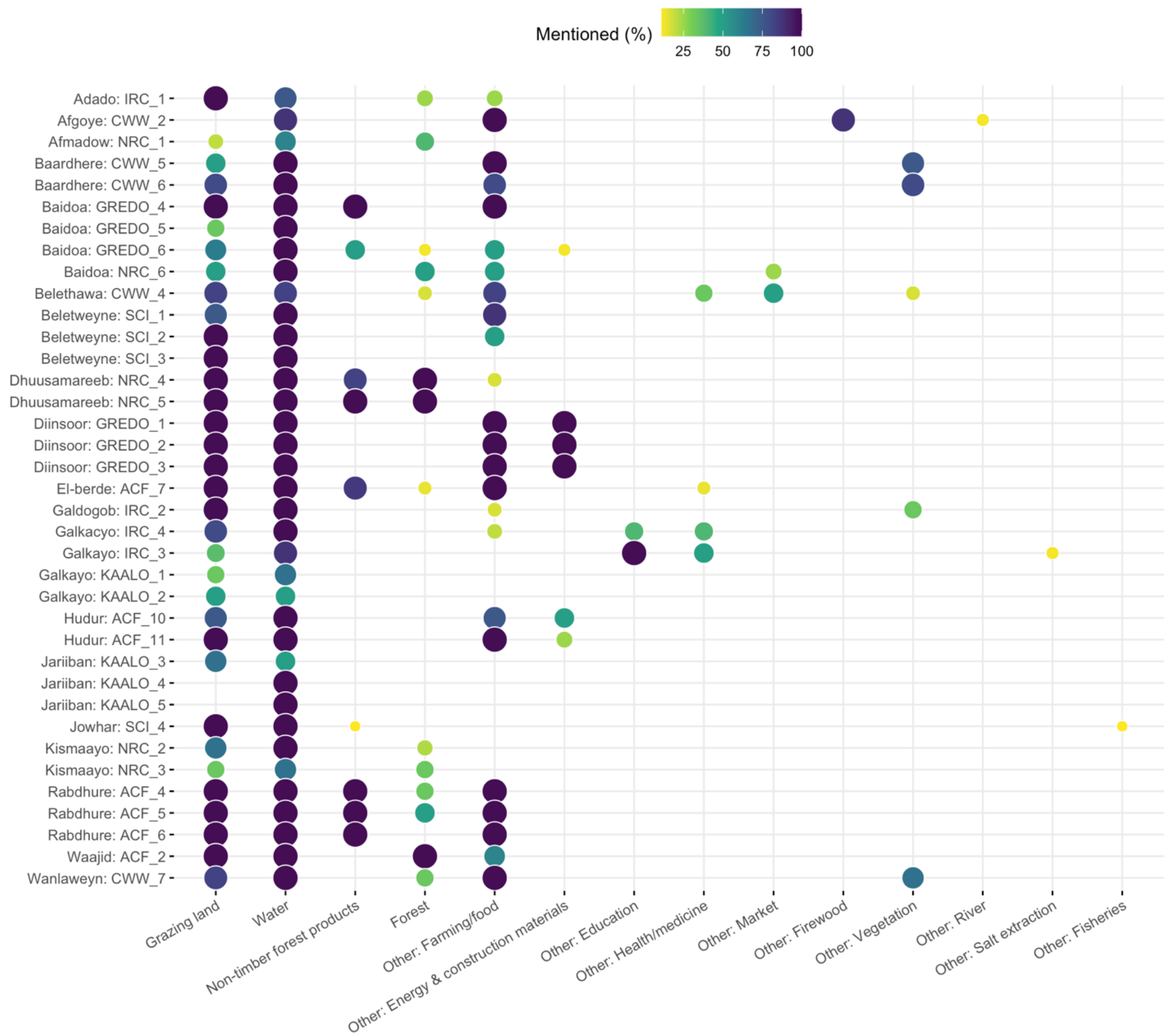


FIGURE 23: ECOSYSTEM SERVICE DEPENDENCY AS IDENTIFIED BY THE COMMUNITIES. THE POINT COLOR AND SIZE INDICATE THE PERCENTAGE OF COMMUNITIES IN A PROJECT AREA THAT IDENTIFIED A SERVICE. FOR INSTANCE, IF 100%, IT MEANS THAT ALL COMMUNITIES IN THAT PROJECT AREA MENTIONED THAT PARTICULAR SERVICE.

communities included energy & construction, education, health and markets. Services such as river access, salt extraction and fisheries were only mentioned in one project area as these are location specific.

Based on the survey conducted at 166 communities across the 37 project areas (Table 2), water and grazing land were the two most frequently mentioned ecosystem services by the communities (Figure 23). In many of the BRCiS III project areas, these two services were mentioned in 100% of the communities. In addition, about half of the communities (clustered in specific regions) mentioned farming land as one of the priority resources they relied on. Furthermore, a few communities prioritized non-timber forest products or construction materials derived from batches of forests. Interestingly, other services identified by the

Grazing, water and food provision were the most commonly identified ecosystem services.

communities included energy & construction, education, health and markets. Services such as river access, salt extraction and fisheries were only mentioned in one project area.

As expected, the average level of access to ecosystem services was higher during the wet season (Figure 24). Almost all project areas experienced few access limitations and communities were able to utilise sufficient resources during the wet season. However, this is should not be interpreted as an overly optimistic picture of the quality and sustainability of these services. Typically, there is a difference between simply having access to ecosystem services and the adequacy or reliability of that access. Furthermore, degradation and resource competition and environmental variability influence the quality of available ecosystem services.

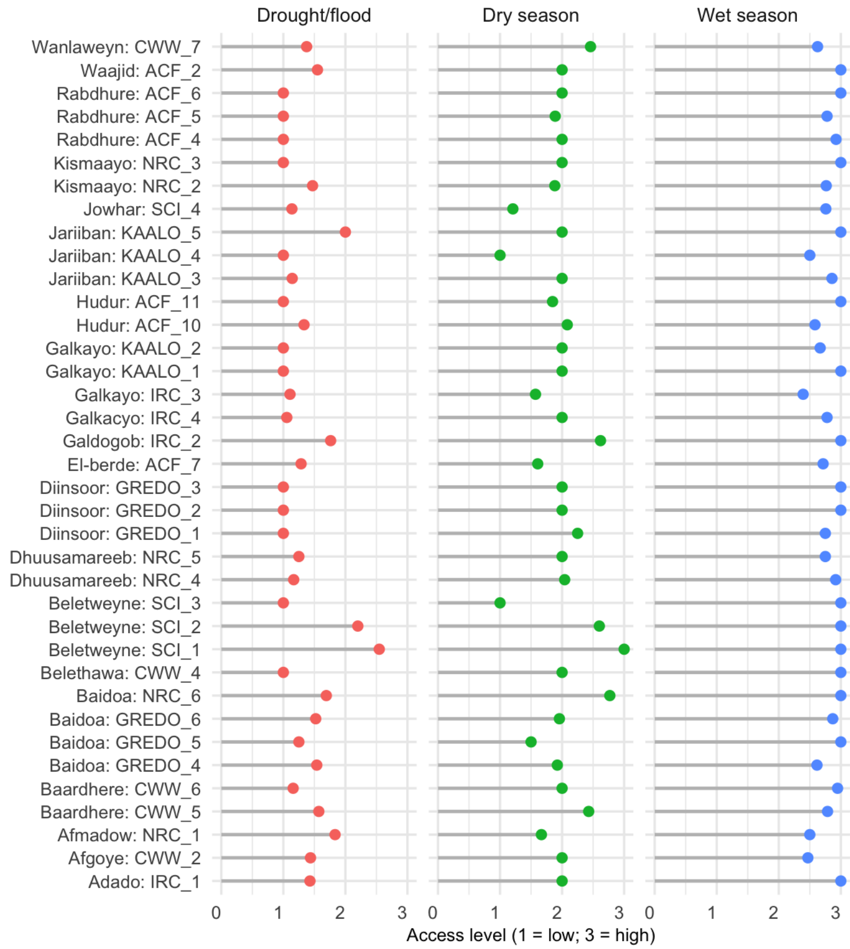


FIGURE 24: ACCESS TO ECOSYSTEM SERVICES PER PROJECT AREA DURING DROUGHT/FLOOD, DRY SEASON AND WET SEASON. ACCESS LEVELS WERE AGGREGATED TO PROJECT AREA LEVEL BY AVERAGING THE COMMUNITY RESPONSES FOR ALL IDENTIFIED ECOSYSTEM SERVICES BY PROJECT AREA AND SEASON. DEFINITIONS: LEVEL 1: "LIMITED OR RESTRICTED ACCESS TO MOST SERVICES", LEVEL 2: "ACCESS TO SOME, BUT NOT ALL ESSENTIAL SERVICES", LEVEL 3: "UNRESTRICTED ACCESS TO MULTIPLE CRITICAL ECOSYSTEM SERVICES".

During a 'normal' dry season, ecosystem services were still accessible in most project areas, although with more restrictions in terms of quantity, frequency and/or quality of access. There were considerable variations in access during a normal dry season as some areas experienced no restrictions in terms of access to ecosystem services (e.g. *"Beletweyne: SCI_1"*) while others were severely restricted to access ecosystem services during the dry season (e.g. *"Jariiban: KAALO_4"*). During periods of drought/flood, access deteriorated for all project areas and almost all communities faced severe restrictions in accessing the ecosystem services they relied on. However, it is important to differentiate how these two types of climate extremes. Each affects the availability and accessibility of ecosystem services differently. Droughts reduce the availability of key provisioning services, such as water for drinking, irrigation, and livestock. Rivers, wells, and other water sources dry up or diminish significantly, or reduce in quality. Drought reduces the productivity of rangelands and triggers crop failures. Flooding damages infrastructure like wells, irrigation systems, and roads, further limiting access to water and other services. Standing water from floods harms crops, washes away topsoil, and increases the prevalence of waterborne diseases.

Provided that Somalia frequently experiences mild or severe droughts as well as mild or severe flooding, the perception of dry season and drought should be explored in more detail with the communities to give further insights in the interpretation of these numbers. Nevertheless, Figure 24 does show the precarious situation at many of the project areas as a 'normal' dry season poses considerable restrictions on the accessibility of key ecosystem services.

Communities experienced fewer access restrictions to ecosystem services during wet season. Accessibility declined during dry season and even more in periods of drought and flood.

2. LIVESTOCK MIGRATION

Livestock migration plays an important role in community resilience. Though, it is challenging to estimate livestock numbers as significant numbers of livestock are on the move during large parts of the year. Hence, to estimate livestock dynamics, temporary and permanent migration numbers into the community areas were recorded through the community survey. However, estimation errors or community-specific factors that result in inaccurate reporting is especially common in the livestock sector.

We distinguish between temporary and permanent migration. With temporary migration we refer to transhumance. Herders move livestock seasonally in search of pasture and water. This is a common resilience strategy for pastoralists and ensures resource utilization across a wide area. Permanent migration

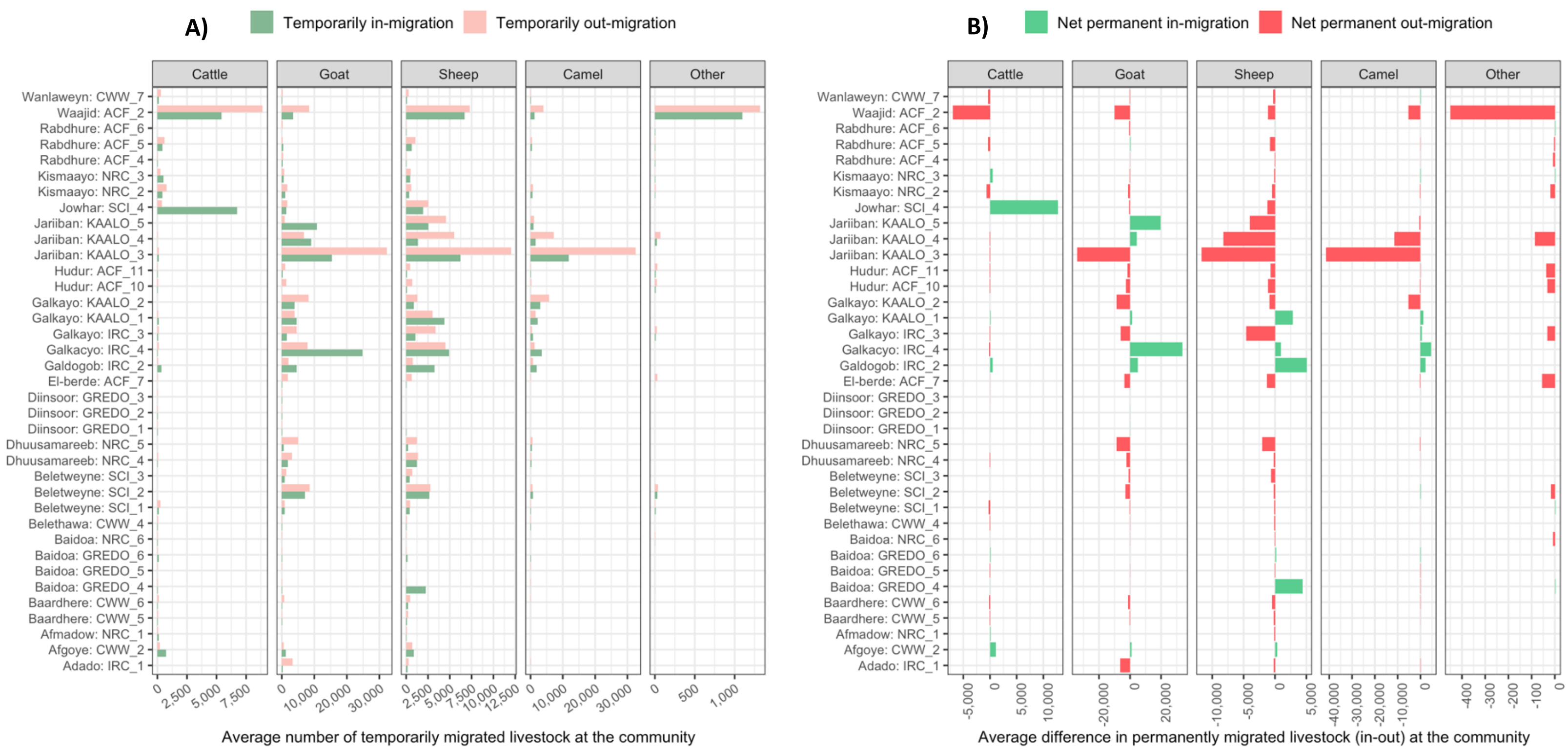


FIGURE 25: AVERAGE LIVESTOCK MIGRATION IN/OUT THE COMMUNITIES PER PROJECT AREA. A) AVERAGE NUMBER OF TEMPORARILY MIGRATED LIVESTOCK IN AND OUT THE COMMUNITY IN THE YEAR 2023. B) AVERAGE DIFFERENCE IN PERMANENT LIVESTOCK MIGRATION (IN-MIGRATION MINUS OUT-MIGRATION) AT THE COMMUNITIES DISPLAYED BY PROJECT AREA.

indicates structural changes in livestock presence. Drivers of such structural change include mortality, destocking (forced sale of animals) or displacement of herders due to resource scarcity, natural disasters or conflict. Theoretically, permanent migration could also reflect shifts in ownership of livestock.

In many cases, permanent out-migration numbers were higher than the in-migration numbers indicating a general decline in livestock migration in the project areas (Figure 25A). In cases among BRCIS III communities where this happens, a lack of available resources could drive this out-going trend and, additionally, this suggests that livestock populations were larger than local ownership suggested which could affect grazing and water needs. Similarly, permanent out-migration exceeded permanent in-migration in many project areas (Figure 25B). For cattle, in-migration and out-migration appeared to be in balance, but this was not the case the other livestock types. Permanent out-migration of goat, sheep, camel and other livestock exceeded in-migration in most of the project areas. Interestingly, temporarily migration numbers of cattle were highest in southern Somalia (e.g. SCI, ACF), while goat, sheep and camel migration were highest in the more northern arid regions (e.g. KAALO, IRC). We would consider our findings on livestock dynamics as anecdotal evidence, and clarity on this phenomenon will require a more systematic livestock mobility monitoring approach.

Goat, sheep and camel migration numbers were higher in the arid, more northern regions of Somalia (e.g. KAALO, IRC) compared to the more southern project areas, as expected.

3. CONFLICTS

Conflict, in the context of this baseline report, refers to disputes or clashes over resources, types of land use, or disputes that result from social grievances that can escalate into violence, injury or fatalities. Conflict triggers refer to immediate reasons that spark a dispute. Conflict triggers are typically related and are path dependent. The focus is on conflict triggers in relation to ecosystem services. Across the surveyed BRCiS III communities, conflicts were a pervasive issue, with water being the most frequent trigger of disputes (Figure 26). The second most common source of conflict stemmed from tensions between farmers and livestock owners over resource use and land management.

While the category „others“ remains unspecified, clan-based conflicts and insurgencies are mentioned less frequently - although they typically result in higher levels of fatalities and injuries.

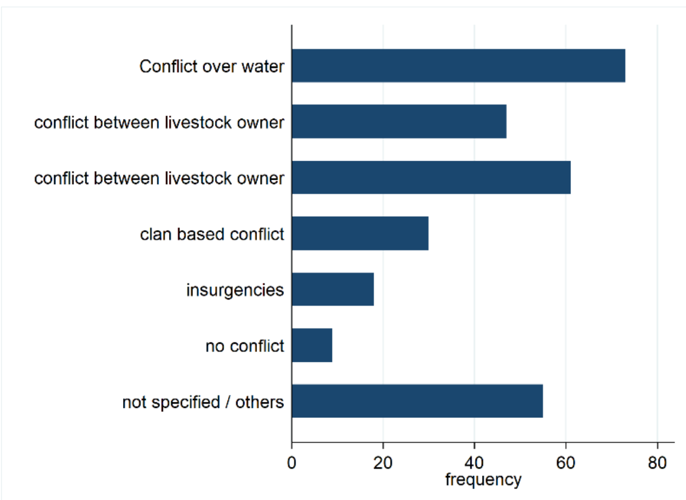
Most interviewed communities observed a decrease in conflict incidents over the past year (2023) (Figure 26). However, the intensity and impact of conflicts varied significantly across BRCiS III project areas. During the time of data collection, some locations, such as "Beletweyne: SCI_3," reported over 100 injuries and close to 100 fatalities, highlighting the severe toll conflicts can take on specific communities (Appendix B: Figure 35).

Although the survey data provides important insights about conflict triggers, additional in-depth research is necessary to unpack the complex interplay between resource scarcity, seasonal variations, and local conflict dynamics in a qualitative manner. Also, the link between resource availability, seasonal pressures, and conflict dynamics requires further investigation. Both can only be done on a case-by-case basis.

One is to adopt a conflict-sensitive approach to planning restoration that acknowledges the complex interplay between resource availability such as water and social tensions. Thus, interventions aimed at restoring ecosystem services must ensure equitable access to these (and future) resources and address potential grievances and avoid favoritism toward specific groups or single actors.

Interventions such as establishing water points or grazing corridors must be designed with the input of all actors to prevent exacerbating existing tensions.

At the same time, conflict-specific measures to restoration have the potential to help creating stability "through the backdoor". Such restoration measures could include supporting community-led resource management arrangements through farmer cooperatives, facilitating agreements on resource sharing along riverrine, and engaging traditional and formal governance systems can make use of shared ecosystems as platforms for peacebuilding and peacekeeping. Data suggest that water, land and grazing rights are such resources around which resource negation platforms could be established.



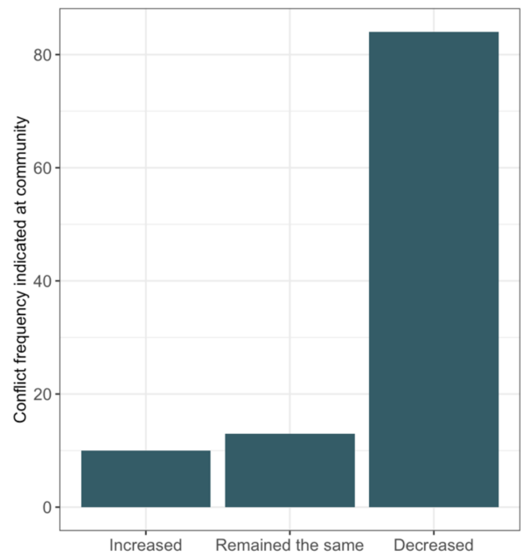


FIGURE 26: LEFT: DRIVERS OF CONFLICT AS MENTIONED DURING THE SURVEY IN THE COMMUNITY. MUTLIPLE DRIVERS COULD BE IDENTIFIED PER COMMUNITY. RIGHT: TREND IN CONFLICT FREQUENCY/OCCURANCE AS IDENTIFIED AT THE COMMUNITY LEVEL OVER THE YEAR 2023.

C. REMOTE SENSING-BASED INDICATORS

1. SOIL & VEGETATION

Through remote sensing and machine learning (methods: III.D.1) various soil and vegetation properties were predicted for the 37 project areas in the BRCiS III programme (Figure 27-Figure 30). For comparison purposes, the same soil and vegetation properties were predicted for three counties in northern Kenya (Samburu, Marsabit and Isiolo) using the same machine learning models. These counties were selected due to their aridity and relative proximity to Somalia.

Soil Organic Carbon (SOC) is an important indicator of soil health (Table 3). Low SOC (< 10 g/kg) is related to aridity or degradation while areas with higher SOC (> 15 g/kg) are considered as carbon-rich environments in the context of the project landscapes. Across the project areas, SOC contents ranged between 2.5 g/kg to around 15 g/kg (Figure 27). Relative to northern Kenya, these SOC concentrations are on the low but, generally, in a similar range (Figure 27). Though, soil carbon levels in Samburu and Marsabit do exceed the levels in the majority of the BRCiS III project areas. The lowest SOC concentrations were found for the areas of IRC and KAALO where the SOC generally did not exceed 5 g/kg which is extremely low. Most of the project areas were characterised by either extremely low SOC (< 5 g/kg) or low SOC (5-10 g/kg). Only in *"Baidoa: GREDO_6"*, *"Rabdhure: ACF_4"* and *"Baidoa: GREDO_4"* the median SOC exceeded 10 g/kg. Additionally, there was much less variation in SOC in the SOC-poor areas (e.g. *"Galkacyo: IRC_3"*) indicating that these areas were rather homogenous. Areas with higher SOC content showed much more

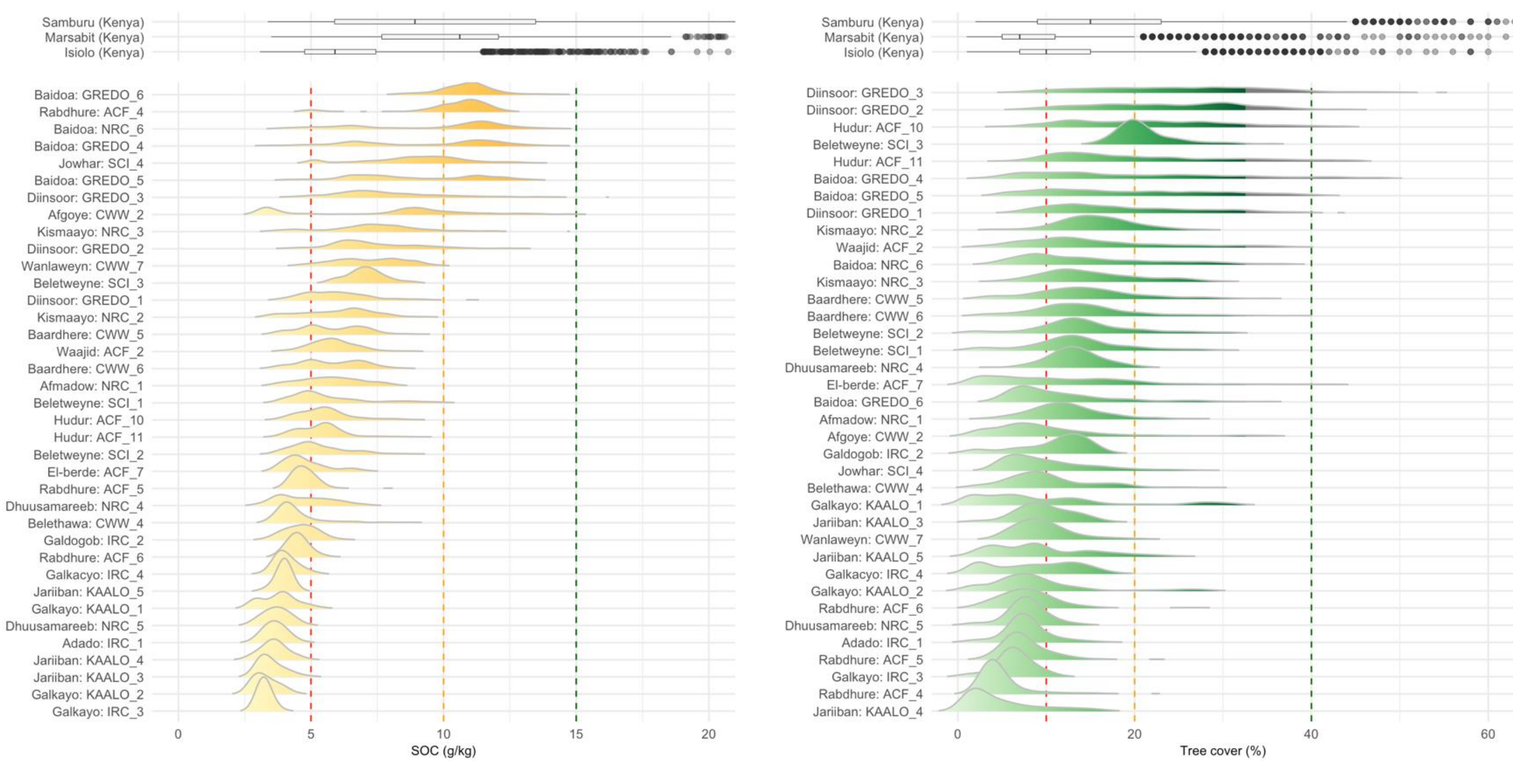


FIGURE 27: RIGHT: THE DISTRIBUTION OF SOC (G/KG); LEFT: DISTRIBUTION OF TREE COVER (%) PER PROJECT AREA. THE BOXPLOTS ABOVE THE DENSITY PLOTS FUNCTION AS REFERENCE.

variation (e.g. *"Afgoye: CWW_2"* and *"Jowhar: SCI_4"*) where the SOC ranged from 3-15 g/kg and 5-14 g/kg, respectively, indicating a more heterogenous landscape (Figure 28).

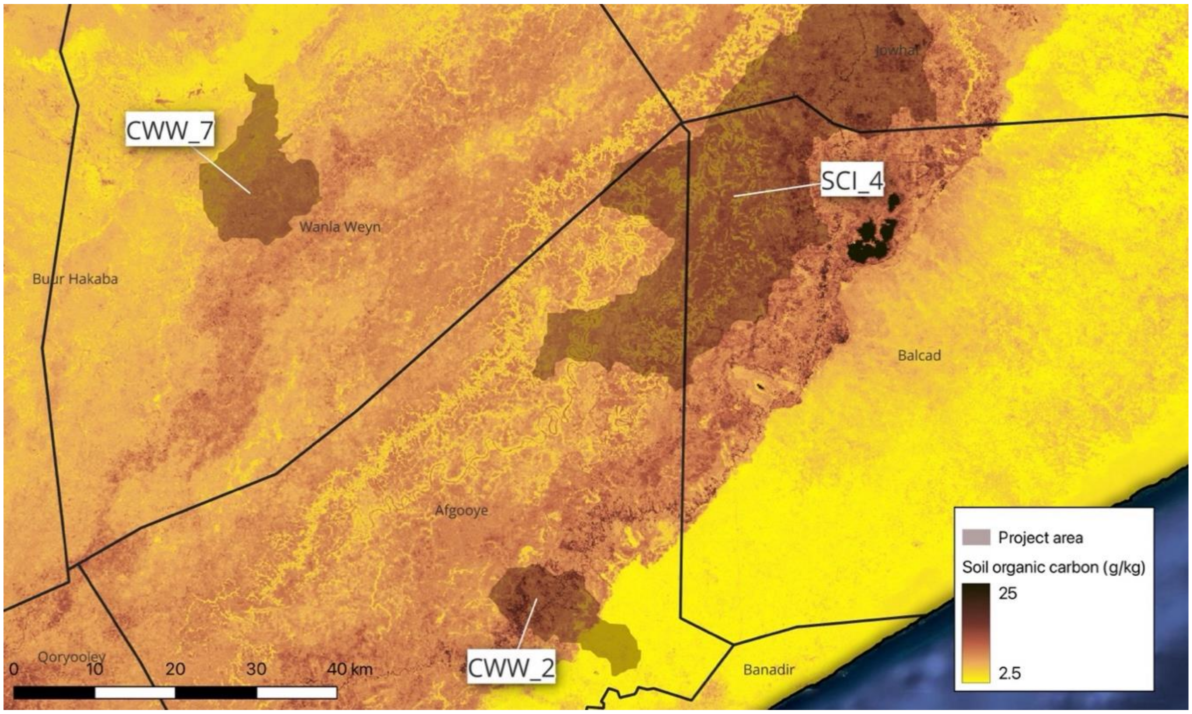


FIGURE 28: ZOOMED IN EXAMPLE OF HIGH VARIATION IN SOC AROUND THE AFGOYE, BALCAD JOWHAR REGIONS.

Tree cover was generally low in the areas surveyed and in the produced maps given the high aridity in the region (Figure 27). Forests are rare throughout the country, especially closed-canopy forests. Hence, tree cover exceeding 40% can be considered high in Somalia. Many of the project areas, though, had a median tree cover below 10% tree cover which is considered very low. Several areas (e.g. *"Baardhere: CWW_5"*) were predicted to have a median tree cover between 10-20% and only three areas (*"Hudur: ACF_10"*, *"Diinsoor: GREDO_2-3"*) showed above moderate tree coverage (median > 20%). Such tree cover is comparable to the northern Kenya region of Samburu, while lower median tree cover was observed in the Kenyan counties of Isiolo (< 10%) and Marsabit (~ 10%).

Grass cover is important in dryland systems to store carbon and prevent soil erosion. Grass coverage in the project areas was generally low as most of the areas had between 5-20% grass cover (Figure 29). In some of the GREDO, ACF and NRC project areas, the median grass coverage exceeded 20%, while some parts of *"Baidoa: GREDO_4-6"* and *"Baidoa: NRC_6"* showed grass cover above 40%. Compared to the region, these herbasceous cover rates are very low. In the northern counties of Kenya, which are also largely arid, median grass coverage tended to be higher, particularly indicated by a median grass cover of 48% in Marsabit which is higher than any of the BRCiS III project areas.

Soil erosion is a big issue in sub-Saharan Africa. Eroded soils release CO_2 to the atmosphere and can only store limited amounts of carbon (Abdalla et al., 2018; Dlamini et al., 2014). Hence, erosion prevention and restoration are important steps to improving ecosystem health and fighting climate change. In arid systems like Somalia, a healthy herbaceous layer can reduce erosion as the vegetation protects the soils against disturbances. Given the low vegetation cover (grasses and trees) in Somalia, erosion prevalence was high

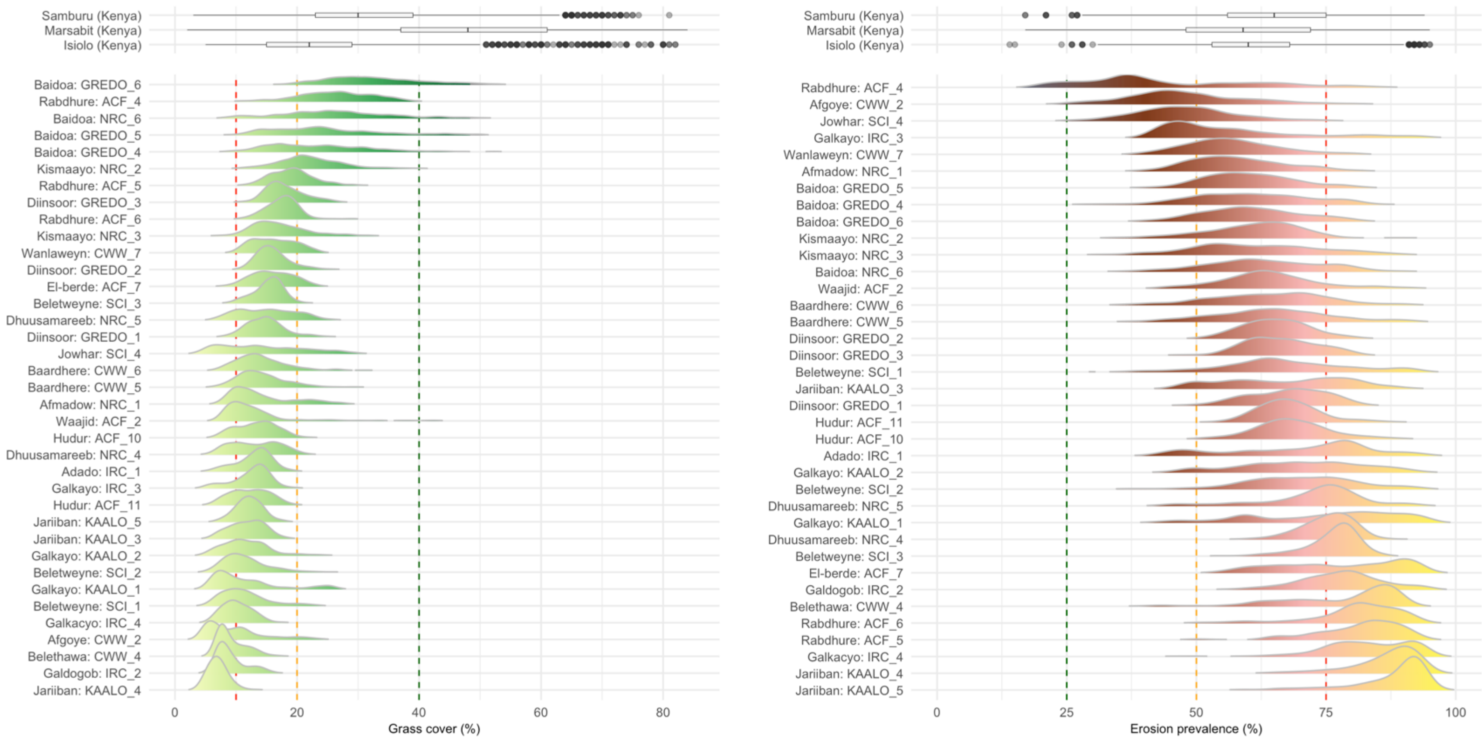


FIGURE 29: RIGHT: THE DISTRIBUTION OF GRASS COVER (%); LEFT: DISTRIBUTION OF EROSION PREVALENCE (%) PER PROJECT AREA. THE BOXPLOTS ABOVE THE DENSITY PLOTS FUNCTION AS REFERENCE.

throughout the country. Within the LDSF methodology, erosion was assessed visually on the ground by identifying the presence of either sheet, rill or gully erosion. Based on such ground observations, erosion was modelled for Somalia which showed that median erosion rates in most of the project areas exceeded 50% which is considered high (Figure 29). In *"Jariiban: KAALO_5"* area, for instance, erosion prevalence was extreme with almost the entire area experiencing erosion above 90%. Only four regions in the project area displayed a median erosion prevalence below 50% which is considered as moderate. Hence, soil and water conservation are critical for enhanced resilience of the project areas given the projected increases in extreme weather events in the region. While these rates are considered high, they are comparable to erosion rates in northern Kenya where the median erosion prevalence is around 65%.

pH is an indicator of soil acidity or alkalinity. Soils are considered acidic when pH < 5.5 and considered alkaline when pH > 7.5. While acidic soils can be neutralised relatively easily, alkaline soils are harder to neutralise as they require a combination of minerals to be applied. Hence, alkaline soils can be a constraining factor for land restoration. From Figure 30, we see that acidic soils are rare in the project areas. Only small parts of a few project areas (e.g. *"Jariiban: KAALO_3"*) are considered acidic. Alkalinity is more prevalent throughout the project areas, which is expected given the level of aridity. Seven project areas had median pH values above 7.5 and were, hence, largely considered alkaline. Vegetation growth in these areas can be difficult due to a reduced availability of nutrients. The arid northern regions of Kenya also tend towards alkalinity , but less than some of the BRCiS III project areas.

The **change in EVI (2000-2023)** provides an indication of the medium-term vegetation trends at the various project areas. In case of vegetation loss during the last two decades, the EVI would display a negative trend (< 100%) while in case of increased vegetation cover, we would see a positive trend (> 100%). Large parts of *"Kismaayo: NRC_2-3"* showed considerable negative EVI trends (Figure 30). These areas are located near *Kismaayo* (Figure 2) where there have been high rates of increased human settlement in the last two decades. This poses a likely cause of the declining trend in EVI. Most of the other project areas displayed a rather normal distribution of EVI change centred around 100%, which indicates that, generally, not a lot has changed in terms of the EVI in those areas. A few areas, such as *"Hudur: ACF_10"*, indicated an increase in vegetation over the last twenty years which can be driven by either climatic or anthropogenic factors.

Across the project areas, soil and vegetation indicators showed a, generally, arid and degraded landscape indicated by a low median SOC (5.2 g/kg), low average tree and grass cover (13% and 15%) and a high average erosion prevalence (67%).

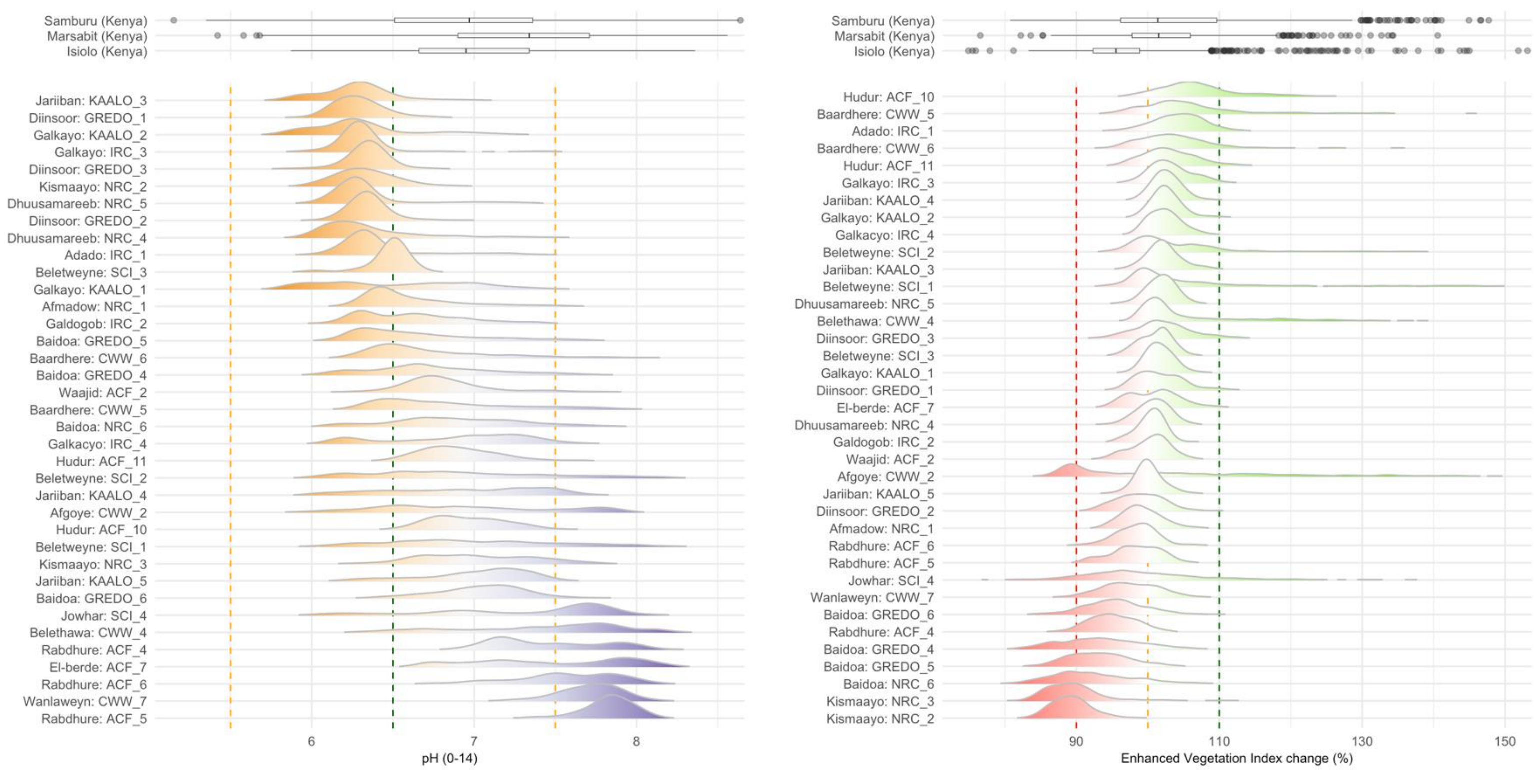


FIGURE 30: RIGHT: THE DISTRIBUTION OF PH AND LEFT: DISTRIBUTION OF EVI CHANGE (%) PER PROJECT AREA. THE BOXPLOTS ABOVE THE DENSITY PLOTS FUNCTION AS REFERENCE.

2. CLIMATE

Annual average precipitation across the project areas in Somalia was low, ranging between 100-300 mm (Figure 31). Most of the project areas with extremely little precipitation (~100 mm), attributed to KAALO and IRC, are located in the north of the country. Variation in precipitation was generally very low across the areas, which was indicated by the small confidence intervals around the mean. The wettest areas received around 300 mm annually and were mainly located in the middle of the country, at higher altitudes. Average daytime temperatures were high across the project areas and ranged between 36-43 °C. In some areas, annual temperatures varied up to 2 °C in each direction (e.g. *"Baidoa: GREDO_4"*), while variability was low in many other project areas (e.g. *"Rabdhure: ACF_6"*).

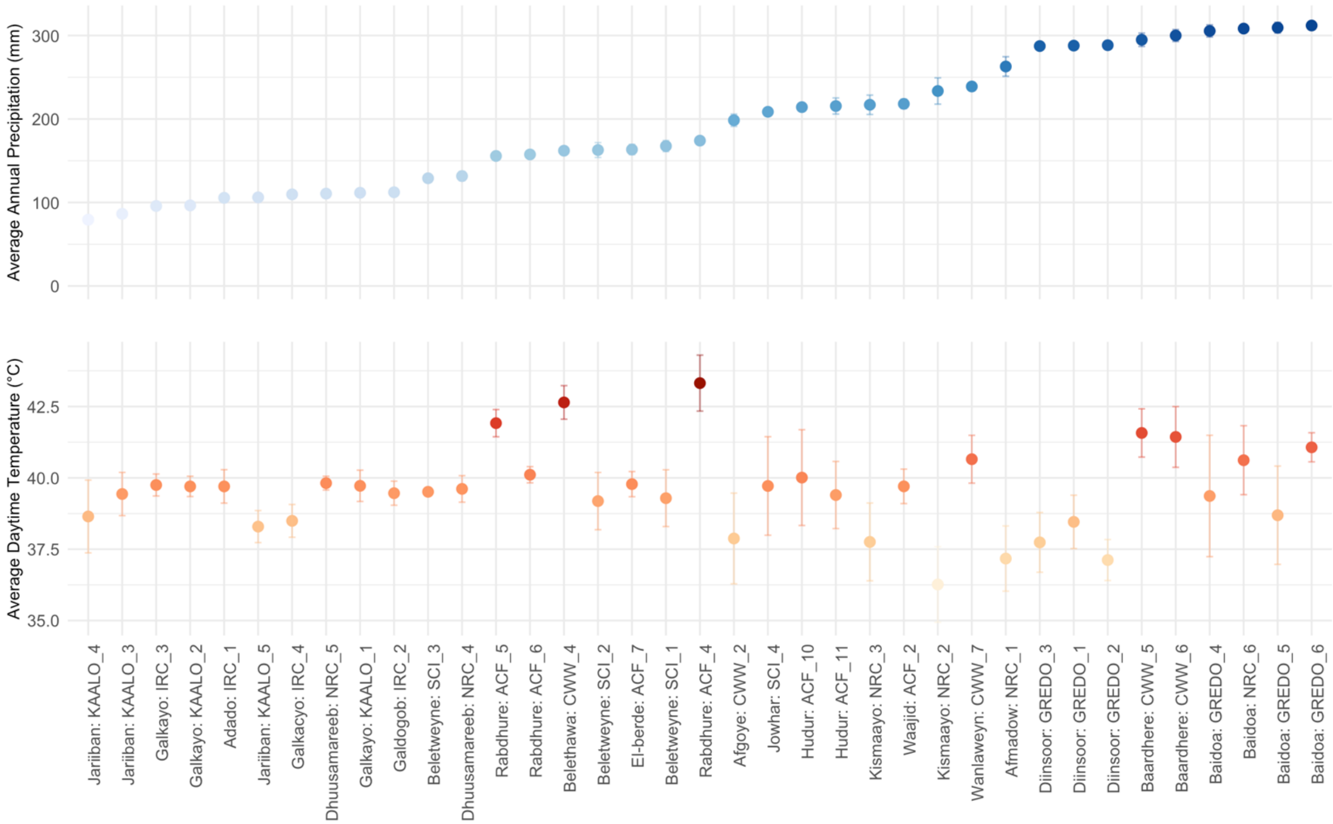


FIGURE 31: CLIMATIC PROPERTIES AT THE PROJECT AREA LEVEL. TOP: AVERAGE ANNUAL SUM OF PRECIPATION (MM) AT THE PROJECT AREAS OVER THE YEARS 2001-2023 DERIVED FROM THE GPM SATELLITES. BOTTOM: AVERAGE DAYTIME TEMPERATURE AT THE PROJECT AREAS OVER THE PERIOD 2001-2023. TEMPERATURE ESTIMATES ARE DERIVED FROM MODIS SATELLITE.

D. ECOSYSTEM CLUSTERING

Based on five remotely sensed indicators (SOC, erosion, grass cover, tree cover and precipitation), a model-based clustering was performed to find clusters in the data. Three clusters were identified and classified based on degradation level (Figure 32).

Moderately degraded – This cluster showed the highest SOC contents ranging between 7-11 g/kg (Figure 32). While these levels can be considered high in the Somalia context, these concentrations are generally regarded as low. Erosion was prevalent in this group, generally around 50-65%, but less prevalent than in the other two clusters. Likewise, tree cover and grass cover were comparably high, ranging between 10-30% and 15-25% respectively. Annual average precipitation generally ranged between 200-300 mm.

Degraded – This cluster is characterised by very low SOC contents ranging between 3-6 g/kg (Figure 32). Here, erosion was very prevalent (60-75%) and grass and tree cover generally did not exceed 20%. In this group, precipitation levels were moderate for Somalia ranging between 150-300 mm per year. These combined indicators suggest a degraded ecosystem as, even though the precipitation was relatively high, SOC contents were very low, and erosion was high. This indicates that, based on these precipitation levels, higher ecosystem health should be possible in this group.

Highly degraded – The highest level of aridity and degradation was found in this group (Figure 32). This group displayed extremely low SOC which generally did not exceed 4 g/kg. Erosion was extremely high (80-90%) and tree cover, generally, did not exceed 10%. Grass cover was low as well (8-18%), but comparable to the *degraded* cluster. This group was considerably distinct from the *degraded* group in terms of rainfall. Median rainfall in this group was around 100 mm annually, which considerably less than the other two

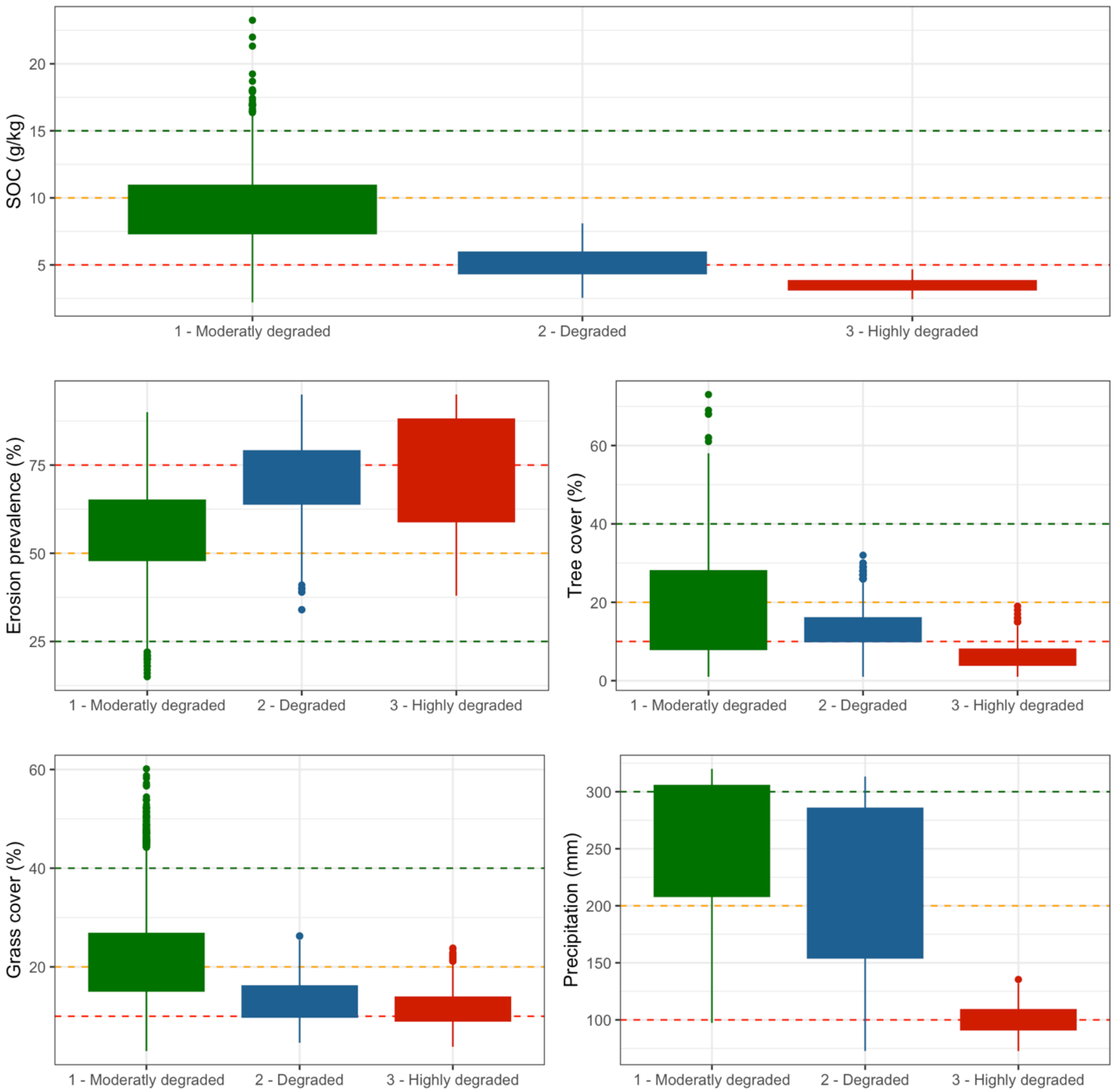


FIGURE 32: THREE CLUSTERS AS A RESULT OF THE MODEL-BASED CLUSTERING. THE *MODERATELY DEGRADED* CLUSTER (GREEN) HAS MODERATE SOC LEVELS, HIGH EROSION, MEDIUM TREE/GRASS COVER AND MEDIUM PRECIPITATION. THE *DEGRADED* CLUSTER (BLUE) HAS LOW SOC, GRASS AND TREE COVER, VERY HIGH EROSION AND LOW-MEDIUM PRECIPITATION. THE *HIGHLY DEGRADED* (RED) CLUSTER HAS EXTREMELY LOW SOC, GRASS COVER, PRECIPITATION AND EXTREMELY HIGH EROSION AND LOW TREE COVER.

groups. These low precipitation levels could become a constraining factor to active restoration such as tree planting.

After these clusters were identified, we predicted the probability for each pixel of belonging to any of these clusters (Figure 34). The result was a map which shows the probability of a pixel being *moderately degraded*, *degraded* or *highly degraded*. Figure 34 shows the resulting map for Somalia which shows *moderately degraded* as green, *degraded* as blue and *highly degraded* as red. Least degraded areas are generally in the middle of the country and along the Southern coast. Degradation, as well as aridity, is higher in Northern Somalia, especially at the Northeastern part of the country.

Figure 33 shows the extracted degradation groups for each project area. It shows the occurrence of each degradation level within each project area and, hence, provides an overview of the general ecosystem health in the area. The project areas *"Baidoa: GREDO_6"* showed the least degradation as almost the entirety is *moderately degraded* and almost no areas are *degraded* or *highly degraded*. Generally, most project areas that fall under the responsibility of GREDO were characterised by relatively low degradation. The Baido area has been subject to high levels of insecurity for many years, which has led people to move out of the region. This has decreased the human pressure in the region and could partially explain the lower degradation levels in the region. Other project areas had more heterogeneity in the observed degradation levels where parts of the project area were *moderately degraded,* and parts were *degraded* (e.g. *"Afgoye:*

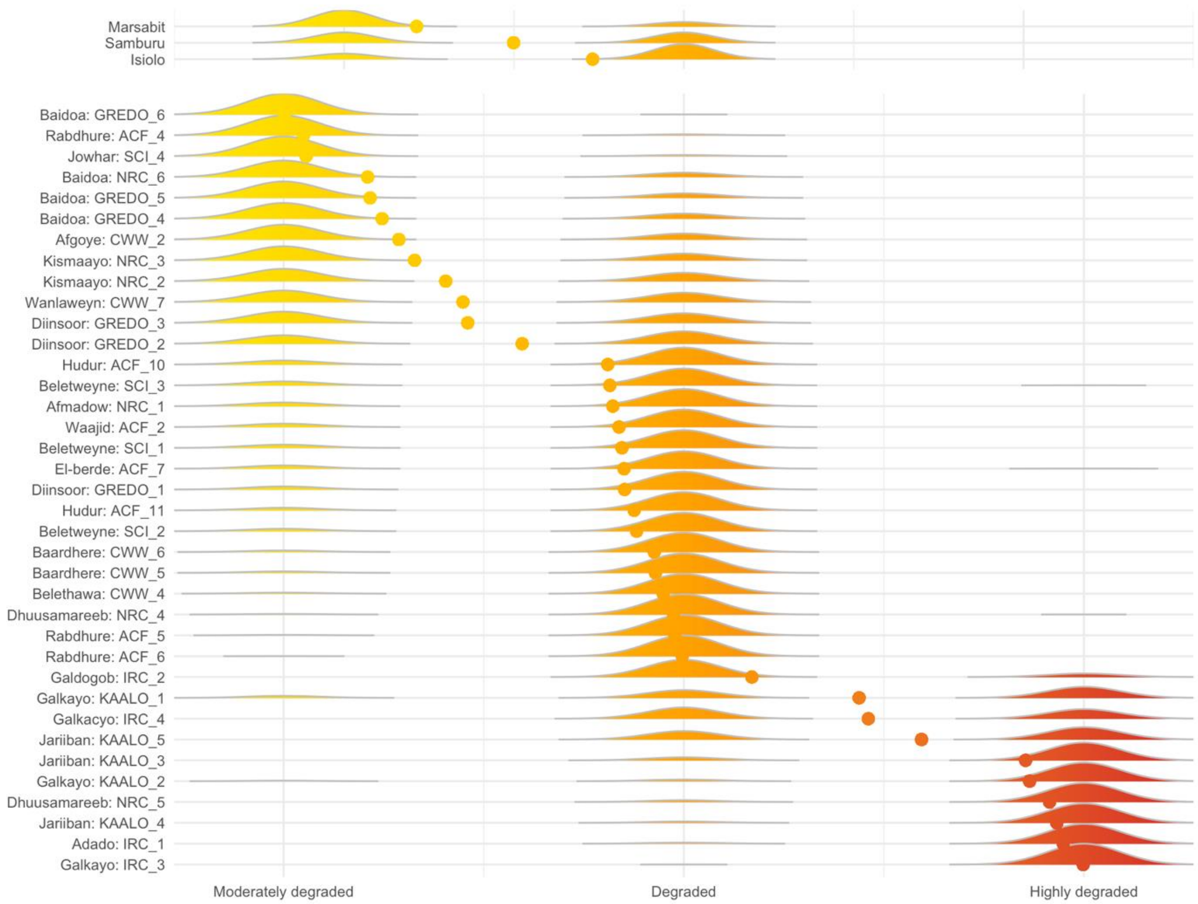


FIGURE 33: OCCURANCE OF THE THREE DEGRADATION GROUPS AT EACH PROJECT AREA. THE DOTS INDICATE THE AVERAGE DEGRADATION LEVEL PER PROJECT AREA (GREEN = MODERATELY DEGRADED, ORANGE = DEGRADED, RED = HIGHLY DEGRADED).

CWW_2"). Many of the project areas in Northern Somalia, under the responsibility of KAALO IRC and ACF, were either *degraded* or *highly degraded*. It worth noting that the modelled degradation at the project areas correlates strongly with the aridity in the region. Hence, the degradation levels, as modelled in this assessment, represent partly a natural state of aridity and represent partly a state degradation in the region.

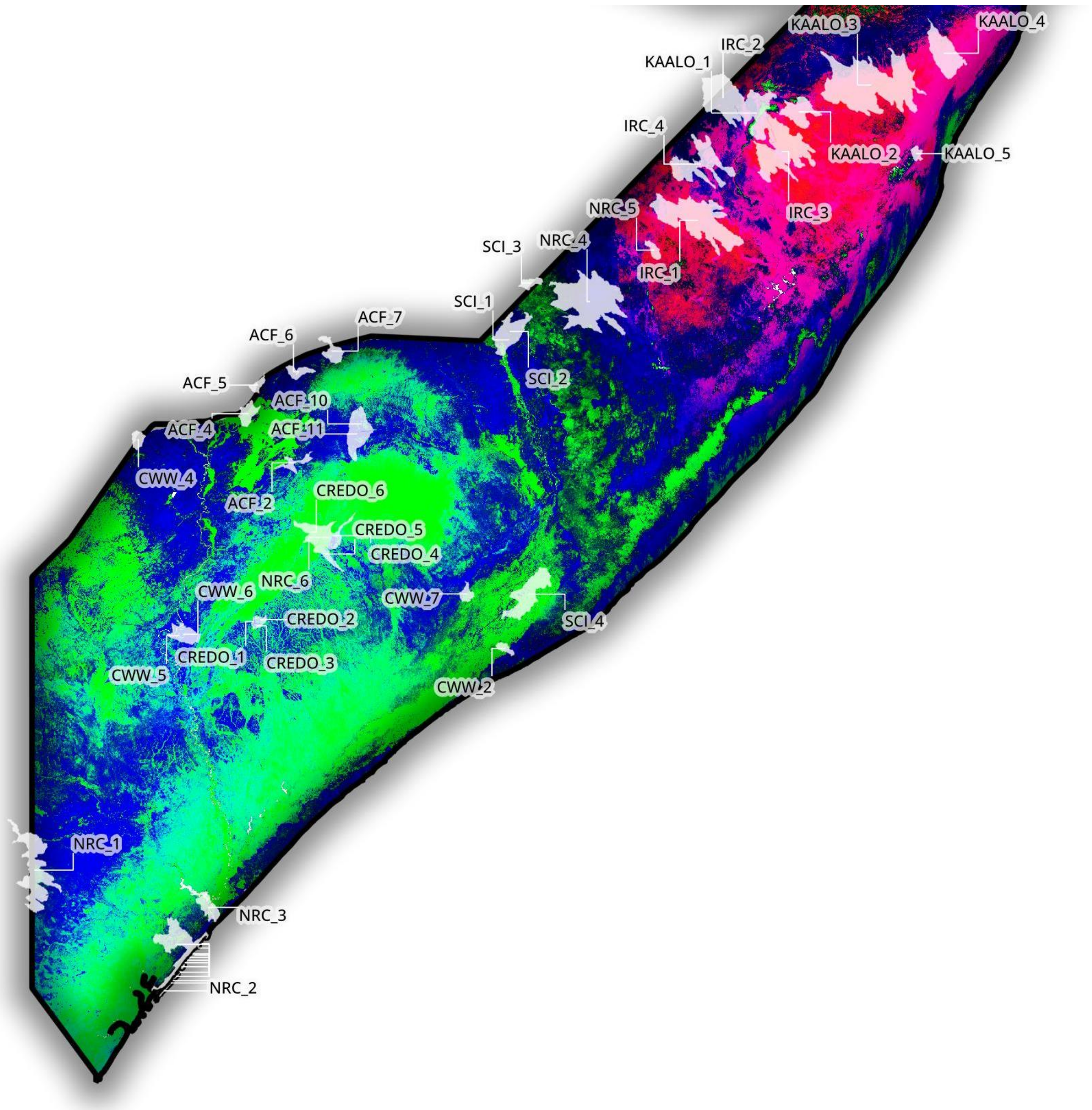


FIGURE 34: FALSE COLOR RGB COMPOSITE BASED ON THE PREDICTED PROBABILITY OF THE DEGRADATION CLUSTERS. GREEN=*MODERATELY DEGRADED*, BLUE=*DEGRADED*, RED=*HIGHLY DEGRADED*.

V. DISCUSSION & RECOMMENDATIONS

This report provides an overview of the current state of land health in the various BRCiS III project areas. The high levels of land degradation across the project areas, stress the need for the implementation of land restoration efforts across the programme. Degraded lands are less productive, more vulnerable to floods and droughts, have a lower carbon sequestration potential and emit higher levels of CO_2 to the atmosphere (Abdalla et al., 2016; Dlamini et al., 2014). Driven by extreme weather events, extensive grazing and land use changes, high rates of soil erosion cause an overall degradation of the landscape across sub-Sahara Africa. Hence, grazing management and erosion control measures have been identified as effective pathways to reduce erosion, sequester carbon and increase productivity (Koka et al., 2024; Malepfane et al., 2022). Additionally, the establishment of enclosures can reduce the stress on the land and allow vegetation regrowth to occur. Particularly, in combination with reseeding, enclosures can increase the recovery of vegetation and have been found to be an effective restoration technique in semiarid landscapes (Mureithi et al., 2014). It is important to note that sufficient precipitation is required for some erosion control and water harvesting measures, such as soil bunds and active grass reseeding (Knoop et al., 2012). Other erosion control measures, such as gully plugging and water-spreading weirs, have been found useful in highly degraded, low-precipitation areas as measures to reduce the water flow, reduce gully formation, and encourage sediment deposition (Frankl et al., 2021; Getnet et al., 2022).

How to translate the baseline data into practical restoration action, however, should be designed in collaboration with BRCiS Members. Thus, as a starting point for the forthcoming conversation about how to design practical actions, we summarised our conclusions in a few strategic actions. We focus on the three broad ecosystem groups, based on bio-physical and climatic properties, that are present in the project areas (Figure 32). Below we discuss various implications at the different degradation groups and potential restoration approaches that can be considered.

Restoration of areas moderately degraded (group 1): These areas displayed the lowest degradation across the project areas and are characterised by relatively high SOC contents (7-11 g/kg), tree/grass cover, precipitation (200-300 mm) and relatively low erosion (50-65%) (Figure 32). Though, in absolute terms, the SOC levels can be considered low, and erosion high. Given the high erosion prevalence, erosion control measures, such as soil bunds, could be beneficial in these areas. Precipitation levels exceeding 200 mm are considered for soil bunds (Knoop et al., 2012). Additionally, given the high erosion, yet moderate SOC contents, one could consider active reseeding to improve grass cover which can decrease erosion and increase SOC over time. The relatively high tree cover indicates that the ecosystem can support some extent of tree growth making the planting of drought-tolerant trees a potential option in the areas with higher SOC contents and sufficient precipitation. Though, for some areas, the combination of medium tree cover and low SOC could indicate the presence of invasive species in which case invasive species removal should be considered. Furthermore, grazing management should be considered in areas with high livestock numbers and high erosion rates.

Restoration of degraded areas (group 2): In this group, erosion levels were high, while SOC contents and grass cover were low (Figure 32). Though, precipitation levels were moderate but varied widely in this group (150-270 mm) meaning that some areas could sustain active restoration. Hence, in the areas with higher precipitation, seeding exercises in combination with soil erosion control measures, such as soil bunds, could help restore the grass cover while reducing the erosion prevalence. Lastly, given the high erosion rates, grazing management could be an effective option in regions where high livestock numbers are present. To achieve this, enclosures could be important to protect the area from freegrazers.

Restoration of highly degraded areas (group 3): This class was highly degraded with very little available rainfall. Active restoration like reseeding and tree planting is difficult to realise due to the degraded nature of the area and the very low rainfall levels which do not exceed 125 mm annually (Figure 31). Such low precipitation levels, make the establishment of soil bunds in this area not preferred (Knoop et al., 2012). Passive restoration practices, such as grazing management, the establishment of enclosures and fire management could pose effective restoration pathways. Such interventions could reduce stress on the soil and allow native vegetation to recover through natural regeneration. Particularly, as livestock migration numbers in these arid regions were considerable (Figure 25), planned grazing could prove an effective pathway to reduce soil erosion and increase carbon sequestration. This is further supported by the LDSF data, which suggested lower erosion prevalence in areas where grazing management was applied in Somalia (Figure 22).

A. PROJECT AREA SPECIFIC RECOMMENDATIONS

The project areas were divided under the seven BRCiS consortium members which are located across Somalia. As the members operate in geographically distinctive areas, the bio-physical and climatic conditions were considerably different across the members:

ACF

Albeit located relatively close to each other (Figure 2), the project areas that fall under Action Against Hunger displayed a diverse set of ecosystem characteristics. *"Rabdhure: ACF_4"* is located in a riverine area with higher vegetation cover and, as a result, this area showed relatively high SOC (~10-15 g/kg), high grass cover (~20-35%) and low erosion prevalence (median ~37%) (Figure 29). The other areas under ACF showed higher levels of degradation (Figure 33) with median SOC contents around 6 g/kg (*"Waajid: ACF_2"*, *"Hudur: ACF_10"*, ACF_1) or even lower in *"Rabdhure: ACF_5-6"* and *"El-berde: ACF_7"* (~3-4 g/kg) (Figure 27). Erosion in these areas generally exceeded 70% and was particularly high in *"Rabdhure: ACF_5"* (~90%). Relative to Somalia, precipitation levels were moderate in these areas ranging from around 160 mm/year in *"Rabdhure: ACF_5"* to 220 mm/year in *"Waajid: ACF_2"* (Figure 31). Most communities in these project areas identified grazing, water and farming as the key ecosystem services they relied on (Figure 24). As farming is an important livelihood in this region, the restoration of farmlands should be considered through, for instance, water retention and erosion control measures such as soil bunds. Additionally, at the very eroded areas (e.g. *"Rabdhure: ACF_5"*), erosion control measures, such as gully plugging, could be an effective strategy. Lastly, livestock (out)-migration numbers were high in *"Waajid: ACF_2"* (mainly cattle and sheep) (Figure 25) while median erosion levels were high as well (~70%) (Figure 29). Hence, grazing management could be considered in *"Waajid: ACF_2"*.

CWW

The areas of CWW stretch throughout Somalia, from the coastal region of Afgooye to the Ethiopian border region of Doolow (Figure 2). Correspondingly, the bio-physical and climatic properties ranged widely across the CWW project areas. The area of *"Afgoye: CWW_2"* is located near the coast around a riverbed. While *"Afgoye: CWW_2"* partly consists of a fertile riverine soil, there is also a large stretch of sandy soils along the coast. This was reflected in the wide SOC distribution at *"Afgoye: CWW_2"*, which showed higher SOC concentrations around the river (~9 g/kg) and much lower levels at the coastal sandy soils (~3 g/kg) (Figure 27). Interestingly, *"Afgoye: CWW_2"* displayed a considerable negative EVI trend at the sandy soils which indicates that a lot of vegetation cover has been lost in the last two decades (Figure 30). Also, a wide distribution of SOC levels was seen at *"Wanlaweyn: CWW_7"* (~5-10 g/kg) (Figure 27) where the area was also partly covered by riverine soils. Both *"Afgoye: CWW_2"* and *"Wanlaweyn: CWW_7"* had relatively low erosion rates (median ~40-50%). The other project areas (*"Belethawa: CWW_4"* and *"Baardhere: CWW_5-6"*) displayed lower SOC levels (~4-7 g/kg) and higher erosion prevalence (~70-85%). Interestingly, small parts of *"Belethawa: CWW_4"* are riverine as well, which was reflected by the small pocket of high SOC values (~10 g/kg) in Figure 27. Generally, precipitation in the CWW project areas was moderate to high ranging between 160 mm/year in *"Belethawa: CWW_4"* to 300 mm/year in *"Baardhere: CWW_6"* (Figure 31). Most communities in these areas identified grazing, water and farming as the key ecosystem service they relied on (Figure 25). As farming is an important livelihood in this region, the restoration of farmlands should be considered through, for instance, water retention and erosion control measures, such as soil bunds. Additionally, at the very eroded areas (e.g. *"Rabdhure: ACF_4"*), erosion control measures, such as gully plugging, could be an effective strategy. Furthermore, the large loss in vegetation cover in parts of *"Afgoye: CWW_2"* indicates that the area used to support higher levels of vegetation and that, hence, active replanting could be a viable option. Lastly, livestock migration was reported low across the CWW areas (Figure 25), suggesting little need for grazing management.

IRC

IRC is present in the arid north of Somalia where it is responsible for four project areas that are relatively close to each other in a similar type of ecosystem (Figure 2). This homogeneity was reflected in the bio-physical indicators. SOC was low across all project area with the highest in *"Galdogob: IRC_2"* (~4 g/kg) and the lowest contents observed in *"Galkacyo: IRC_3"* (~3g/kg) (Figure 27). Likewise, tree and grass cover was very sparse across the project areas and did not exceed 15%. Erosion rates varied more as lower rates were observed at *"Galkacyo: IRC_3"* (~40%) and very high rates of erosion were present in *"Galkacyo: IRC_4"* (~90%). There was little variation in precipitation, which ranged from around 100 mm/year in *"Galkacyo: IRC_3"* to 120 mm/year in *"Galdogob: IRC_2"* (Figure 31). Given the low SOC rates in the areas, agriculture was not identified often as a key ecosystem service, but instead, people relied on the ecosystem mainly for water provision and grazing lands (Figure 24). Correspondingly, high goat and sheep migration numbers were reported, and, to a lesser extent, camels were reported to migrate through the region (Figure 25). Interestingly, the communities in *"Galkacyo: IRC_4"* reported a high temporary and permanent influx of goats in the region in the past year. The relatively high livestock numbers, particularly sheep, could make grazing management a viable strategy. Additionally, at the very eroded areas (e.g. *"Galkacyo: IRC_4"*), erosion control measures, such as gully plugging, could be an effective strategy.

Kaalo

Kaalo operates in the most northern parts of the BRCiS III programme where they cover five project areas (Figure 2). These areas are amongst the most arid regions in the programme and generally did not receive more than 110 mm of rain annually (Figure 31). Correspondingly, the median SOC concentrations were low throughout the Kaalo project areas and did not exceed 5 g/kg (Figure 27). Similarly, median grass and tree cover was low as well and generally did not exceed 15% and 10%, respectively. Lastly, erosion was prevalent across the project areas with the lowest rates in *"Galkayo: KAALO_2"* (~75%) and the highest rates in

"Jariiban: KAALO_5" (> 90%). As a results of the SOC-poor landscape, the communities in the project areas mainly identified grazing and water provision as the key ecosystem services (Figure 24). In the absence agriculture, the communities relied on livestock, which was reflected in the high livestock migration numbers, including particularly drought resilient animals as goats, sheep and camels (Figure 25). Hence, grazing management could be considered to reduce erosion. Additionally, given the very high erosion prevalence across the Kaalo project areas, erosion control measures, such as gully plugging, could be an effective strategy.

NRC

NRC is present throughout Somalia with two project areas in the southern coastal region near Kismaayo, one in the south along the border with Kenya, one in central Somalia, and two areas more north in Dhuusamarreeb (Figure 2). Due to the large geographical differences, the bio-physical conditions varied widely as well. The highest median SOC concentration (~11 g/kg) and grass cover (~25%) were observed around Baidoa (*"Kismaayo: NRC_2"*), while erosion and tree cover were more moderate here (60% and 15%, respectively) (Figure 27, Figure 29, Figure 30). This was followed by *"Kismaayo: NRC_3"*, around Kismaayo, which showed moderate median SOC contents (~7 g/kg), grass cover (~15%), tree cover (~15%) and low erosion (65%). Though, these numbers can still be regarded as a generally degraded and SOC-poor system. Furthermore, the project areas around Baidoa (*"Baidoa: NRC_6"*) and Kismaayo (*"Kismaayo: NRC_2-3"*) have experienced a considerable negative trend in EVI which indicates a decrease in vegetation cover in that region in the last two decades (Figure 30). This phenomenon is likely due to the increased urbanisation during that timeframe. *"Afmadow: NRC_1"* is relatively similar to *"Kismaayo: NRC_2"*-3 but showed lower median SOC (~5-6 g/kg) while also less erosion (55%). The areas of *"Dhuusamareeb: NRC_4-5"* displayed lower median SOC levels around 4 g/kg and high median erosion prevalence around 75% (Figure 27, Figure 29). In the more northern areas of *"Dhuusamareeb: NRC_4-5"*, goat and sheep migration numbers were higher while cattle are more abundant around Kismaayo (Figure 25). Although, absolute livestock numbers are higher in *"Dhuusamareeb: NRC_4-5"* and these areas also mentioned grazing more often as a key ecosystem service (Figure 24). Hence, planned grazing could be considered in *"Dhuusamareeb: NRC_4-5"*. The large loss in vegetation cover in the regions of *"Baidoa: NRC_6"* and *"Kismaayo: NRC_2-3"* indicate that the area used to support higher levels of vegetation and that, hence, active replanting could be a viable option. Moreover, precipitation levels in *"Afmadow: NRC_1"* and *"Kismaayo: NRC_2-3"* range between 220-260 mm/year (Figure 31) which could support the creation of soil bunds as well.

SCI

The project areas of SCI are located in the middle of Somalia. One is at the coastal district of Balcad and the other two are more north in Beletweyne (Figure 2). The coastal area of *"Jowhar: SCI_4"* showed a high median SOC around 9-10 g/kg and relatively low erosion prevalence (~45%) (Figure 27, Figure 29). The other areas of *"Beletweyne: SCI_1-3"* showed lower SOC contents (~5-7 g/kg) and higher erosion rates around 65-75%. Correspondingly, the precipitation levels were higher in *"Jowhar: SCI_4"* (~210 mm/year) compared to *"Beletweyne: SCI_1-2"* (~170 mm/year) and *"Beletweyne: SCI_3"* (~130 mm/year) (Figure 31). In the more SOC-rich area of *"Jowhar: SCI_4"*, cattle migration numbers were high and have increased in 2023, while goats and sheep were more abundant in the more arid areas of *"Beletweyne: SCI_2-3"* (Figure 25). Given the presence of livestock in all the SCI areas, grazing management could be considered. Furthermore, some parts of *"Jowhar: SCI_4"* have experienced a loss in vegetation cover in the last two decades (Figure 30). At these locations some active restoration could be worthwhile to bring back the vegetation cover. Additionally, water harvesting through soil bunds could be supported in *“Jowhar: SCI_4”* given the rainfall levels.

GREDO

The six project areas falling under GREDO displayed the lowest levels of degradation across all project areas (Figure 33). Median SOC contents were highest in *"Baidoa: GREDO_4-6"* (~10-12 g/kg) while these areas also contained some of the highest grass coverage (>20%) and lowest erosion prevalence (~60%) (Figure 27Figure 29Figure 30). Slightly lower median SOC concentrations were found at *"Diinsoor: GREDO_1-3"* (~7-8 g/kg) while these areas had relatively high tree cover (>20%) but also higher erosion prevalence (~70%). Similarly, *"Baidoa: GREDO_4-6"* had higher average precipitation (>300 mm/year) compared to *"Diinsoor: GREDO_1-3"* which was around 280 mm/year (Figure 31). Vegetation cover has gone down in *"Baidoa: GREDO_4-6"* in the last two decades (Figure 30) which could be leveraged during the restoration works to aim to retain some of those historic vegetation cover. The precipitation levels, as well as the historic vegetation presence, suggest that active replanting could be an effective strategy in these areas. Lastly, none of the GREDO project areas contained large numbers of livestock, except for some sheep in *“Baidoa: GREDO_4”* (Figure 25). In the absence of large livestock numbers, the communities in the GREDO project areas identified farming as a key ecosystem service they rely on (Figure 24). Hence, the restoration of farmlands should be considered in these areas. Given the recent establishment of half moons in the GREDO project areas, focus on enhancing their efficiency and structural integrity with additional farm inputs such as quality seeds would be beneficial. Aditionally, during the workshop in Nairobi, the importance of establishing robust social fences as well as strong grazing management plans was discussed, which would be another important focus point for GREDO.

B. WORKSHOP: GENERAL RECOMMENDATIONS

Aside from the project area specific recommendations provided above, the following general recommendations were developed based on discussions and outcomes from the validation workshop held from December 3 – 5 2024, at Magna Hotel & Suites in Gigiri, Nairobi, Kenya. The workshop objectives were to:

a. Present and validate the findings from this BRCiS III Ecosystem Baseline Report with BRCiS III project members.
b. Promote the exchange of knowledge and experience from restoration actors in Somalia and similar contexts about how they are addressing or responding to different restoration challenges.
c. Facilitate collaborative planning for upcoming ecosystem restoration and resilience-building activities in target areas in Somalia.

The workshop brought together approximately 45 participants representing BRCiS III member organizations and their downstream partners. Participants contributed their expertise in diverse areas including ecosystem services, agroecology and ecosystem restoration practices. The recommendations are discussed below:

1. **Community engagement is fundamental in enhancing local ownership and encourages adaptability and sustainability in ecosystem restoration efforts:** Members should leverage existing Community Action Plans (CAPs) and Area Level Action Plans, developed in collaboration with the community, as foundational elements to integrate ecosystem services and ecosystem restoration effectively while acknowledging community needs. These plans must remain flexible and adaptable, allowing for modifications based on ongoing feedback and environmental monitoring. The data of both biophysical conditions, as well as social and community dynamics, need to be considered when planning and implementing actions. The workshop outlined a process that can systematically consider these dimensions together with the community and prioritize approaches that are better grounded in current realities and enhance agency and buy-in. One approach to address location-specific environmental issues such as water management, rangeland management or grazing restoration is the establishment of Community Environmental Management Groups (EMGs). EMGs can act as knowledge hubs within respective communities to foster sustainable restoration practices, including agroecology, and ownership among community members. In addition, ecosystem restoration champions, selected by BRCiS III members, can play a pivotal role as direct links between knowledge and action within Environmental Management Groups (EMGs). These champions would ideally be positioned to translate restoration strategies and ecological insights into practical on-the-ground actions. By serving as conduits for communication and implementation, they can ensure that scientific and traditional knowledge is integrated into community-driven restoration efforts. Furthermore, these champions can spearhead the adoption of agroecological practices and other sustainable practices that are critical for building resilience in surrounding ecosystems through targeted training, ultimately strengthening the capacity of EMGs to address specific environmental challenges effectively.

2. **Monitoring and evaluation are pivotal in ensuring the tracking of progress of ecosystem restoration efforts.** By enhancing monitoring capabilities and utilizing technology like the Regreening App, members can gather critical data and track restoration implementation progress in near real-time across the target BRCiS III locations. Integrating this data with remote sensing ensures the availability of accurate ecological information to allow for timely adjustment to the restoration methods and a reliable measure of the overall effectiveness of restoration activities in line with restoration plans. In addition, the integration of different types of monitoring data such as qualitative assessments and community narratives could further enhance the nuanced assessment of progress and potential needs for adjustments.

3. **By leveraging interactive tools like dashboards, the restoration process becomes both transparent and participatory, ensuring that all community members and relevant stakeholders are well-informed and actively involved.** These tools, provide real-time data that enable effective contributions from all parties including relevant ministries such as the Ministry of Livestock, Forestry and Range (MoLFR), Ministry of Environment and Climate Change (MoECC) and the Ministry of Agriculture and Irrigation (MoAI) and policymakers, enhancing the decision-making process and fostering a deeper connection to the project outcomes and impact. Additionally, the use of dashboards allows for the continuous documentation and presentation of successful restoration practices including best practices in specific environments. This ongoing sharing of knowledge fosters a culture of continuous improvement and collective interactive learning among stakeholders which is essential for replicating, piloting and scaling of restoration efforts. This

approach not only strengthens the immediate restoration activities but also builds a resilient framework for future sustainability initiatives.

C. FINAL REMARKS

This ecosystem baseline report provides a crucial snapshot of current land health conditions across the BRCiS III project areas. It captured data on various ecosystem health indicators. As ecosystems are dynamic, systematic monitoring is essential to track changes from the baseline. These ecosystem insights should be used by the BRCiS Members to plan and evaluate current and future restoration plans together with the communities. This community buy-in is particularly crucial for a successful implementation and, hence, community engagement must be a pivotal focus point. Additionally, to ensure continuous monitoring of the activities, it is important to capture data on the ground while restoration activities are ongoing. This will allow for timely adjustments and insights, but will also provide location-specific information which can be used to assess ecosystem impacts at a later stage. Especially, given the ambition of BRCiS III to implement a variety of land restoration techniques across the project area, a close monitoring of the areas is required to assess the impacts of the interventions. While some of the ecosystem changes may be responses to general changes in the environmental conditions, others will be a direct response to restoration activities. Field data, in combination with remotely sensed data, can help distinguish between natural ecosystem changes and restoration-induced changes and, hence, can assist in implementing effective and adaptive restoration efforts.

VI. APPENDICES

A. PROJECT AREA DELINEATION

Determine clusters of target communities

Remote sensing is a useful tool to assess ecological variation across a landscape, but it cannot assess on-the-ground economic and social interactions between communities. Therefore, prior to the remote sensing analysis, thorough discussions were held with the seven BRCiS Members. During the first step, the members selected 136 target communities on which they would focus during the project. Secondly, the members indicated which target communities share resources (grazing fields, water, forest etc), have strong economic ties and/or are in a current conflict. Based on this information it was determined which target communities could be placed in a single cluster.

Area delineation based on target community clusters and remote sensing

An ecological approach was used to do the actual cluster delineation. It is based on the hypothesis that ecosystems that are in the same watershed tend to be relatively homogeneous in terms of ecological properties cause ecosystems are largely influenced by topography. Based on a satellite-derived Digital Elevation Model (DEM), the watersheds were determined at various levels (level 1-12) (Lehner and Grill, 2013). The watersheds can be interpreted as the area where the water would flow in case of rain. At level 1, the watershed covers the entirety of the African continent while a level 12, a watershed can cover as little as a few km^2 based on the topographical features in a landscape.

Based on the level 12 watersheds, the area surrounding a cluster of target communities (as determined by the discussion with the members) was delineated. To ensure that the area between the target communities was included in the cluster area, a polygon was created from the target communities in a specific cluster. In case there were only two target communities in a cluster, they were connected by a line. Consequently, the watersheds that intersected with the target community polygon or line were selected and merged. The result of these merged watersheds was taken as the cluster delineation.

B. FURTHER RESULTS

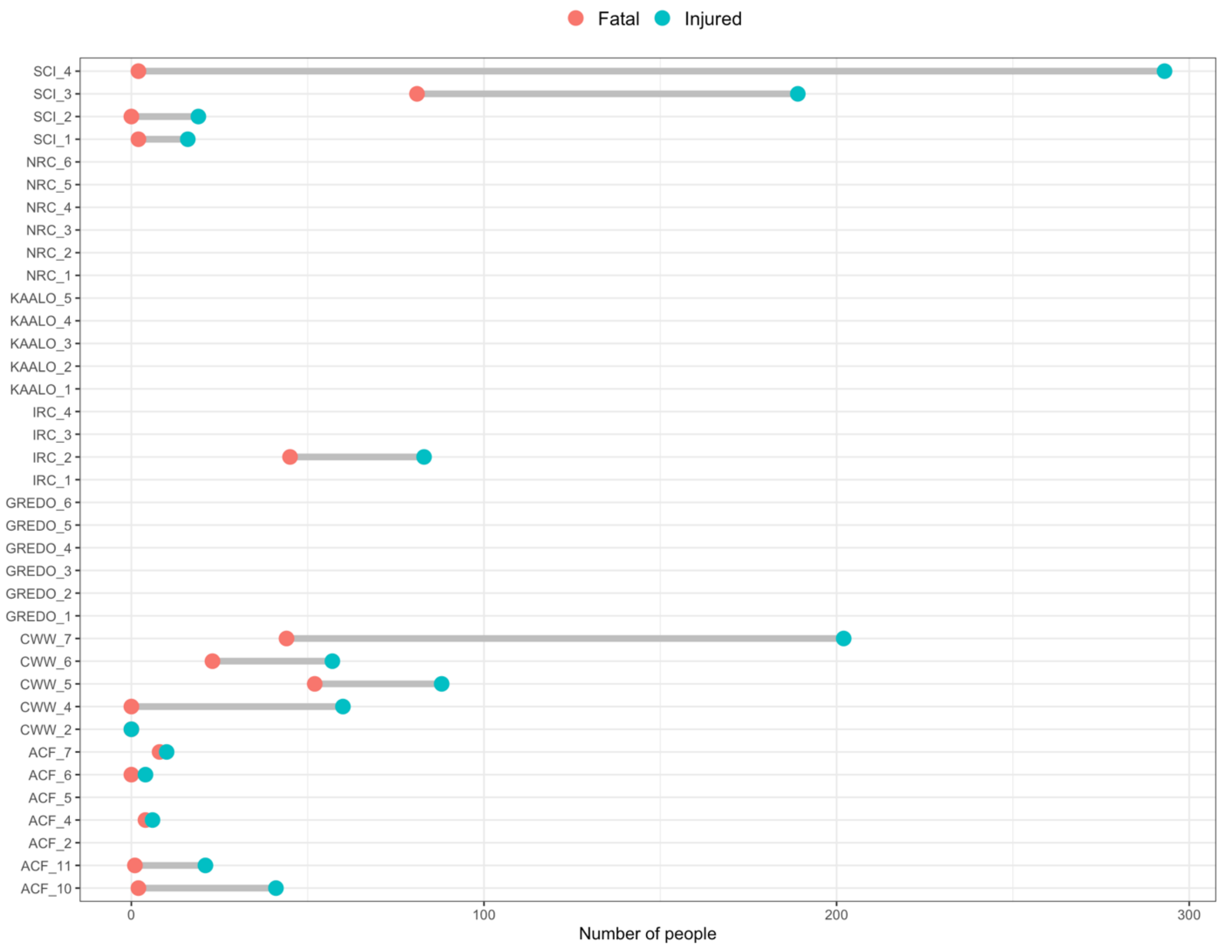


FIGURE 35: NUMBER OF PEOPLE FATALITIES OR INJURED AS A RESULT OF CONFLICT IN THE VARIOUS PROJECT AREAS.

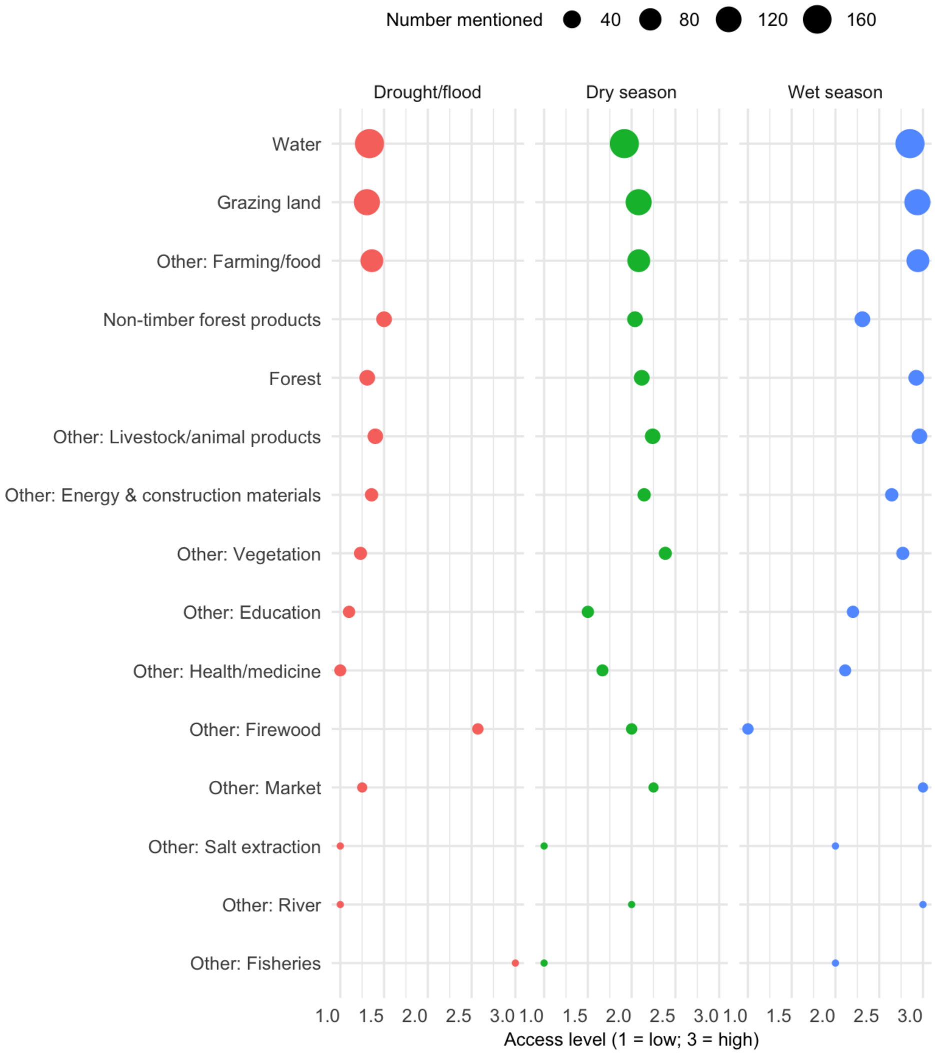


FIGURE 36: ACCESS TO KEY ECOSYSTEM SERVICES DURING WET SEASON, DRY SEASON AND PERIOD OF DROUGHT/FLOOD AS INDICATED BY THE COMMUNITIES. THE LARGER THE DOT, THE MORE OFTEN THIS ECOSYSTEM SERVICE WAS MENTIONED BY THE COMMUNITIES.

C. INDICATOR FRAMEWORK

Ecosystem services indicators	Definition	Data required	Unit	Data source and data collection method	Interpretation	Data source - Tier 1: Ground data collection -Tier 2: Remotely sensed
Ecosystem health						
Soil erosion prevalence	Percentage of area with visible soil erosion (sheet, gully, rill)	Erosion percentage (%)	Percent	LDSF data, Predictive mapping using Earth Observation (Landsat).	**Low** (<25%) **Moderate** (25-75%) **High** (>75%)	Tier 1 + Tier 2
Soil organic carbon	Presence and thickness of dark, rich, topsoil (indicative of higher organic carbon).	Grams of carbon per kg from ground LDSF collection	$g\ kg^{-1}$	LDSF data, Predictive mapping using Earth Observation (Landsat).	**Low** (<5) **Moderate** (5-15) **High** (>15)	Tier 1 + Tier 2
Soil PH	Average pH level of the soil in each area	Ground truth LDSF data on pH	Scale: 1-14	LDSF data, Predictive mapping using Earth Observation (Landsat).	**Acidic**: pH < 5.5 **Neutral**: pH = 5.5 – 7.5 **Alkaline**: pH > 7.5	Tier 1 + Tier 2
Vegetation cover	Degree of woody or herbaceous vegetation covering the surface	LDSF: Woody cover/ herbaceous cover rating	0= absent, 1= <4% 2= 5-15% 3= 15-40% 4= 40-65% 5= > 65%	LDSF data	**Good:** above 3 for herbaceous and woody cover rating **Average:** 2-3 rating of herbaceous and woody cover rating and moderate diversity **Poor:** almost no herbaceous or woody cover (1-2)	Tier 1
Vegetation cover trend	Medium-term trends in vegetation cover.	Satellite derived vegetation index time series for Somalia. EVI was chosen due to its long history.	Percentage change in EVI relative to 2001-2005 average.	MODIS	**Good**: > +10% **Neutral**: ~0% **Bad** < -10%	Tier 2
Biodiversity	Number of different plant species observed in the area.	List and number of different plant species observed in delineated area.	Number of species	LDSF data	**High:** Large variety and abundance of plant species; **Moderate:** Some variety but lacking in species richness or abundance in certain areas; **Low:** Little variety	Tier 1

					and/or abundance of plant species.	
Tree cover	Percentage tree cover at area	Ground truth LDSF data on number of trees	Percentage tree cover	LDSF data, Predictive mapping using Earth Observation (Landsat).	**High:** >40% **Medium:** 10-40% **Low:** <10%	Tier 1 + Tier 2
Grass cover	Percentage grass cover at area	Ground truth LDSF data on grass presence	Percentage grass cover	LDSF data, Predictive mapping using Earth Observation (Landsat).	**High:** >40% **Medium:** 10-40% **Low:** <10%	Tier 1 + Tier 2
Forest cover	Percentage forest cover at area	Ground truth LDSF data on forest cover	Percentage forest cover	LDSF data, Predictive mapping using Earth Observation (Landsat).	**High:** >40% **Medium:** 10-40% **Low:** <10% *Excluded cause very little forest in Somalia.*	Tier 1 + Tier 2
Crop cover	Percentage crop cover at area	Ground truth LDSF data on forest cover	Percentage crop cover	LDSF data, Predictive mapping using Earth Observation (Landsat).	**High:** >50% crop cover. **Medium:** 20-50% crop cover. **Low:** <20% crop cover. *Excluded due to limited added value during analysis.*	Tier 1 + Tier 2
Infiltration capacity	Ability of the soil to absorb water	Ground truth LDSF data	mm/hour	LDSF data	**High:** > 100 mm/h **Medium:** 50-100 mm/h **Low:** < 50 mm/h	Tier 1
Climate						
Water availability I	Access to water sources (bore holes, rivers, lakes) & annual precipitation	Location of water bore holes, (seasonal) lakes, rivers	Meters	SWALIM has data on bore holes. Lakes and seasonal rivers can be derived from satellites.	**High availability**: Low distance to water source; **Medium availability**: Medium distance to water source; **Low availability**: Long distance to water source *Excluded due to limited size dataset and, hence, little added value.*	Tier 2
Water availability II	Average precipitation at project area level	Annual precipitation (2001-2023) data derived from GPM	mm yr^{-1}	Global Precipitation Measurement (GPM) satellite data	**High availability**: > 300 mm/year **Medium availability**: 100-300 mm/year. **Low availability**: < 100 mm/year	Tier 2

Water insecurity	Number of drought events in the last 20 years.	Daily precipitation data derived from satellites.	Number of drought events	Global Precipitation Measurement (GPM) satellite data	**High insecurity**: >2 drought events last 20 years. **Medium insecurity**: 1-2 drought events last 20 years. **Low insecurity**: 0 drought events last 20 years; *Excluded due to difficulty of analysis and high correlation with aridity index.*	Tier 2
Temperature	Average temperature at project area level	Average annual daytime temperature time series between 2001-2023 at the project areas derived from MODIS>	°C	MODIS satellite data	**High**: > 30 °C **Medium**: 20 - 30 °C **Low**: < 20 °C	Tier 2
Aridity	Ratio between precipitation and potential evapotranspiration based on long term averages.	Location specific long-term averages on precipitation and evapotranspiration for Somalia.	Aridity index (0 – 2)	Satellite derived	**Low (hyper-arid):** < 0.05 **Medium (arid):** 0.05 – 0.2 **High (semi-arid):** > 0.2	Tier 2
Animal presence				**Key informant interviews**		
Habitats	Areas or environments where various species live, reproduce, and interact	Animal species diversity, habitat size, quality; bees	Percentage of habitats per km²	IUCN animal habitat data	**Healthy**: Diverse species, undisturbed areas. **At Risk**: Decreasing diversity, some disturbances. **Degraded**: Low species diversity, significant habitat loss/degradation. *Excluded due to poor and limited data for Somalia.*	Tier 1
Human well-being						
Access level to ecosystem services	The degree to which community members can utilize the surrounding ecosystem services.	Accessibility to ecosystem services (water, firewood, grazing areas)	High-medium-low	Data collection at communities	**High (3)**: Unrestricted access to multiple critical ecosystem services **Medium (2)**: Access to some but not all essential services; **Low (1)**: Limited or restricted access to most services	Tier 1
Key ecosystem services	Which ecosystem services do the communities rely on.	Survey response at the community level.	Ecosystem service	Data collection at communities	**Qualitative**	Tier 1

People affected in resource conflicts.	Number of people affected in conflicts within and between communities over essential ecosystem services.	Number of people affected during, e.g, crops raiding, attacks.	Number of people affected (injured/fatal) in conflicts per year	Data collection at communities	**High**: > 10 **Medium**: 0-10 **Low**: < 2	Tier 1
Frequency of resource conflicts	Frequency of conflicts within and between communities over essential ecosystem services	Number of conflicts per project area.	Number of reported conflicts per year	ACLED	**High**: Frequent and severe conflicts over critical resources; **Medium**: Occasional disputes, possibly resolved locally; **Low**: Rare disputes, often quickly resolved *Excluded due to overlap with in-field community survey on people affected by conflict.*	Tier 1
Drivers of conflicts	Driver of conflicts within and between communities	Social, economic or cultural drivers	Drivers	Data collection at communities.	**Qualitative**	Tier 1

D. COMMUNITY SURVEY FORMS

Data capture sheet (Part 1 and 2)

<GPS Coordinates>

<Consent>

Member	
Region	
District	
Cluster	
Map code	
Date of Engagement	
Team	
Team lead	

Please note down the main discussion points here. Specifically focus on arguments around boundaries that were drawn, points of disagreement or complications in identification of areas on the map.

Note here the main points from the discussions

Table 1. Access to ecosystem services

Ecosystem service 1:………………………………

Please mark the table below using the following code: **X** – wet season in a normal year; **O** – dry season in a normal year; **A** – during adverse events such as flooding or drought

Demographic group	**High access** Unrestricted access to multiple critical ecosystem services	**Medium access** Access to some, but not all, essential services	**Low access** Limited or restricted access to most services
Women			
Men			
Youth			
Elderly			
Ethnic Group A			
Ethnic Group B			

Please mark the table below using the following code: **X** – wet season in a normal year; **O** – dry season in a normal year; **A** – during adverse events such as flooding or drought

Ecosystem service 2:………………………………

Demographic group	**High access** Unrestricted access to multiple critical ecosystem services	**Medium access** Access to some, but not all, essential services	**Low access** Limited or restricted access to most services
Women			
Men			
Youth			
Elderly			

Ethnic Group A			
Ethnic Group B			

Please mark the table below using the following code: **X** – wet season in a normal year; **O** – dry season in a normal year; **A** – during adverse events such as flooding or drought

Ecosystem service 3:………………………………

Demographic group	**High access** Unrestricted access to multiple critical ecosystem services	**Medium access** Access to some, but not all, essential services	**Low access** Limited or restricted access to most services
Women			
Men			
Youth			
Elderly			
Ethnic Group A			
Ethnic Group B			

Please mark the table below using the following code: **X** – wet season in a normal year; **O** – dry season in a normal year; **A** – during adverse events such as flooding or drought

Ecosystem service 4:………………………………

Demographic group	**High access** Unrestricted access to multiple critical ecosystem services	**Medium access** Access to some, but not all, essential services	**Low access** Limited or restricted access to most services
Women			
Men			
Youth			
Elderly			
Ethnic Group A			
Ethnic Group B			

Please mark the table below using the following code: **X** – wet season in a normal year; **O** – dry season in a normal year; **A** – during adverse events such as flooding or drought

Table 3. Livestock Dynamics

Enter the dynamics gathered from the community around the various livestock types.

Livestock Type	Over the last 12 months, how many of this type have temporarily migrated out of the community?	Over the last 12 months, how many of this type have temporarily migrated into the community?	Over the last 12 months, how many of this type have permanently migrated out of the community?	Over the last 12 months, how many of this type have permanently migrated out of the community?
Cattle				
Sheep				
Goats				
Camel				
Other				

Table 3: Conflicts

Which types of conflicts mentioned by the Community

a. Conflict over water
b. Conflict between livestock owners
c. Conflict between livestock owners and agriculturalists
d. Clan based conflict.
e. Human-Wildlife conflicts
f. Natural resource-based conflict.
g. Insurgencies
h. Other

1. How many injuries have occured due to conflict over the 12 months?

2. How many fatalities have occured due to conflict over the 12 months?

3. Over the last 12 months, how did the intensity change?
   a. Increase
   b. remains the same
   c. Decrease

4. Over the last 12 months, how did the frequency change?
   a. Increase
   b. Remains the same
   c. Decrease

Area-specific conflict

Table 3.1. Conflict 1……………………………………

Please mark the tables below using the following code: X – wet season in a normal year; O – dry season in a normal year; A – during adverse events such as flooding or drought; Note: descriptors could be any feature or name that the community uses or recognises and that – in their use – refers to the specified area and marked on the map

Geographic area	**High** Regular conflicts causing significant harm or loss.	**Medium** Occasional conflicts with moderate impact.	**Low** Rarely conflicts with minimal impact.
Area 1 descriptor (Community name) ____________________			
Area 2 descriptor (Community name)- __________________________			
Area 3 descriptor (Community name) ____________________			

Table 3.2. Conflict 2……………………………………

Please mark the tables below using the following code: X – wet season in a normal year; O – dry season in a normal year; A – during adverse events such as flooding or drought; Note: descriptors could be any feature or name that the community uses or recognises and that – in their use – refers to the specified area

Geographic area	**High** Regular conflicts causing significant harm or loss.	**Medium** Occasional conflicts with moderate impact.	**Low** Rarely conflicts with minimal impact.
Area 1 descriptor (Community name) ____________________			
Area 2 descriptor (Community name)- __________________________			
Area 3 descriptor (Community name) ____________________			

Table 3.3. Conflict 3……………………………………

Please mark the tables below using the following code: X – wet season in a normal year; O – dry season in a normal year; A – during adverse events such as flooding or drought; Note: descriptors could be any feature or name that the community uses or recognises and that – in their use – refers to the specified area

Geographic area	**High** Regular conflicts causing significant harm or loss.	**Medium** Occasional conflicts with moderate impact.	**Low** Rarely conflicts with minimal impact.
Area 1 descriptor (Community name) ____________________			
Area 2 descriptor (Community name)- __________________________			
Area 3 descriptor (Community name) ____________________			

Table 3.4. Conflict 4……………………………………

Please mark the tables below using the following code: X – wet season in a normal year; O – dry season in a normal year; A – during adverse events such as flooding or drought; Note: descriptors could be any feature or name that the community uses or recognises and that – in their use – refers to the specified area

Geographic area	**High** Regular conflicts causing significant harm or loss.	**Medium** Occasional conflicts with moderate impact.	**Low** Rarely conflicts with minimal impact.
Area 1 descriptor (Community name) ____________________			
Area 2 descriptor (Community name)- __________________________			
Area 3 descriptor (Community name) ____________________			

Table 3.5. Conflict 5……………………………………

Please mark the tables below using the following code: X – wet season in a normal year; O – dry season in a normal year; A – during adverse events such as flooding or drought; Note: descriptors could be any feature or name that the community uses or recognises and that – in their use – refers to the specified area

Geographic area	**High** Regular conflicts causing significant harm or loss.	**Medium** Occasional conflicts with moderate impact.	**Low** Rarely conflicts with minimal impact.
Area 1 descriptor (Community name) ____________________			
Area 2 descriptor (Community name)- __________________________			
Area 3 descriptor (Community name) ____________________			

Note any other obervations from the discussions that might be relevant

- End of first part –

Additional part when CRCs are established

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