Product Design Process to Support the De-risking, Inclusion and Value Enhancement of Pastoral Economies (DRIVE) in Somalia

International Livestock Research Institute

Executive Summary

Livestock is central to Somalia's economy. The livestock sector contributes around 40 per cent of agricultural GDP and constitutes 80% of all export earnings. Livestock is the major productive asset for pastoral communities, who are particularly among the vulnerable, and considered low-income households. The pastoralists' main risk is drought, which is also the primary cause of livestock illness and mortality. In 2021, drought resulted in about 2.3 million people experiencing serious water, food and pasture shortages in Somalia. Consequently, approximately 100,000 people in the central and southern areas of Somalia abandoned their homes in search of food, water and pasture for livestock.

Innovative drought index-insurance products have been proven to be a cost-efficient risk transfer mechanism for livestock in arid and semi-arid pastoral regions of Kenya and Ethiopia, which have livestock systems that are similar to those in Somalia. A pre-feasibility study was jointly conducted by the International Livestock Research Institute (ILRI) and the World Bank in 2019 to assess the possibility of implementing drought index insurance for pastoralists, commonly referred to as index-based livestock insurance (IBLI) in the pastoral areas of Somalia.

This document is part of the preparation for the de-risking, inclusion and value enhancement of pastoral economies (DRIVE) project. Its purpose is to i) outline the product design preparation for Puntland, ii) determine the unit areas of insurance (UAIs), iii) carry out scenario analysis on payouts and costing and iv) provide better understanding of the insurance concept to pastoral communities and private sector actors that may be interested in offering the insurance products.

Since the assignment had two main areas of focus; understanding the technical and socio-economic characteristics of areas deemed feasible for implementing a drought index insurance program, a combination of desktop reviews and stakeholder engagements were carried out. A detailed desk-based technical assessment utilising secondary data from Somalia was carried out in 2019. To conduct the clustering process, Puntland was chosen as an illustrative case because of its established networks with development partners, limited financial resources and security. It should be noted that a similar process will be carried out in Somaliland and other parts of Somalia, which are deemed fit for the introduction of a drought index insurance product.

The findings presented below are largely based on a two-day engagement with different stakeholders such as community representatives, government officials and private sector representatives. Some qualitative findings were complemented by data from a pastoral survey conducted after the stakeholder engagements. Similarly, some of the information provided, which could be relevant to the operational component of the drought index insurance came from independent complementary studies and ongoing engagements by ILRI and the Somalia Resilience Program (ILRI-SomRep) in Puntland and other parts of Somalia.

Socio-economic and market characteristics

In Puntland, the least wealthy pastoralists typically have a minimum of 5-10 camels and 60 shoats. Pastoralists with livestock holdings below these levels tend to move closer to the urban centres. From 2000, the major climatic shocks experienced in Puntland have been droughts that were severe in 2003, 2006, 2011 and 2016–17, coupled with incidences of floods and locust attacks between 2018 and 2019. Migration continues to be one of the traditional coping mechanisms, where herders move to distant areas (sometimes trekking for up to 800 km) in search of pasture. Over time, the traditional migration process has shifted from trekking on foot to the use of vehicles to transport animals. Conversely, wealthy households arrange for water and fodder to be transported to where their livestock are located. It would

be important to link the insurance product to the management of rangelands, either through incentives such as subsidies or partnering with development organizations in the area that work with communities on land use planning and rangeland management. Destocking continues to be one of the coping strategies used by the pastoralists during severe drought situations. They also diversify into different economic activities, such as producing charcoal for sale, to meet household expenses.

The main sources of income and food for the Puntland pastoral communities are sales of live animals and livestock products, such as milk. Although pastoralists still buy staple foods (e.g. rice, pasta and wheat etc.) in normal seasons, reliance on these foods increases during dry seasons when milk production decreases.

Some pastoralists seek loans and credit from shopkeepers, while others rely on remittances to deal with climatic shocks (e.g. during drought periods) since markets are affected and livestock prices fall. Even though there are numerous financial institutions, mostly conventional banks, they are risk averse and have not invested in the high risk livestock sector. A study from the 1990s, estimated that less than 10% of money for primary livestock purchases was formally sourced from banks, the majority of it being informally sourced from colleagues, friends and associates.

Several micro-financial institutions (MFIs) exist, complementing the services provided by the banks, but their outreach and coverage mirrors that of banks. One of the most popular and well established banks in Somalia, the Dahabshil Bank, has a micro-finance service through its foundation that is working with small businesses unable to meet the commercial banks' lending criteria and loan requirements. Similar customized initiatives do not apply to livestock producers. However, there have been some promising preliminary discussions between ILRI-SomReP and Galaxy Bank on the potential of bundling insurance and credit services.

Most of the MFIs are supported by the Growth Enterprise Employment and Livelihoods (GEEL) program, which offers interest free loans to sectors such as livestock, crops and fisheries. Other institutions that support MFIs, producers' groups and cooperatives are consortiums such as SomReP. The Somalia Resilience Program currently supports 416 village savings and loan associations (VSLAs), which include pastoral and agro-pastoral areas in Puntland, Somaliland and southwest states of Somalia. The VSLAs have 5,576 and 1,878 women and men, respectively. Some of these groups have access to loans based on a graduation model. The initial loan amount is 300 United States Dollars (USD) rising to a maximum graduating amount of USD 1,000.

There appears to be no gender disparities in savings in the category of those who can afford to save. Results from the sample surveyed in Puntland showed that 39% of women-headed and 45% of men-headed households had cash savings. Women preferred to keep their savings as mobile money, while the men kept the cash at home. It is crucial to have a better understanding of the characteristics of women who have the capacity to save compared to those that cannot.

Even though the insurance sector is nascent, it is starting to grow. While the industry is weak and underdeveloped, the concept of insurance is not new in Somalia, since there was once a government-run national insurance scheme during the pre-war regime. While insurance coverage is very low, 90% of existing business is medical insurance that is mainly provided by Takaful Insurance of Africa (TIA)-Somalia and First Somali Takaful & Re-Takaful (FISO) to non-governmental organizations (NGOs) and expatriates (Banerjee et al. 2021). Recently the Horn of Africa, UMMA Insurance, Baraka Takaful and Amanah insurance companies have also started offering insurance products. Takaful Insurance of Africa is the largest insurer in terms of underwritten policy premiums and its primary business is medical insurance cover that constitutes around 90% of the underwritten business. However, the total gross underwritten

premium is below USD 6 million. There is general interest on drought index insurance from all the insurance companies mentioned above, however, advanced talks have only taken place with TIA-Somalia, which has an operating office in Puntland. Further engagements with all insurance companies are required to gauge both their appetite and expectations regarding implementation of drought index insurance for pastoralists, starting in Puntland and eventually extending to all suitable areas in Somalia.

Product design and costing

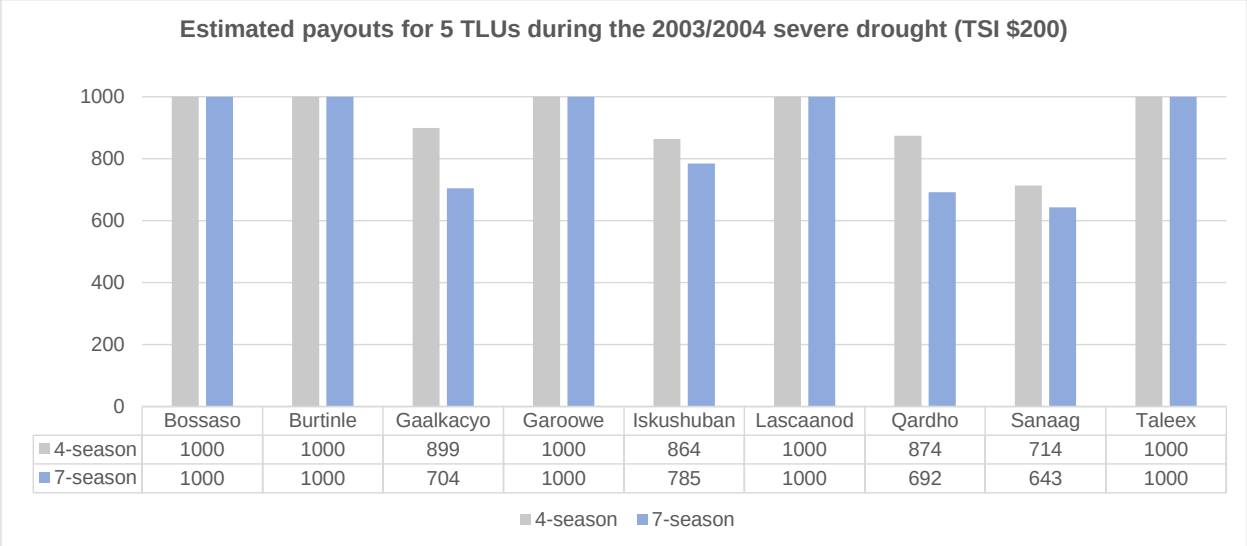
Seasonality is well defined and relatively homogenous in rangelands across Puntland, although the very dry UAIs with low normalized difference vegetation index (NDVI) intensity seem to have prolonged growth seasons during the short rainy season (SRS). Forage production is at its highest from October to December, similar to higher NDVI intensity areas. Through a participatory clustering exercise with stakeholders from the public and private sectors and community representatives, nine UAIs were identified for Puntland. To estimate the total sum insured, the cost of feed supplements, water and consumption by each animal type, as well as affordability and willingness to pay by the pastoralists were considered. A scenario analysis based on estimates of resources needed to access water and food supplements suggested that a tropical livestock unit (TLU) would require USD 340 to survive a 12 calendar months-long drought.

Implementation of drought index insurance products through DRIVE in Somalia will play a critical role in boosting the pastoralists' livelihoods and the country's economy. The current index-based livestock insurance is meant to provide early financial relief when satellite data shows forage index values falling below a certain threshold. This is designed to help pastoralists cope with the devastating impacts of drought before the situation worsens.

During the last two decades, Somalia has experienced significant droughts that have led to widespread livestock mortality, loss of pastoral livelihoods, economic losses, malnutrition and in some instances, loss of human lives due to famine. One of the worst droughts based on satellite data was the 2003 SRS/2004 long rainy season (LRS) drought, locally referred to as 'Kartoomaley'. This drought caused serious socio-economic and environmental losses. Over 85% of total livestock of all species was lost, while some areas experienced extinction of some tree and grass species in Puntland and across Somalia. In the aftermath of this drought, some pastoralists were forced to transition into other economic activities, including migration to urban centres to seek employment and in worst case scenarios, settling in refugee camps. If the current index-based livestock insurance (IBLI) product cover was in place, this drought would have activated about 100% of payouts for most areas in Puntland and in all of Somalia, providing the much needed resources to keep livestock alive and to purchase goods for household consumption. In a household with an IBLI cover of 5 TLUs under a USD 200 total sum insured (TSI), each household would have received between USD 640 to USD 1,000 in payouts (Figure E1).

Data from the pastoral survey indicate that respondents in Puntland are willing to pay USD 33, 23 and 2 as premiums for a camel, cattle and shoat, respectively. While further research will be required in other regions of Somalia during the implementation planning stages, these preliminary findings from Puntland provide useful guidelines for policymakers on the likely levels of premium co-financing or subsidies that may be required to launch drought index insurance for pastoralists.

Figure E1. Estimated payouts (USD) for the 2003–04 severe drought experienced in Puntland.



	Bossaso	Burtinle	Gaalkacyo	Garoowe	Iskushuban	Lascaanod	Qardho	Sanaag	Taleex
4-season	1000	1000	899	1000	864	1000	874	714	1000
7-season	1000	1000	704	1000	785	1000	692	643	1000

Recommendations

Findings from a stakeholders' engagement in Puntland confirmed that drought is one of the biggest risks faced by the pastoralists and that index-based drought risk financing insurance (IBDRFI) product(s) could be necessary to mitigate drought-related risks and losses for pastoralists. Some of the findings were derived from relevant data taken from pastoral surveys conducted in the first quarter of 2022, even though the sample of respondents in these surveys was relatively small and skewed towards women and other marginalized groups. Insights were also drawn from other studies relevant to this technical assignment that were done during the same period.

R1: Product design

- The clustering, basis of valuation and TSI were determined using data from Puntland during a stressful economic time. The estimate for the TSI is relatively high compared to the values in neighbouring Kenya and Ethiopia, where Somalian pastoralists source their food supplements. To design a national drought index insurance product, it is important to carry out similar exercises in other parts of Somalia to understand the agro-ecological and socio-economic characteristics and operational mechanisms, while also determining the willingness and ability of the community to pay for insurance products.
- Puntland experiences two typical growing periods spanning from March to June ('Gu' or LRS) and October to December ('Deyr' or SRS) thus allowing the definition of two risk coverage periods. The bimodal seasonal regime is similar across most of Somalia and would form the basis for the formulation of a two-risk coverage product. However, in-depth review is required to ascertain the level of variation in terms of forage intensity, rangeland sizes and delimitations of the two seasons across the country.
- Using 4 and 7-season drought return periods for Puntland; the triggers are at 25th and 14th percentiles of the forage index, respectively. The 4-season trigger model requires high annual

premium rates of 20%, while the 7-season trigger requires 14%. As the product is new in Somalia, there is need for all relevant stakeholders including the government, private sector, donor agencies and the pastoral communities to agree upon the most affordable and realistic local IBLI cost models. Since most of the analysis has been done for Puntland only, similar analysis should be undertaken across the country.

R2: Implementation process

- Costs related to the creation of an enabling environment, market and capacity development and identification of effective distribution channels as part of the implementation design must be carefully considered and incorporated. Considerable investments will have to be made to create awareness and understanding of the product.
- Linking value chain development to the insurance component should be considered from the very initial stages of development, rather than as an afterthought. Careful consideration is required on bundling of services to clearly define the kind of services (e.g. savings products or information products with insurance) that should or could be bundled and for whom. Since data show that respondents are inclined to save more, albeit informally through groups, this could be favourably considered by banks, such as Galaxy Bank and the Somalia GEEL program.

R3: Conflict mitigation

- In-depth analysis of the security situation especially conflicts and the potential operational implications on the IBDRFI implementation.
- Analysis of potential complementary interventions to enhance IBDRFI payout effectiveness, facilitate uptake and mitigate conflicts between pastoral communities.
- Analysis of potential impacts of IBDRFI payouts on conflicts and consideration for payout distribution approaches that would potentially mitigate these conflicts.

R4: Monitoring and evaluation and Learning strategy

- Monitoring and evaluation and learning strategy, as part of a broader learning framework, to ensure that appropriate mechanisms for quality assurance and impact evaluation are in place.

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Acronyms and Abbreviations

AP	Annual Premiums
CL	Commercial Loading
DIRISHA	Drought Index-Insurance for Resilience in the Sahel and Horn of Africa
DRIVE	De-risking, Inclusion and Value Enhancement of Pastoral Economies Project
EO	Earth Observation
EOS	End of Season
eMODIS	EROS Moderate Resolution Imaging Spectro-radiometer
ENSO	EL Niño Southern Oscillation
FAO	Food and Agriculture Organization of the United Nations
FGD	Focus Group Discussions
FISO	First Somali Takaful and Re-Takaful
GEEL	Growth Enterprise Employment and Livelihoods
HH	Households
HoA	Horn of Africa
IBDRFI	Index-Based Drought Risk Financing and Insurance
IBLI	Index-based livestock insurance
ILRI	International Livestock Research Institute
IGAD	Intergovernmental Authority on Development
LRS	Long Rainy Season
MODIS	Moderate Resolution Imaging Spectroradiometer
MNOs	Mobile Network Operators
MFIs	Micro-finance Institutions
NDVI	Normalized Difference Vegetation Index
NGOs	Non-governmental Organizations
PBR	Pure Burn Rate
SOMREP	Somalia Resilience Program
SOS	Start of Season
SRS	Short Rainy Season
T4	Four Season Trigger
T7	7-Season Trigger
TIA	Takaful Insurance of Africa-Somalia
TLU(s)	Tropical livestock unit(s)
TSI	Total Sum Insured
TWG	Technical Working Group
UAIs	Unit areas of insurance
UN	United Nations
USD	United States Dollar

VSLAs	Village Savings and Loan Associations
WB	The World Bank Group

1. Introduction

1.1. Background

Livestock is central to Somalia's economy. The livestock sector contributes around 40 per cent of agricultural GDP and constitutes 80% of all export earnings. Livestock is the major productive asset for pastoral communities, particularly among vulnerable, low-income households (HH). Pastoral households have few options for durable productive assets, economic activities or enterprises, thus have limited opportunities to diversify their income portfolios and livelihoods base (World Bank 2019).

Drought is the main risk that the pastoralists face as it is also the primary cause of livestock illness and mortality (World Bank 2019). Drought also heightens food insecurity, reduces terms of trade, increases loss in livelihoods and conflict and causes starvation. The 2021 Somalia drought resulted in about 2.3 million people suffering serious water, food and pasture shortages. Approximately 100,000 people in the central and southern areas of Somalia abandoned their homes in search of food, water and pasture for livestock (UN News 2021).

Risk transfer through insurance provides an opportunity to institute appropriate mechanisms that guarantee availability of resources to mount a timely response before a weather shock becomes a crisis or disaster. The traditional ex-post humanitarian response to drought often comes too late when the foundation for herd recovery has been destroyed, making it impossible for vulnerable pastoralists to escape the poverty trap. Through insurance, it is now possible to crowd-in private sector capital and expertise to address the challenges associated with climate change. Insurance provides auditable, transparent and timely risk management solutions that deliver funds to avert catastrophic drought impacts.

Innovative drought index-insurance products have been proven to be a cost-efficient risk transfer mechanism for livestock in arid and semi-arid pastoral regions of Kenya and Ethiopia, which have livestock systems that are similar to those in Somalia They have been shown to positively impact pastoral households' livelihoods and resilience to drought shocks. Lessons learned from these experiences constitute a very important future asset to i) assess opportunities and constraints of implementing drought index-insurance for livestock in Somalia, ii) identify the main areas and the magnitude of initial investment required and iii) to gain insights on how to design and customize drought index insurance models and implementation approaches for the Somalian pastoral context.

A pre-feasibility study was jointly conducted by ILRI and the World Bank in 2019 to assess the possibility of implementing an IBDRFI solution in the pastoral areas of Somalia. This study recommended a more in-depth technical design review and customization study involving local stakeholders to fully understand grazing and migration patterns in the country thus enabling adaptation of product design to the local context.

1.2. Objective and scope of the assignment

This assignment forms part of the preparation for the de-risking, inclusion and value enhancement of pastoral economies (DRIVE) project. This assignment builds on the 2019 pre-feasibility study. The objective of the assignment was to conduct an in-depth technical review and design a drought index insurance product customized to the agro-ecological, seasonal and livelihood needs of pastoral households in Puntland, Somalia. The assignment encompassed the following key aspects i) product design preparation for Puntland, ii) determination of unit areas of insurance (UAIs), iii) scenario analysis

on payouts and costing and iv) providing better understanding of the insurance concept to pastoral communities and private sector actors interested in offering insurance products.

Section 2 below briefly describes the approach taken while Section 3 describes the main findings. The findings include details on the socio-economic impacts of historical droughts, coping strategies and decision-making of pastoralists. This is followed by the description of the clustering process to derive the UAIs, an assessment of affordability and willingness of pastoralists to pay for insurance and a scenario analysis. The report concludes with recommendations and the way forward for implementation of a drought index insurance for pastoralists in Puntland, which can be extended to the rest of Somalia.

2. Methodology

2.1 Study Plan

Since the assignment had two main components; understanding the technical and socio-economic characteristics of areas deemed feasible for implementing a drought index insurance program, a combination of desktop reviews and stakeholders' engagements were carried out. A detailed desk-based technical assessment using Somalian secondary data was done in 2019. In order to carry out the clustering process, Puntland was chosen as an example because it has established networks with development partners, limited financial resources and better security. It should be noted that a similar process will be carried out in Somaliland and other parts of Somalia, which are deemed suitable for the introduction of a drought index insurance product.

The strategy was a combination of desktop reviews, based on additional Puntland-specific data sets obtained from SomRep[1] and participative stakeholder engagements. The first step in the engagement process was the setting up of a technical working group (TWG) for Puntland. The TWG was made up of representatives from the various ministries (finance, planning and economic development, livestock and animal husbandry among others), insurance companies, financial institutions including banks, telecommunication companies, cooperatives and associations (Annexure 1). The TWG was engaged at several levels to i) provide general awareness on the insurance product, ii) involve representatives in the clustering process to determine UAIs and iii) get a general sense of the socio-economic characteristics and potential willingness and ability of pastoralists to pay for insurance.

The second level of engagement was with the representatives of pastoral communities from different Puntland regions/districts such as Nugaal, Hasbahale, Bursalah, Bosaso and Xudun, who participated in the validation process of the clustering exercises conducted by members of the TWG, in addition to being part of focus group discussions (FGDs). The FGDs were carried out to i) seek views and gauge interest on livestock insurance, ii) understand historical drought frequency and coping strategies, iii) understand decision-making processes during periods of shocks, iv) get information on costs of keeping animals alive and v) gauge willingness to contribute premiums for such a product. There was a total of 27 participants over a two-day period (Annexure 2). The information gathered from the clustering exercise, FGDs and additional available datasets was then used to carry out scenario analysis using price estimates generated for different drought situations and subsequent payouts.

[1] ILRI and SomRep have been collaborating in the preparation and implementation of an index-based livestock insurance program in Somalia since 2019. They are part of a consortium called Somalia Livestock Insurance Consortium.

2.2 Clustering process

The product design for Somalia was largely influenced by the existing asset protection-based product implemented in Kenya and Ethiopia. Specifically designed to protect pastoralists in the face of drought shocks, it has so far been implemented in Africa with different modalities, including retail micro-insurance products, macro-level insurance schemes for social livelihoods protection or scalability mechanisms of social safety net programs. All these initiatives rely on similar earth observation (EO) technologies and indices (i.e. based on NDVI data) and are generally designed from anticipatory response principles of early drought detection for early action and impact mitigation. Micro-level IBLI schemes have been implemented in northern Kenya and southern Ethiopia with private insurance companies involved in marketing, promoting and underwriting of the scheme on a voluntary basis with individual pastoralists. Macro-level social livelihoods protection insurance schemes are currently operational at national level in Kenya, through the Kenyan Livestock Insurance Program, eastern Ethiopia and Zambia. Like the current functional product, the assumption was that payouts would be triggered at the end of the season when conditions are critical. However, the choice of increasing the number and frequency of payouts requires extensive consultations with the community members, insurance companies and government officials, which was beyond the scope of this assignment. The maximum payout amount is determined by the TSI, which should be enough to purchase food supplements (feed and fodder), water and medication or discharge any activity with financial implications to keep livestock alive during droughts.

3. Findings

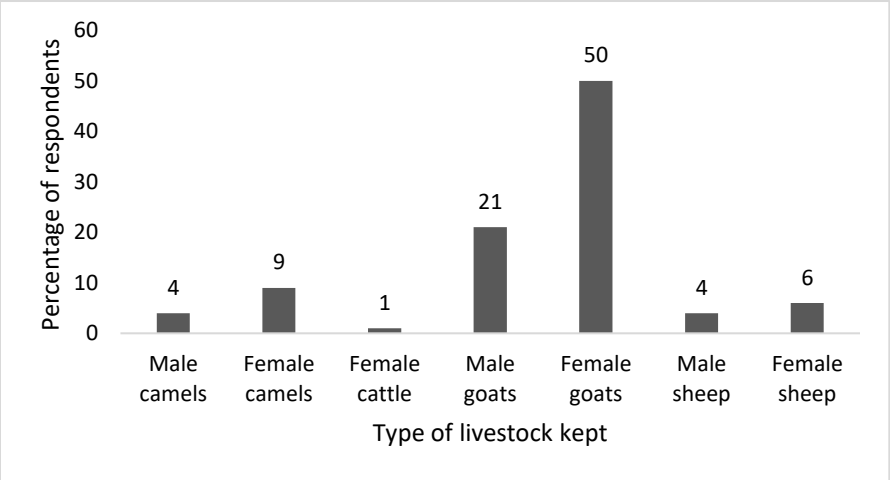
The findings presented in the next section are largely based on a two-day stakeholder engagement, with representatives from different sectors such as the community, private sector and government. Some of the qualitative findings have been complemented by data from the pastoral survey, which was conducted after the stakeholder engagements. Similarly, some of the information provided, which may be relevant for the operational component of the drought index insurance, was obtained from complementary studies conducted independently of this assignment and ongoing engagements by ILRI-SomRep in Puntland and wider Somalia.

3.1 Socio-economic characteristics

In Somalia, poverty remains a dominant feature especially among internally displaced people in settlements and nomads. These population groups are the most vulnerable, even when assessed by other measures and indicators of poverty (World Bank 2018). The households that rely on agriculture and livestock production exhibit the highest rates of poverty, followed by those that rely on small business activities. Households that receive remittances have shown the lowest poverty rates. However, since the onset of the COVID-19 pandemic in 2020, the rate of remittances has substantially declined (Banerjee et al. 2021). On average, rural households own about 4 TLUs of livestock. The nomadic population owns about 21 TLUs per household. The households that rely on agriculture and livestock production own the highest number of livestock units (World Bank 2019).

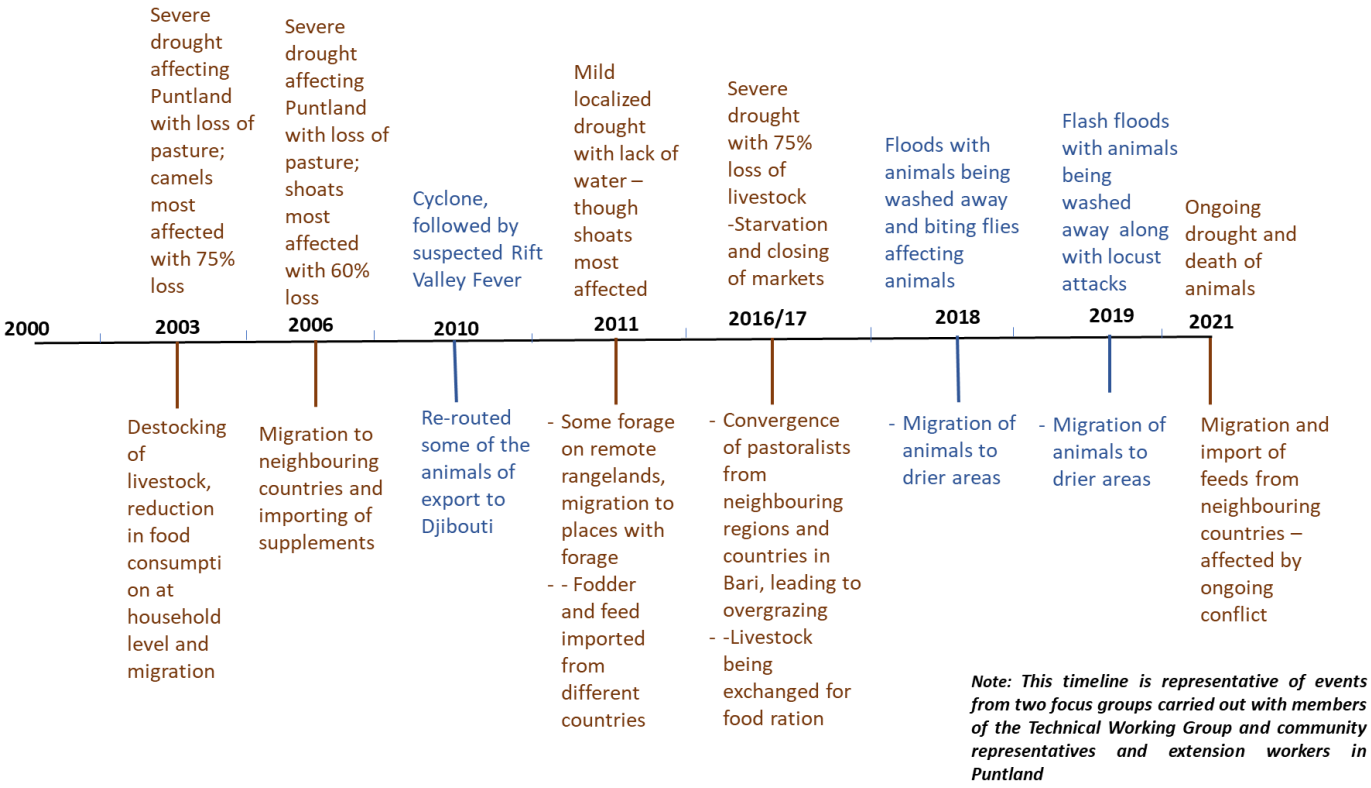
In Puntland, according to the surveyed respondents, the least wealthy pastoralists own a minimum of 5-10 camels and 60 shoats. Pastoralists with less livestock than that tend to move closer to the urban centres in search of menial jobs such as loading and packaging services. It should be noted that the increased frequency of droughts has led to a sharp decline in cattle rearing in favour of camels. Over the years, there have also been changes in herd composition largely due to climatic shocks and conditions... The droughts had a larger impact on cattle whose numbers have declined in households (Figure 1).

Figure 1. Livestock holding in Puntland.



Since 2000, the major climatic shocks in Puntland have been droughts with some severe ones in 2003, 2006, 2011 and 2016-17, coupled with incidences of floods and locust attacks between 2018 and 2019. In addition to the covariate shocks, the situation was worsened by outbreaks of Rift Valley fever and foot and mouth disease. Apart from affecting livestock health, these diseases also affected livelihoods, as exports to middle eastern countries were banned (Banerjee et al. 2021). Figure 2 provides a timeline of the main shocks and their impact on Puntland communities. The implication of such frequent climatic shocks and other risks on the product design should be considered to ensure that the proposed insurance services are best suited to mitigate their impacts.

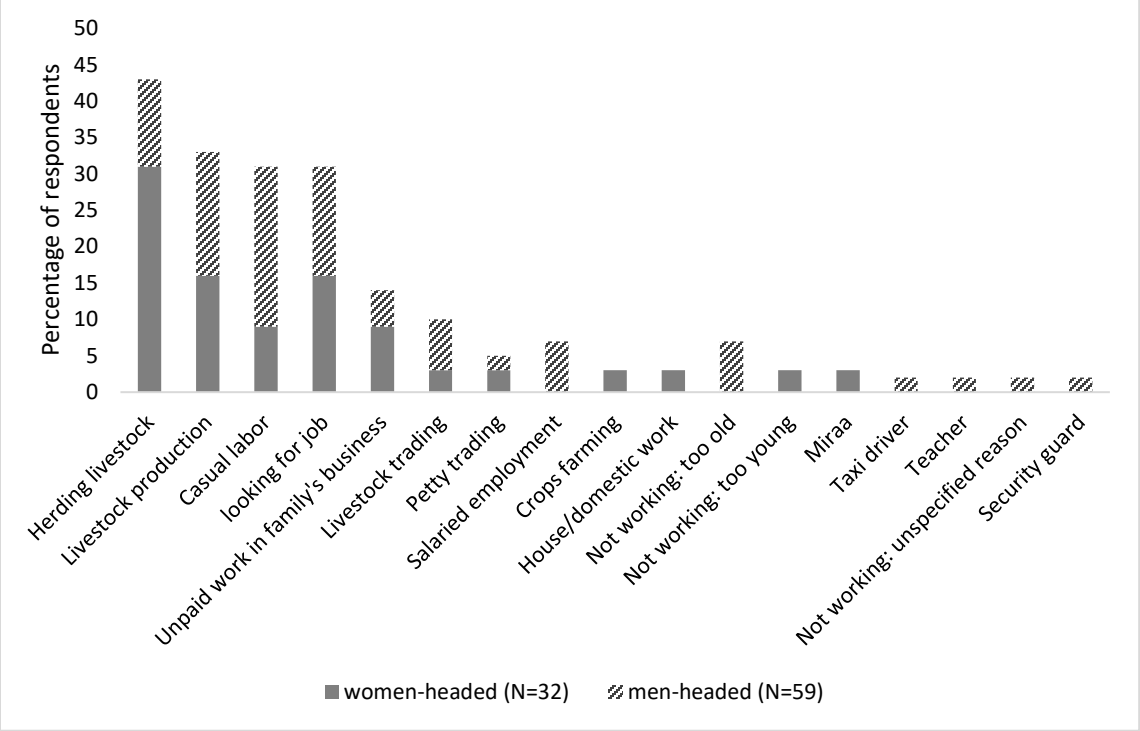
Figure 2. Timeline of shocks and their impact on the communities in Puntland.



Source: As narrated by the respondents during stakeholder engagement sessions.

The respondents stated that migration continues to be part of the traditional coping mechanisms where herders move to distant areas to look for pasture, moving large herds of animals while leaving women, children and small ruminants near permanent sources of water. It was estimated that herders can move their animals as far as 800 km and in severe cases either to Ethiopia or close to the coast. Figure 3 shows the main occupation among women and men who are household heads.

Figure 3. Main Income sources among men and women headed pastoralists households in Puntland.



Source: Authors' own calculations based on pastoral survey data.

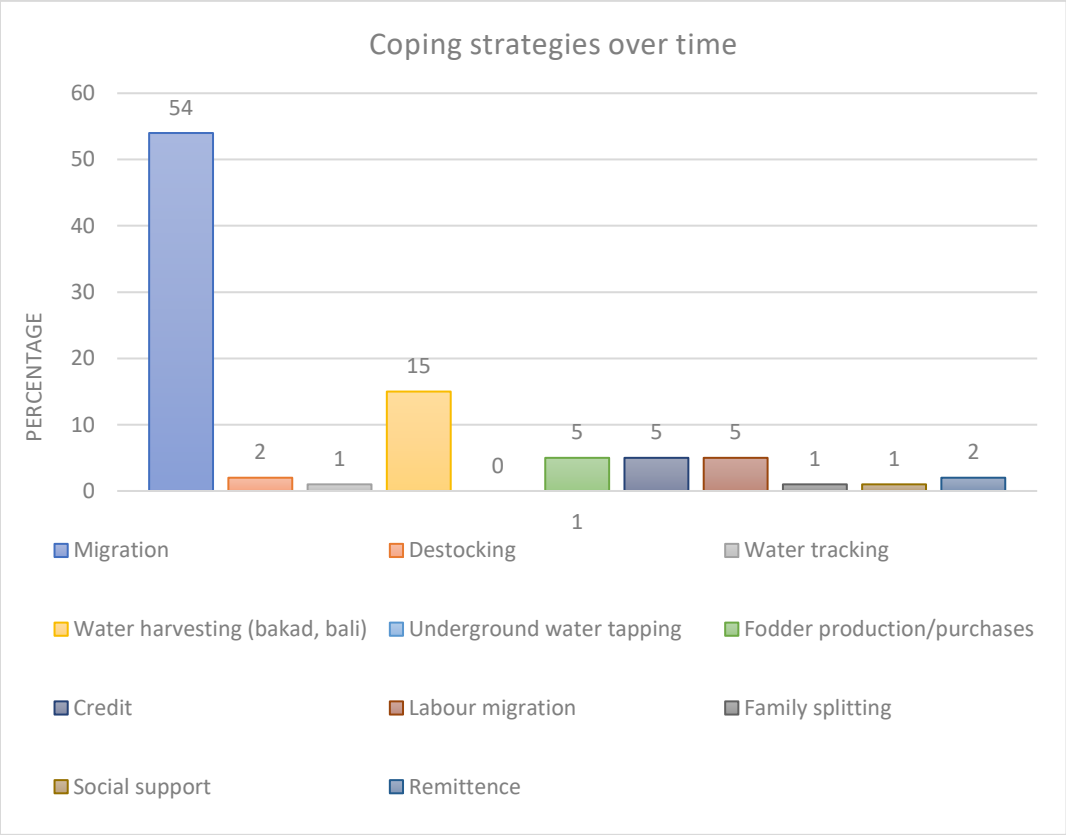
Over time, the traditional migration process has shifted from trekking on foot to transporting animals in vehicles to areas with pasture. On the other hand, wealthy households arrange for water and fodder to be transported to the settlements where their animals are located. Vehicular transportation causes congregation of animals in specific rangelands thus increasing grazing pressure leading to rapid desertification. It would be important to link the insurance product to management of rangelands, either through incentives such as subsidies or by partnering with development organizations working with communities on land use planning and rangeland management. Some pastoralists have started growing grass in their enclosures, with any surplus being sold to other pastoralists. One vehicle load sells for USD 200 during non-dry periods but this increases substantially to USD 1,500 during droughts. For targeting purposes, it is important to understand whether such producers work individually or in groups. The wealthy pastoralists have started digging wells and exploring methods of water harvesting.

Destocking continues to be one of the coping strategies pastoralists employ during severe droughts in addition to diversification into different economic activities such as producing charcoal for sale to meet household expenses. Recently, pastoralists have started selling animals to build up savings and invest in construction of houses in cities, which provide an alternate place to move to in case of droughts and other climatic shocks. Moreover, some pastoralists are moving closer to towns to start camel dairy farming to supply milk to towns. In the process they hire daily wage labourers to tend to the animals.

During drought periods or any other climatic shocks, markets get affected and livestock prices fall, forcing some pastoralists to seek loans or credit from shopkeepers, while others rely on remittances (though this has been affected significantly by the Covid-19 pandemic), gifts or 'Sadaqa' (a form of charity) or help extended by wealthier members of the community to poorer members during stressful times.

Figure 4 summarizes the main coping strategies by the community during severe droughts. Culturally, women do not herd[2] livestock and women-headed households normally partake in charcoal burning, firewood gathering, domestic work in wealthy households and looking after children, the elderly and small ruminants. The youth[3] tend to move to urban centres and join the labour force to earn a living.

Figure 4. Main coping strategies in response to severe droughts over time.



In addition to the community's own coping strategies, external support is also extended to households in times of severe droughts. Non-governmental and development organizations usually provide cash transfers, restocking support and food aid, however, this assistance is mostly offered after the drought. Sometimes veterinary services like deworming and targeted treatment are organized by the Ministry of Livestock and Animal Husbandry. During droughts, the ministry launches mass deworming of animals and provides multi-vitamin supplements through the community NGOs. The local governments sometimes facilitate the creation of multi-disciplinary committees comprising of business people, sheikhs, elders and government officials to raise funds for water trucking, food aid and restocking.

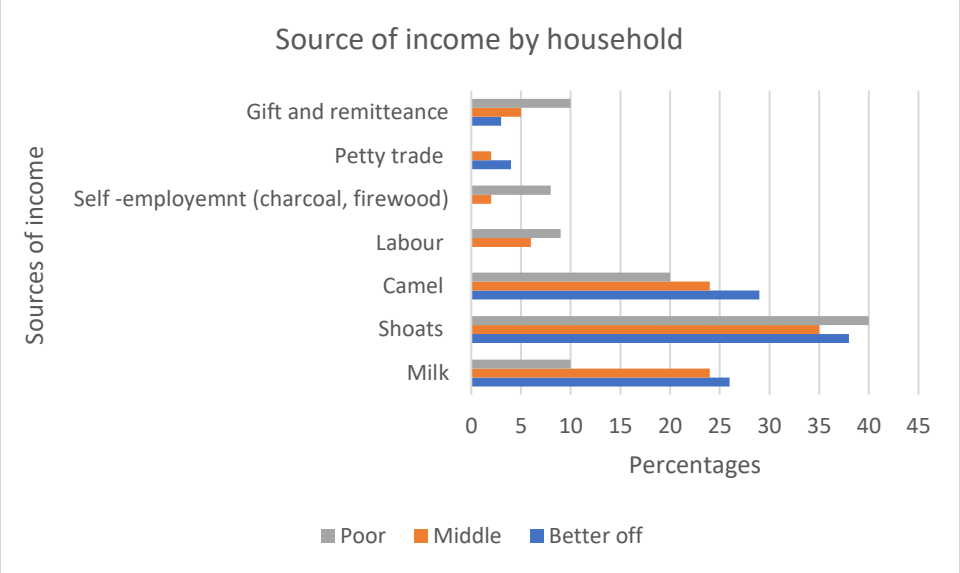
The main source of income and food for the pastoral communities in Puntland is livestock. Most of the income is derived from the sale of livestock and livestock products. Annually, an average household sells 1 camel and 7 shoats. Depending on the household type, a poor household can earn between USD 300 - 600 and a better-off[4] household can earn up to USD 1,000 annually from livestock sales. Another source

[2] Except in the case of small ruminants
[3] This specifically refers to male youth
[4] Term as used by the respondents to define wealthy households.

of income is milk, which is also consumed in most pastoral households. Due to seasonal fluctuations, milk production can fall by as much as 30% during dry seasons.

The major milk producers are camels, as they have a long lactation period. They produce about 3 litres per camel per day in the wet season[5]. Milk production can be as high as 2,700 and 1,300 litres for wealthy and middle-income households, respectively. This could be attributed to wealthy households owning more camels compared to middle-income and poor households. Collectively, both household types contribute 40% to the total milk sold. Most poor households do not have camels and rely on goat milk. One she-goat produces around 0.5 litres of milk per day during the wet season and lactates for about 2 months. An average household with 12 lactating goats could get about 400 litres of milk per year and sell half of it. Poor households also rely on paid work, gifts, remittances and charcoal sales to supplement their income. Figure 6 shows the distribution of the main sources of income by wealth status of households.

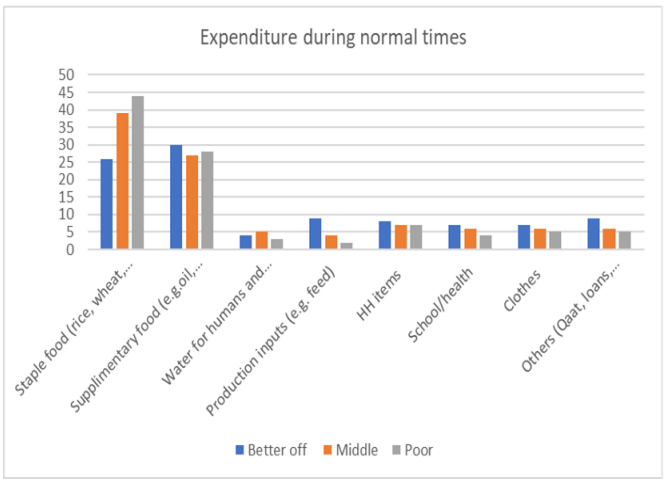
Figure 5. Main sources of income by household type.

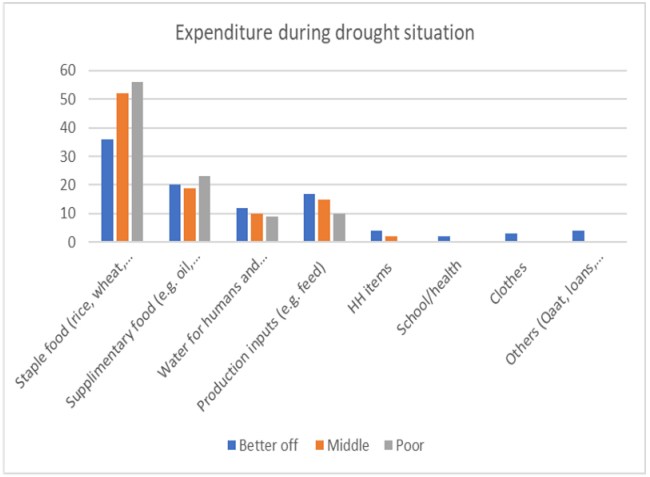


Pastoralists' expenditure patterns were also examined under this study in Puntland. Even though pastoralists buy staple foods such as rice, pasta and wheat to supplement their main diet of milk during normal times, the reliance on purchased foods is greater during the dry season because milk production tends to decline. According to the respondents, a poor, middle-income and 'better-off' household can afford about 600, 950 and 1,500 kg of staple food, respectively. In addition, other expenses include water for human and livestock consumption and production inputs, such as veterinary services and animal feed, which become a top priority during dry periods. Though there is some expenditure on school fees, health and clothing depending on the type of household one belongs to, these items become less important during drought periods. Figure 6 and 7illustrates expenditure patterns by household type during normal and dry periods.

[5] At any given time in the year, there are about 1-3 camels lactating at the same time per household.

Figure 6 and 7. Expenditure of households during normal and drought conditions.



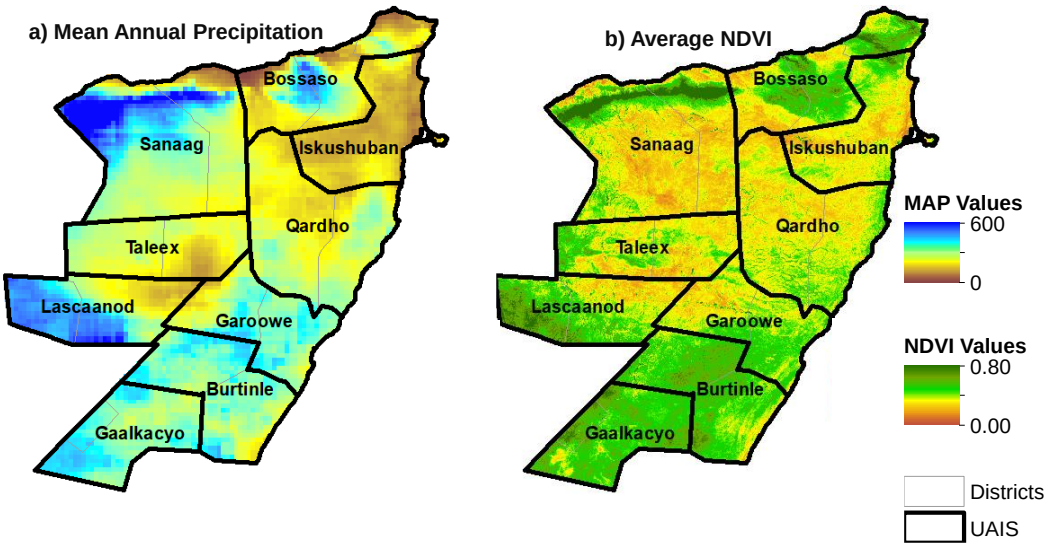


3.2. Seasonality and insurance contract coverage windows in Puntland

The average vegetation growing season in Puntland is relatively homogeneous, although there is variation in intensity of vegetation signals in response variation in precipitation within the area. Generally, NDVI intensity increases southwards with increase in precipitation as shown in

Figure .

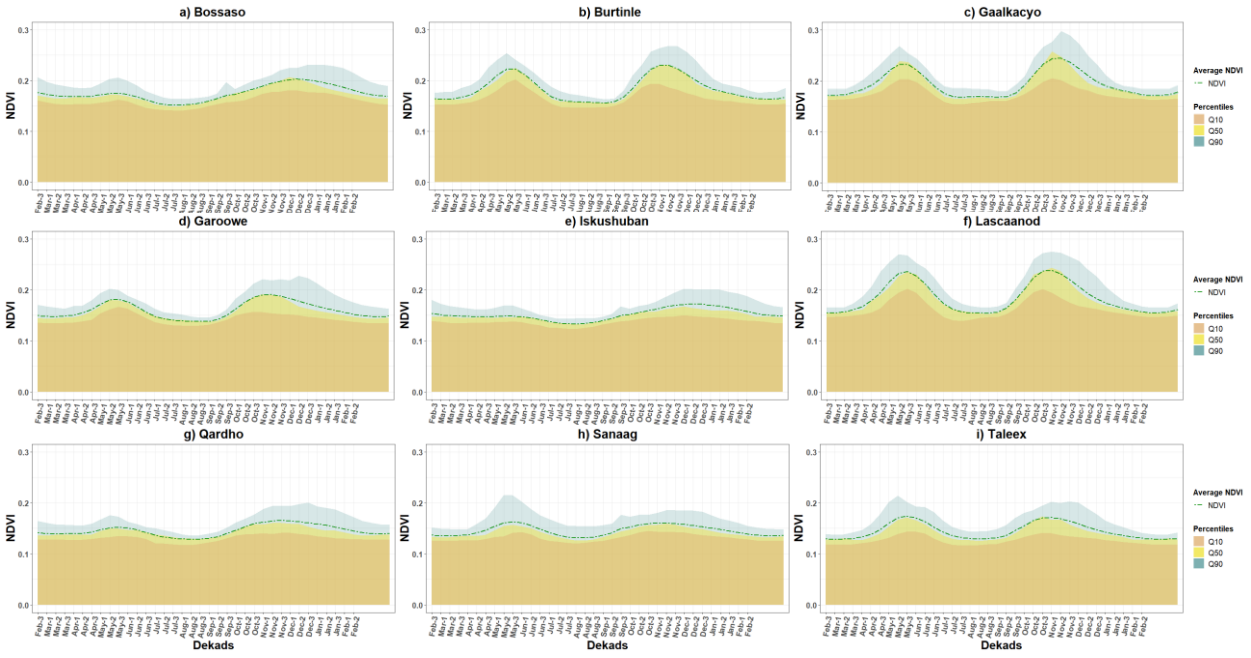
Figure 8. Average rainfall and vegetation conditions in Puntland in a) mean annual precipitation (MAP, in mm) and b) average NDVI intensity.



There is bimodal rainfall distribution in Puntland - the LRS (Gu) from March to June and the SRS (Deyr) from October to December. The seasonality of forage production in the rangelands is well defined and

relatively homogenous across the state although the very dry UAIs with low NDVI intensity such as Bosaaso, Iskushuban, Qardho and Sanaag seem to have prolonged growth seasons during the SRS. The highest forage production is concentrated from October to December, similar to higher NDVI intensity areas. Overall, the typical forage growing season is March to June for the LRS and October to December for the SRS in the country. The arid areas including Bosaaso, Iskushuban, Qardho and Sanaag (Figure 9) have low vegetation cover/density resulting in weak NDVI signals that do not vary greatly during normal and drought seasons, even though they are still considered important animal foraging areas. This may be problematic in index computations, as NDVI in these areas does not perform as well as in areas of high forage production, where major differences between NDVI signals are observed in normal and drought seasons e.g. Burtinle, Gaalkacyo, Lascaanod and Taleex (Figure 9). This requires close monitoring and review after product implementation to minimize chances of basis risk.

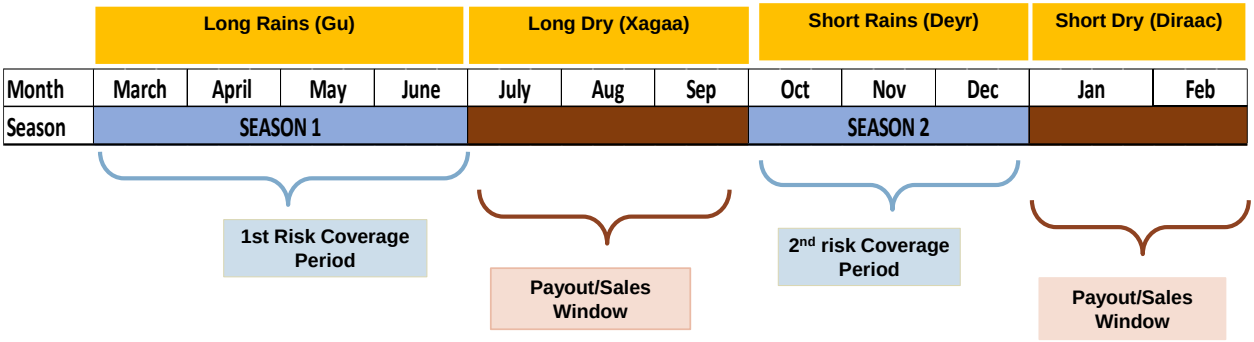
Figure 9. Variability in forage production across Puntland using average 10th, 50th and 90th percentile ranges of NDVI from July 2002 to June 2021.



The insurance coverage period is defined by the duration of the vegetation growing season, which is closely related to the onset and cessation of each rainy season, since the models estimate seasonal forage deficits instigated by droughts. In Puntland, the two typical growing periods observed allow the definition of two risk coverage periods as illustrated in **Error! Reference source not found.**. Since the insurance contracts are issued on an annual basis covering 2 seasons, the sum insured and payouts are split across the two seasons. The first risk period covers the four wet months of the LRS and subsequent three dry months, accounting for 58% of the annual coverage. The second risk period covers three wet months of the SRS and subsequent two dry months, accounting for 42% of the annual cover. The bimodal seasonal regime is similar across most of Somalia, thus would form the basis for the formulation of a two-

risk coverage product. However, in-depth review is required to ascertain the level of variation for start and end of seasons across the regions.

Figure 10. Seasonality design for IBLI contracts showing drought risk coverage windows in Puntland.



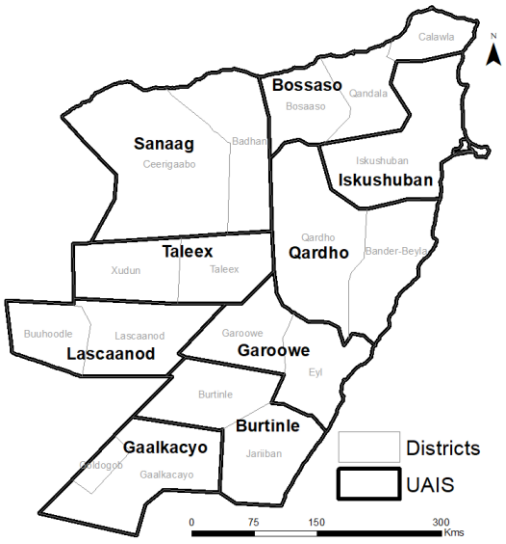
3.2. Delineation of unit areas of insurance

After definition and validation of suitable rangeland areas for an IBLI product, clustering was done to delineate UAIs, the units on which drought risk profiling, product costing and computation of forage index for determination of payouts are done. The process involves definition of homogeneous risk zones or geographical areas with similar soils and topography, rainfall regime, forage/pasture growing conditions and where pastoral communities/clans normally graze their animals during the wet seasons. The area should be large enough to encompass herd grazing movements in normal rainy seasons, but not so large that rainfall and pasture conditions become heterogenous across the selected geographical area. Administrative units such as districts, counties, woredas, subdistricts etc. are typically used to define the homogeneous grazing areas (UAIs) (Chelanga, Khalai, Fava, & Mude, 2017). In Puntland, the district administrative units were selected as the basic building block for the definition of UAIs during the clustering exercise. With the guidance of a technical expert, the exercise was done through FGDs in two stages i) with the TWG comprising of relevant government institutions and the private sector representatives and ii) with the pastoral community representatives and livestock extension service workers for validation, refinement and adoption of the delineated clusters.

The clustering exercise resulted in nine UAIs for Puntland (

Figure **). After grouping the districts into UAI clusters, a common name was adopted based on the popularity of the main district within the unit.** It should be noted that there is an on-going administrative dispute between Puntland and Somaliland states regarding district boundaries shared by the two states. However, pastoralists in the two states move and share grazing resources freely, thus the role of this exercise was to identify areas with similar vegetation conditions and pastoral experiences for the purpose of designing an IBLI product. A similar exercise in Somaliland should take this into account to avoid any conflicts considering that the livestock index insurance will be implemented nationally.

Figure 11. Delineated unit areas of insurance for Puntland state in Somalia.



UAI Cluster	District
1. Bosaaso	Qandala
	Bosaaso
	Calawla
2. Burtinle	Burtinle
	Jariiban
3. Gaalkacyo	Gaalkacyo
	Galdogob
4. Garoowe	Garoowe
	Eyl
5. Iskushuban	Iskushuban
6. Laas Caanod	Buuhoodle
	Laas Caanood
7. Qardho	Qardho
	Bandarbayla
8. Sanaag	Cerigaabo
	Badhan
9. Taleex	Taleex
	Xudun

3.4. Basis of valuation and sum insured

As the policy aims to make timely payouts where forage availability is depleted by drought so that pastoralists can purchase fodder, feed supplements and water to keep their animals alive, the basis of valuation and the sum insured for the drought index insurance product for Puntland was estimated from information gathered on the costs of these inputs per animal species. Daily animal nutritional requirements and the costs of locally sourced feed supplements were averaged for each species to determine monthly costs. The cost of water varied by delivery distance, e.g. below 30 km, an 8,000-litre tanker cost about USD 50 while over 80 km, the cost ranged from USD 250 to 300. The estimated average delivery distance was 55 km at USD 3.125/km resulting in a total cost of about USD 172. Combining water and food supplement costs, the average monthly cost was determined as shown in

Table 1. Averaging across the different animal species, the annual cost per TLU was estimated to be about USD 360. **This valuation provides an indicative sum insured of keeping 1 TLU alive per year in Puntland and is considerably higher than the current sum insured values for the drought index insurance covers in Ethiopia and Kenya**. It is noteworthy that at the time of the field surveys, the cost of feed supplements, which are mainly imported from neighbouring countries, may have been higher than normal due to high inflation, restriction of movement due to the COVID-19 pandemic and ongoing conflict in neighbouring Ethiopia.

Table 1. Cost (USD) of feed supplements and water for livestock in Puntland

	Monthly Costs			Annual Cost (12 Months)	
	Feeds	***Water***	***Subtotal***	***Animal***	***TLU***
Shoats	3.26	0.43	3.69	44	440
Camel	21.92	6.45	28.37	340	272
Average					**356**

During the field surveys, the affordability and willingness to pay for the drought index insurance cover by the pastoralists was considered. Pastoral representatives indicated that a typical pastoralist would be willing to sell one camel (considered to be of high economic value and the most preferred animal for insurance coverage) to pay the drought insurance premiums for their entire herd. However, it should be borne in mind that to ensure inclusivity, one would also need to take into consideration shoats and cattle, as the former are largely owned by women, whereas the latter are owned by both men and women. In Puntland, a mature healthy camel is estimated to cost about USD 1,000 on average and assuming a middle-income household has an average camel herd of 50, this would translate to USD 20 premiums per camel. With an indicative sum insured of USD 360 per TLU, the USD 20 premium payment by the pastoralists would translate to a premium rate of about 5.6%. Commercial programs in Kenya and Ethiopia currently charge premium rates of about 15% or USD 54 per TLU, which means middle-income pastoralists in Puntland would be willing and able to fund about 40% of the full commercial premium costs for drought index insurance. Data from the survey indicate that respondents in Puntland are willing to pay USD 33, 23 and 2 as premiums for a camel, cattle and shoat, respectively. While further research will be required in other regions of Somalia during the implementation planning stages, these preliminary findings from Puntland provide useful guidelines for policy makers on the likely levels of premium co-financing or subsidies that may be required to launch drought index insurance for pastoralists across Somalia.

3.4 State of financial services and livestock markets

The payouts from the current product in Kenya and Ethiopia are supposed to facilitate pastoralists' access to services, which help them to cope with droughts. A 2017 study showed that payouts were used for animal feed and fodder, veterinary drugs, household food and school fees and occasionally to settle debts (Taye et al. 2019). Therefore, it becomes crucial to understand the market conditions of a potential implementation site, while also scanning the state of financial services. Even though the state of markets is Puntland-specific, the state of financial services is assumed to mirror that of Somalia and, therefore, equally applicable to Puntland.

3.4.1. Characteristics of markets in Puntland

The livestock markets in Puntland are differentiated into i) primary markets found in the peri-urban centres, ii) satellite markets, which tend to be mobile markets established around water points where animals converge and iii) secondary markets located in larger towns. The satellite markets are accessed by livestock traders, brokers agents and middlemen who supply the secondary markets located in the larger towns of Puntland such as Galkaayo as well as towns at the border with Ethiopia. The most important secondary market is Bosaso, where goats are the main livestock species traded. The female goats (dibaax) are for local consumption, while the male ones (ahmin) are exported. The main livestock

species traded in the Galkaayo livestock market are shoats and a few camels, while in Garowe, also a secondary market, both shoats and camels are sold in equal volumes.

Livestock markets in Puntland also trade commodities such as food items, clothes, shoes, electronics and veterinary drugs, in addition to hosting tea shops and small restaurants. However, pastoralists have challenges accessing these markets, primarily because of lack of market information. Most pastoralists do not get market-related prices for their livestock due to lack of information on the required grades and quality standards to attract good offers. It would be important to further investigate, as part of the implementation process, the scope of providing market information as a bundled service with savings as part of the insurance policy offering.

3.4.2. State of financial services in Somalia and Puntland

There are numerous financial institutions including conventional banks such as Dahabshil, Amal Bank, Premier Bank, IBS Bank, Galaxy Bank and Puntland State Bank, in addition to mobile network operators and micro-finance institutions (MFIs). Mobile money plays a very significant role in Somalia's and by extension, Puntland's financial ecosystem largely due to i) the lack of faith in the local currency, the Somali shilling, ii) the difficulty of transacting in United States dollars for low-value transactions, iii) the zero-rated transaction costs and iv) ease of use of mobile money services. However, there is low availability of pro-poor products as the financial system strongly incentivizes a small number of high value transactions. This limits borrowing opportunities for small, informal or semi-formal businesses (Banerjee et al. 2021).

A study from the 1990s estimated that less than 10% of money for primary livestock purchases was formally sourced from banks, with the bulk of it informally sourced from colleagues, friends and associates. For security reasons, mobile traders seldom carry cash, especially when visiting remote and insecure areas (Little 2010; Banerjee et al. 2021). Furthermore, most of the rural population is unbanked. Banking services reached only 16% of the whole population, with the majority of these clients residing in the urban centres (Banerjee et al. 2021).

Several MFIs exist, complementing services provided by the banks, but their outreach and coverage mirrors that of banks. One of the most popular and well-established banks in Somalia, the Dahabshil Bank, has a micro-finance service through its foundation that works with small businesses unable to meet the commercial bank's lending requirements/criteria to secure loans. Dahabshil Bank does not have livestock-specific products as most of the would-be borrowers cannot meet their basic requirements (Banerjee et al. 2021). However, there have been some promising preliminary discussions between ILRI-SomReP and Galaxy Bank on the potential of bundling insurance and credit services. Since the discussions are still in the early stages, the design of such bundling services is yet to be done.

A lot of the MFIs are supported by the Growth Enterprise Employment and Livelihoods (GEEL) program, which offers interest-free loans to sectors such as livestock, crops and fisheries. Other institutions that support MFIs, producers' groups and cooperatives are consortiums such as SomReP. The Somalia Resilience Programme currently supports 416 village savings and loan associations (VSLAs), which include pastoral and agro-pastoral areas in Puntland, Somaliland and southwest states in Somalia. The VSLAs have 5,576 and 1,878 women and men, respectively. Some of these groups have access to loans based on a graduation model. The initial loan amount is USD 300 rising to a maximum graduating loan of USD 1,000.

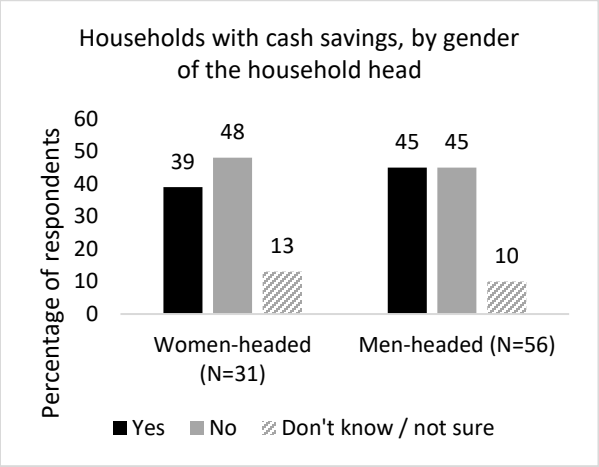
Due to efforts of the SomReP and GEEL program, banks are considering investments in these sectors. One such example is Amal Bank, which invests in cooperatives providing ease access to finance. Amal Bank together with the central government of Somalia, GEEL program and the Qatar Charity Foundation have started providing loan schemes called packages. The focus of these 'packages' is on small-scale business start-ups, targeting women entrepreneurs and youth (both male and female). One of the packages

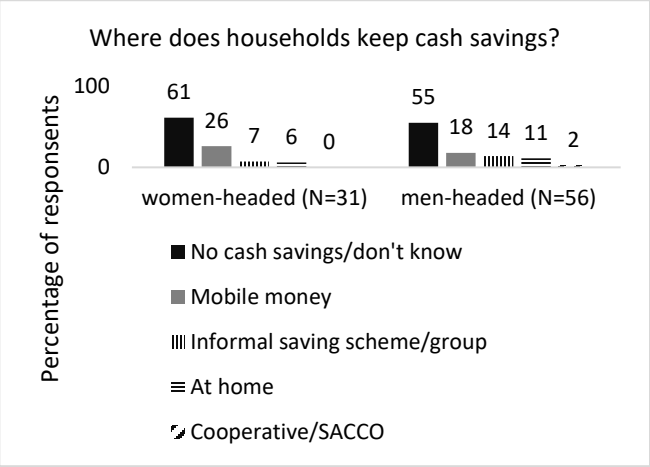
provides loans between USD 200 - 300 interest free, while another one offers loans at 7% interest and a 2-year maximum repayment period. The response to these initiatives has been promising with an initial investment of USD 110,000 in phase 1 expanded to USD 500,000 for phase II. The packages which were piloted through the GEEL program had positive responses among the women and youth, with some application requests exceeding loan limits. Efforts are underway to expand the portfolio to meet the demand.

There seemed to be little gender disparities in terms of savings within the category of those who could afford to save. Results from the sample surveyed in Puntland showed that 39% of women-headed and 45% of men-headed households had cash savings, with the women preferring to keeping their savings as mobile money, while the men preferred to keep the cash at home. Figures 12 and 13 show the households with cash savings and where the savings are kept, respectively.

Figure 12. Proportion of households with cash savings. Figure 13. Places where cash savings are kept.

Source: Authors' own calculations based on pastoral survey data





It is crucial to have better understanding of the characteristics of women (besides being household heads) who have the capacity to save versus the ones who cannot. This could have implications on product recipient targeting and subsidy determination. In addition, since Amal Bank is already participating in a loan provision scheme and is in talks with Galaxy Bank to decide on the type of services they can offer regarding the drought index insurance products, it would be prudent to engage them to gauge their interest and appetite in introducing savings schemes as bundled products with insurance.

Though the insurance sector is nascent, it is starting to grow. While the industry is weak and underdeveloped, the concept of insurance is not new in Somalia, since there was once a government-run national insurance scheme during the pre-war regime. While insurance coverage is very low, 90% of existing business is medical insurance mainly provided by Takaful Insurance of Africa (TIA)-Somalia and First Somali Takaful & Re-Takaful (FISO) to non-governmental organizations (NGOs) and expatriates (Banerjee et al 2021). Recently the Horn of Africa, UMMA Insurance, Baraka Takaful and Amanah insurance[6] companies have also started to offer insurance products. Takaful Insurance of Africa is the largest insurer in terms of underwritten policy premiums and its primary business is medical insurance

[6] Both Baraka Takaful and Amanah Insurance are part of the technical working group formulated in Puntland along with TIA-Somalia.

cover that constitutes around 90% of the underwritten business. However, the total gross underwritten premium is below USD 6 million. The insurance companies also offer motor vehicle, marine cargo, travel and business insurance products that are Shariah-compliant. The insurance companies rely on external reinsurers, such as Kenya-Re, First-Re and Tunis-Re to cover their risks in a self-regulated environment, as there are no insurance laws, regulations or an associated supervisory body. There is general interest on drought index insurance from all the insurance companies mentioned above, however, advanced talks have only taken place with TIA-Somalia that has an operating office in Puntland. Further engagements with all insurance companies are required to gauge both their appetite and expectations regarding implementation of drought index insurance for pastoralists, starting in Puntland and eventually extending to all suitable areas in Somalia.

3.5. Scenario analysis

3.5.1 Overview and objectives of the scenario analysis

The scenario analysis aims to provide a broad overview of how an IBLI product might work in Somalia and an illustration of indicative costing for alternative options of the product. The analysis builds on a feasibility analysis done in Somalia in 2019 (Fava et al. 2019), the more recent Drought Index-Insurance for Resilience in the Sahel and Horn of Africa (DIRISHA) report (Kahiu, Vrieling, & Fava, 2021; Lung et al., 2021) and some background information gathered from Puntland. The scenario analysis considered two product costing options, which were customized for Puntland based on 4 and 7-season drought return periods (Table 2). The two scenarios build upon the work done in Kenya and Ethiopia, where the product is on offer and has been widely tested and validated through in-depth research and quality assessments on operations and design. Detailed methods for IBLI product design are presented in Appendices 3A and B. The two costing options were applied under varying subsidy levels, i.e. partial to full subsidy, as a guide for the estimated cost of a government subsidized IBLI program.

Table 2. Product costing options based on 4 and 7-season drought return periods

Description				TSI		CL
Return Period	**Code**	**Trigger Threshold**	**Exit Threshold**	**12-Month**	**7-Month**	
7 season (3.5 years)	T7	14 Percentile	Min	$360	$200	30%
4 Season (2 years)	T4	25 Percentile	Min	$360	$200	30%
Tigger and Exit are based on the forage index values; TSI - Total Sum Insured; CL - Commercial Loading						

The proposed 4 and 7-season drought return costing options represent severe to very severe drought incidences. They are based on drought frequency and severity derived from remote sensing data, the NDVI (as a proxy for forage availability corroborated by literature) and local expert/pastoral community appraisal of historical droughts from FGDs held in Puntland. The two options are used to define the forage index value below which a payout is activated, known as the trigger threshold. In this context the trigger thresholds are forage index value percentiles of 25^{th} and 14^{th} for the 4 and 7-drought return periods, respectively (see Table 2 and Appendix 3B for details). Conversely, the forage index value at which a maximum payout is reached, known as the exit threshold must be determined. The UAI-specific minimum forage index values for LRS and SRS in Puntland were used. Using the two predefined trigger and exit thresholds, payouts were determined, allowing the estimating pure burn rates for an IBLI program in Puntland. These were further run against a 7-month TSI of USD 200 to cover the two forage growth risk windows for LRS and SRS (as described in Section **Error! Reference source not found.**) and as a fraction of

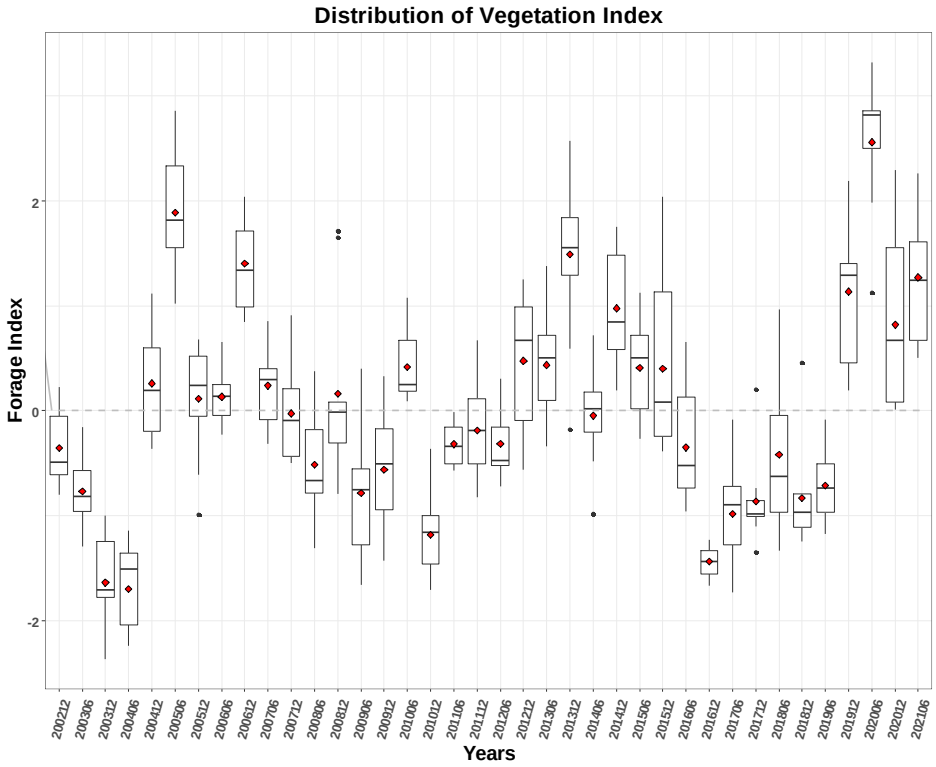
the annual (12-month) TSI of USD 360, estimated from the cost of water and food supplements to keep an animal alive during droughts as described in Section **Error! Reference source not found.**.

Implementing the variables defined above (Table 2), the purpose of this scenario analysis is twofold: i) simulation analysis on historical data to illustrate product performance during drought periods in Puntland and ii) financial analysis under a range of options to illustrate hypothetical costings for IBLI implementation in Somalia. The outcome derived from the historical analysis was applied to a hypothetical market under a 30% commercial loading. Since an IBLI program is new in Somalia, this may be understated and will largely be determined by investment requirements by underwriters and the private sector for development of marketing and distribution channels. It is also noteworthy that the TSI used was determined during a high inflation period driven by the COVID-19 pandemic. The impact of the ongoing political unrest in Ethiopia should also be accounted for through regular product review. Additionally, the proposed cost scenarios are indicative and not meant to be recommendations for a specific option nor do they pretend to cover an exhaustive range of IBDRFI solutions. Instead, they provide information on possible cost estimates for such products. Hence, a detailed analysis of alternative pragmatic options and product design customization needs to be planned with local stakeholders at the early implementation stages of the product. The suggested scenarios provide flexible and pragmatic options to cover a wide range of beneficiaries with various financial capabilities and vulnerabilities and to determine financial implications for the government under various subsidy levels.

3.5.2. Simulation of historical payouts in Puntland

Puntland has experienced several droughts according to forage indices computed using IBLI forage index methods and corroborated by information provided by respondents during FGDs as indicated in Section 3.1. The major widespread drought events occurred in the years 2003-04, 2009-10, 2016-17 and 2017-18. The last two incidences indicate drought persistence for more than three consecutive seasons, suggesting either below normal cyclic rainfall patterns or compromised ability/limited resilience of rangeland systems to recover after major droughts. In the Horn of Africa (HoA), the cyclic below average precipitation seasons/years have been attributed to the impacts of the El Niño Southern Oscillation (ENSO, the La Niña and El Niño phenomena). La Niña often causes hot and dry conditions, resulting in prolonged and recurrent droughts while El Niño induces wetter conditions in the HoA and across Africa (MacLeod, Graham, O'Reilly, Otieno, & Todd, 2021; Nicholson & Kim, 1997; Wang, Deser, Yu, DiNezio, & Clement, 2017).

Figure 14. Distribution of forage in Puntland across the nine UAIs from July 2002 to June 2021.

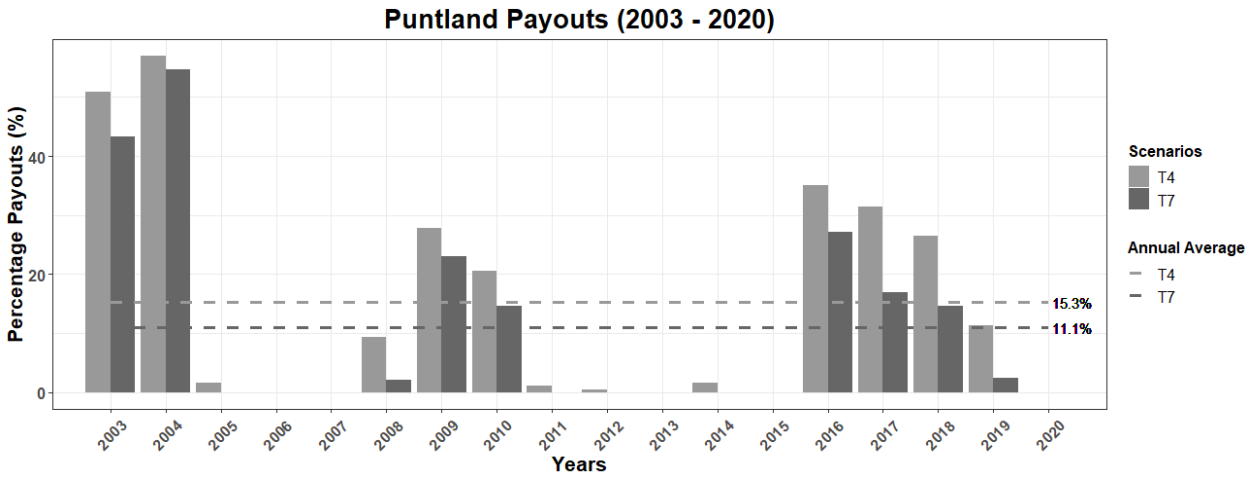


Across the years, the peaks indicate above average years while troughs show drought years. The diamond symbols in the boxplot show the average forage index, with the lower and upper bounds of the box showing 25th and 75th percentiles, respectively. The median is denoted by the inner horizontal line. The vertical whiskers show the full range of data, excluding outliers shown as black points outside the whiskers.

Two historical payout scenarios are demonstrated using the IBLI product model in Puntland over the 2002–21 epoch. The scenarios have trigger thresholds set to pay out every 4 and 7-seasons (referred to as T4 and T7, respectively) to illustrate the implications of increasing the frequency of payouts (Figure 14). After computing T4 and T7, major drought events, i.e. triggering significant (≥ 25%) annual payouts, were evident in both options. T7 scenarios had the lowest number of major drought events for the years 2003, 2004 and 2016, while T4 had the highest number for the years 2003, 2004, 2009, 2016, 2017 and 2018. T7 only captures extremely severe droughts while T4 captures both the moderate to extremely severe drought events. The observed temporal drought patterns in Puntland are aligned with pastoralists and regional reports of drought occurrence in Somalia. It is notable that both trigger options missed the 2021 LRS drought reported across the entire HoA causing widespread livestock mortality in Puntland. This requires in-depth analysis to understand the conditions that may have led to this mismatch between the IBLI models and conditions on the ground.

Figure 15. Historical annual payouts[7] as a percentage of total sum insured in Puntland for the epoch July 2003 to June 2020.

[7] The annual payouts combine long and short season averages.



Under T4 and T7, the average payouts, i.e. pure burn rate[8] are 15 and 11%, respectively. This illustrates that an increase in payout frequency increases the trigger thresholds resulting in significantly higher product costs (Figure 15). A comparison between the two costing options shows that the less frequent payout model (T7), is cheaper but pays significant amounts during severe droughts. Conversely, the higher frequency payout model (T4) is more expensive and would still pay higher amounts than T7 (Table 3). The worst drought years that occurred in Somalia in 2003-04, 2009-10 and 2016-17, attracted average annual payouts that ranged from 21-57% and 15-55% for T4 and T7, respectively (Table 3). The 2003 SRS/2004 LRS was the worst drought period, triggering close to 100% of annual payouts for most of the UAIs in Puntland. This aligns with the FGDs' feedback that most pastoralists lost almost all their livestock during this period, locally known as the Kartoomaley. In areas such as Sanaag and Bari, over 85% of all livestock species was lost. This drought is reported to have caused extinction of some tree and grass species in some areas in Puntland, while some pastoralists were forced to transition into other economic activities including migration to urban centres to seek employment while others had to settle in refugee camps. During Kartoomaley, government and international organizations placed greater focus on saving human lives than livestock assets. Analysis of other important droughts cited in FGDs in Puntland show similar findings (Table A1).

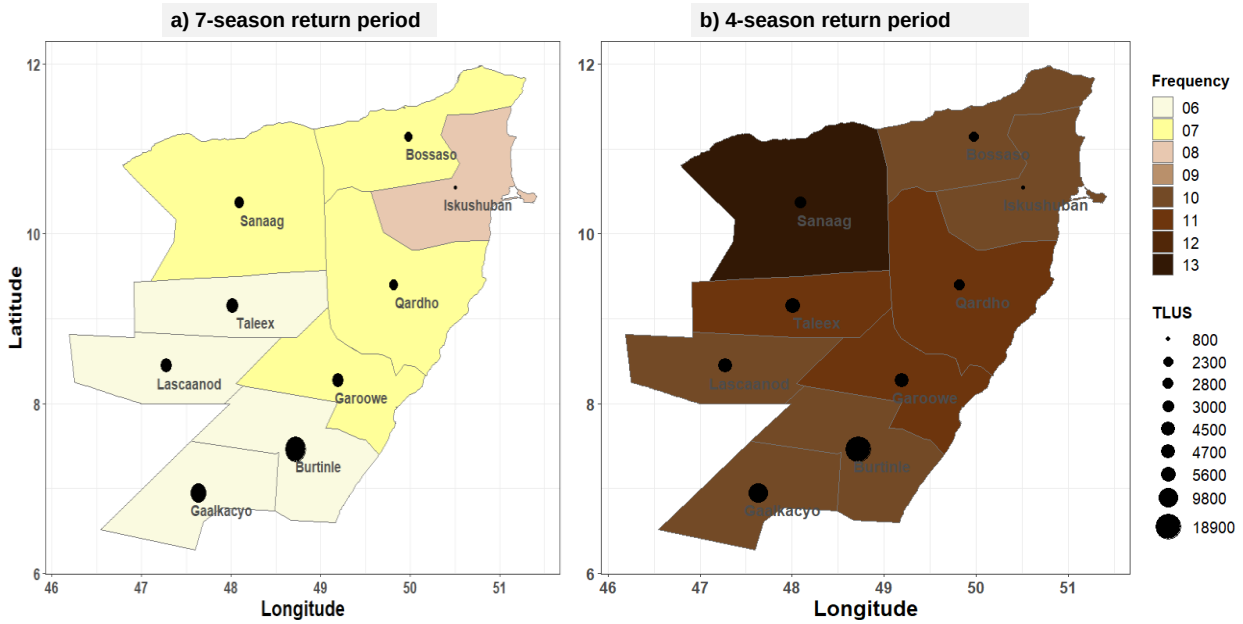
Table 3. Average payouts for the Puntland's unit areas of insurance for the 4 and 7-season drought return periods during severe drought years

[8] Pure burn rate, also known as a pure premium, is a measure of the average loss per exposure, i.e. the average historical cost of a specified risk, excluding any administrative, fiscal, commercial costs or anticipated profits.

4-season drought return period														
UAIS		2003		2004		2009		2010		2016		2017		Annual
Name	ID	LRS	SRS	LRS	SRS	LRS	SRS	LRS	SRS	LRS	SRS	LRS	SRS	UAI
Bossaso	1	46%	42%	58%	0%	0%	20%	0%	0%	0%	42%	22%	10%	40%
Burtinle	2	0%	42%	58%	0%	6%	7%	0%	23%	0%	23%	41%	12%	36%
Gaalkacyo	3	0%	42%	48%	0%	58%	27%	0%	13%	0%	27%	58%	7%	47%
Garoowe	4	0%	42%	58%	0%	2%	0%	0%	42%	2%	28%	19%	14%	34%
Iskushuban	5	19%	28%	58%	0%	0%	0%	0%	0%	19%	42%	0%	15%	30%
Lascaanod	6	8%	42%	58%	0%	42%	0%	0%	27%	0%	18%	0%	0%	33%
Qardho	7	39%	29%	58%	0%	0%	0%	0%	42%	4%	29%	4%	17%	37%
Sanaag	8	22%	13%	58%	0%	58%	2%	0%	13%	4%	42%	4%	2%	37%
Taleex	9	2%	42%	58%	0%	28%	0%	0%	23%	0%	36%	28%	29%	41%
Seasonal Average		**15%**	**36%**	**57%**	**0%**	**22%**	**6%**	**0%**	**21%**	**3%**	**32%**	**20%**	**12%**	
Annual Average		**51%**		**57%**		**28%**		**21%**		**35%**		**32%**		**37%**
7-season drought return period														
Bossaso	1	40%	42%	58%	0%	0%	6%	0%	0%	0%	42%	0%	0%	31%
Burtinle	2	0%	42%	58%	0%	0%	0%	0%	18%	0%	18%	39%	0%	29%
Gaalkacyo	3	0%	42%	28%	0%	58%	22%	0%	0%	0%	22%	58%	0%	38%
Garoowe	4	0%	42%	58%	0%	0%	0%	0%	42%	0%	22%	13%	0%	30%
Iskushuban	5	3%	20%	58%	0%	0%	0%	0%	0%	3%	42%	0%	0%	21%
Lascaanod	6	0%	42%	58%	0%	38%	0%	0%	24%	0%	13%	0%	0%	29%
Qardho	7	38%	11%	58%	0%	0%	0%	0%	42%	0%	11%	0%	0%	27%
Sanaag	8	19%	6%	58%	0%	58%	0%	0%	6%	0%	42%	0%	0%	32%
Taleex	9	0%	42%	58%	0%	25%	0%	0%	0%	0%	29%	25%	16%	32%
Seasonal Average		**11%**	**32%**	**55%**	**0%**	**20%**	**3%**	**0%**	**15%**	**0%**	**27%**	**15%**	**2%**	
Annual Average		**43%**		**55%**		**23%**		**15%**		**27%**		**17%**		**30%**

Spatial patterns of drought are generally similar, but small variations occur across the UAIs (Figure 16) Error! Reference source not found.**. Annual average payouts fall in the range 10-15%.** During the severe drought years, Gaalckayo had the highest rates of payouts (47 and 38% for T4 and T7, respectively) while Iskushuban had the least rates (30 and 21% for T4 and T7, respectively) (Table 3). Spatially, considering drought severity for T7 and T4, Iskushuban had the highest number of droughts triggered under T7, with eight observed drought events for the epoch July 2002 to June 2021, while other UAIs triggered six or seven drought events (Figure 16). Under T4, Sanaag had the highest drought incidences at 13, over the 20 years of the NDVI data.

Figure 16. Number of drought events triggered under 4 and 7-season return periods across Puntland's unit areas of insurance.



3.5.3. Costing scenario for drought index insurance for pastoralists in Puntland

Indicative costings for an IBLI product in Puntland were computed. The costing was determined using the 4 and 7-season drought return costing models (Error! Reference source not found.**) to provide governments and donor communities with premium and subsidy options for an affordable IBLI product for pastoralists in Somalia.** Even though most of the analysis focused on Puntland, the costing can be broadly applied to government or donor-driven product costing across Somalia. However, adjustments to product parameters such as UAIs, risk windows and TSI will be required. The financial implications of government or private driven IBLI implementation of micro-insurance are also provided. The analysis was done assuming an IBLI-like contract design discussed above to estimate the historical payouts for both risk windows covering the LRS and SRS from July 2002 to June 2021. The analysis provided two options (T4 and T7) and assumed a TSI of USD 200 under three subsidy regimes of 25, 65 and 90%. In Puntland, one TLU would require about USD 360 per annum to survive a drought over 12 calendar months, as calculated in Section 3.4. Since this amount is quite high, a cheaper alternative for the same USD 200 TSI is proposed based on 7-months' coverage for the LRS and SRS drought risk windows only, i.e. 4 and 3 months for the LRS and SRS, respectively. Alternative options for the USD 360 annual TSI are presented in Appendix 3C and Table A4.

Using T7 and T4 within a soft market operating at 30% commercial loading, the annual premium rates applied to the sum insured would correspond to 14 and 20%, respectively (Table 4). The cost is significantly higher for the T4 compared to the T7 option at USD 40/TLU. Under T7, this would translate to USD 70, 182 and 252 investment for 25, 65 and 90% subsidy levels, respectively, assuming 10 TLUs per household coverage. A similar subsidy scheme with T4 costing options increases to USD 100, 260, and 360, under 25, 65 and 90% subsidy levels, respectively. The global fiscal cost for large-scale implementation covering about 50, 000 households under these scenarios is presented below.

Table 4. Cost of '10 TLUs per household' program under 4 (T4) and 7-season (T7) drought return cost options

Description		Rates		APC (100%)		Subsidies (10TLUS/HH)		
				1 TLU	10 TLUS			
Return Period	Trigger (Index P)	PBR	AP (30% CL)	TSI $200	TSI $200	25%	65%	90%
T7 (7 season/3.5 years)	14th	11%	14%	$28	$280	$70	$182	$252
T4 (4 Season/2 years)	25th	15%	20%	$40	$400	$100	$260	$360
Index P - Index Percentiles; PBR - Pure Burn Rate; AP-Annual Premiums; APC - Annual Premium Cost; CL - Commercial Loading; TSI - Total Sum Insured				Option	No. Households			
				T7	1,000	$70,000	$182,000	$252,000
					5,000	$350,000	$910,000	$1,260,000
					10,000	$700,000	$1,820,000	$2,520,000
					20,000	$1,400,000	$3,640,000	$5,040,000
					50,000	$3,500,000	$9,100,000	$12,600,000
				T4	1,000	$100,000	$260,000	$360,000
					5,000	$500,000	$1,300,000	$1,800,000
					10,000	$1,000,000	$2,600,000	$3,600,000
					20,000	$2,000,000	$5,200,000	$7,200,000
					50,000	$5,000,000	$13,000,000	$18,000,000

A micro-level commercial insurance program over 5 years with a target population of 50,000 households, 10 TLUs/household and 90% subsidy regime would cost ≈ USD 12.6 million and 18 million for T7 and T4 costing options, respectively (Table 4). The cost of coverage decreases with a corresponding decrease in the subsidy level, therefore, it may be feasible to provide coverage to a larger population of pastoral communities (see Table 4 for 25, 65 and 90% subsidy options for various household sizes). Since the introduction of a subsidized IBLI program in Somalia will be gradual, it will be possible to cover more households in year 5 of the planned 5-year DRIVE project. These costings do not account for the creation of an enabling environment, marketing and distribution channels for the new IBLI product in Somalia, which are essential for the product's successful launch and implementation.

4. Recommendations and way forward

Findings from the stakeholders' engagement in Puntland validated that drought is one of the biggest risks faced by the pastoralists and that drought index insurance product(s) could be a necessary intervention to help pastoralists cope with the drought related risks and losses. Additional relevant data was taken from the pastoral surveys conducted in the first quarter of 2022, even though the sample of respondents in these surveys was relatively small and skewed towards women and other marginalized groups. Insights were also drawn from other studies relevant to this technical assignment that were conducted during similar timeframes. Various stakeholder engagements in other regions of Somalia revealed that when planning the implementation of drought index insurance products, the following recommendations should be considered:

R1: Product design

- The clustering, valuation basis and total sum insured were determined during a stressful economic time for Puntland due to the COVID-19 pandemic and conflict in Ethiopia. This affected the flow of food supplements and diaspora remittances that are significant contributors to the Somalian economy. From the estimates, a TSI value of USD 360 per TLU per annum was computed. This is relatively high compared to the TSI values of USD 150/TLU per annum in the neighbouring countries of Kenya and Ethiopia, where Somalian pastoralists source their food supplements. To

design a national drought index insurance product, it is important to carry out similar exercises in other parts of Somalia to understand the agro-ecological and socio-economic characteristics and operational mechanisms, while also determining the willingness and ability of the community to pay for insurance products.

- The insurance coverage period is defined by the length of the vegetation growing season, which is closely related to the onset and cessation of each rainy season, since index-based livestock insurance models estimate seasonal forage deficits instigated by drought. In Puntland, two typical growing periods were observed, spanning from March to June (Gu, long rainy season) and October to December (Deyr, short rainy season), thus allowing the definition of two risk coverage periods. The bimodal seasonal pattern is homogeneous across most of Somalia, thus would form the basis for the formulation of a two-risk windows' coverage product. However, in-depth review is required to ascertain the level of variations in forage intensity, rangeland extents and start and end of seasons for the two seasons across the country.
- Puntland has been experiencing moderate to severe droughts every 3-4 seasons, while the very extreme drought events happen every 7-10 seasons. This forms a good basis for the definition of drought return periods in the IBLI contract design.
- Using 4 and 7-season drought return periods for Puntland; the triggers are at 25^{th} and 14^{th} percentiles of the forage index, respectively. The 4-season trigger model requires high annual premium rates of 20%, while the 7-season trigger requires 14%. As the product is new in Somalia, there is need for all relevant stakeholders including the government, private sector, donor agencies and the pastoral communities to agree upon the most affordable and realistic local IBLI cost models. Since most of the analysis has been done for Puntland only, similar analysis should be undertaken across the country.

R2: Implementation process

- The final determination of product premiums, payout frequency, TSI and subsidy levels requires customization depending on the area of implementation, both within Puntland and across other regions in Somalia. This requires engagement with relevant stakeholders including the public and private sectors, development and implementing organizations and community representatives (both men and women) to ensure that the options are affordable for potential consumers of the product. This includes considerations on the timing and frequency of payouts, subsidy levels and other incentives for a drought index insurance product being implemented in Somalia for the first time.
- The scenario analysis on the financial implications presented in this assessment does not consider resources required to create an enabling environment, market and capacity development and identification of effective distribution channels. Since this product is new to Somalia, experiences from Kenya and Ethiopia strongly suggest careful consideration and incorporation of the above aspects during the implementation design phase. Given the high level of financial illiteracy in these communities, considerable investments will have to be made in awareness creation and product knowledge/understanding. It should also be borne in mind that custom-designed strategies will be required for different groups, e.g. women, men, youth and the disabled etc.
- Engagements with the various stakeholders during this study suggested that even though there is significant presence of livestock markets, the linkages are quite poor. The high cost of livestock feed, limited fodder markets, sole dependency on the government for animal health

services and lack of basic market information, all pose significant challenges in stimulating and integrating service provision in the event of payouts. Linking value chain development to financial services from the very initial stages of product development, rather than as an afterthought, should be considered. Since data show that the respondents are inclined to save more, albeit informally and through groups, this could be favourably considered by banks such as Galaxy Bank and the Somalia GEEL program.

- Inspite of the presence of formal financial institutions such as banks in Somalia, there are very few formal financial institutions that have partnered with international development organizations and NGOs to provide access to finance to MFIs for livestock production. Careful consideration is required on bundling of services to clearly define the kind of services (e.g. savings products or information products with insurance) that should or could be bundled and for whom. It should not be assumed that all potential subscribers of the insurance product would want similar complimentary services with insurance.

R3: Conflict mitigation

- Even though the current IBLI product has been implemented in highly insecure areas, the complexity of issues surrounding conflict and insecurity differ from one region to another. Extremist-led violence, ethnic conflicts and clashes between farmers and pastoralists driven by competition over land resources have different implications on IBDFI implementation. As the implementation framework is being designed, in-depth analysis of conflicts will be necessary to find ways of mitigating them through the drought index insurance solutions, e.g. designing the premium subsidies or payouts to enable better natural resource management. It is crucial to conduct detailed engagements with stakeholders that have prior experience in these areas to understand the inter and intra-community dynamics to design effective solutions.

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Annexures

Annexure 1. List of the TWG members

	Organization Name	Emails	Nominated TWG Member	Contact Number	Alternate Email
	Government Institutions				
1	Ministry of finance	dg@mof.plstate.so/Keenadiid@mof.plstate.so	Mohamed Abdi Yusuf	+252907793454	deahaal@gmail.com
2	Ministry of Planning, Economic Development & International Cooperation	dg.mopic@plstate.so	Sharmarke Mohamed Jama	+252977467722	dg.mopic@plstate.so
3	Ministry of livestock and animal husbandry	dg.molah@plstate.so	Abdisalan Mohamed Abdi	+252907712403	abdulsalaam.abdi@gmail.com
4	Ministry of Environment, Agriculture and Climate Change	dg.moeacc@plstate.so	Mohamed Warmsame	+252907317367	moha.warsame111@gmail.com
5	Ministry of trade and industry	dg.mocii@plstate.so	Mohamed Guled Karshe	+252907602336	Guledkarshe9@gmail.com
6	Information Management Centre for Water and Land Resource (IMC)	abdinurali92@gmail.com	Jamal Abdullahi Mohamed	+252907732693	jamal.abdullahi@imcpuntland.so
7	Ministry of Interior	dg.moifad@plstate.so	Yusuf Ahmed	0907743334	awosman.moi@gmail.com
8	Humanitarian Affairs and Disaster Management Agency (HADMA	hadmapunt@gmail.com	Saylici Dahir Muse	+252907554077	Saylici2016@gmail.com
	Insurance companies				
9	FISO		Bashir Isse Salah	+252907798497	infopl@fisoinsurance.com
10	Takaful Africa	ali.hirsi@takaafulafrica.so	Feisal Jama	+252906065334	Faisal.jama@takaafulafrica.so
11	Amanah Insurance Company	naima.ahmed@amaanahinsurance.com	Hussein Adam Ahmed	+252 907791426| +252 90- 5006590	Hussein.adam@amaanahinsurance.com
12	Baraka Takaful	sadam@barakatakaful.com	Sadam Hussein Mohamed	+252616457000	sadam@barakatakaful.com
13		Narin14@gmail.com	Nariin Abdirashid Kaam	+252907685676	Narin14@gmail.com
	Financial institutions/Banks				
14	International banks of Somalia (IBS)	Sharif.nor@ibsbank.com	Abdirahman Mohamud Elmi	0907790608	
15	Amal Bank	nasruddin.yasin@amalbankso.so	Nasruddin Yassin Artan	+252907794802	nasruddin.yasin@amalbankso.so
16	Dahabshiil Bank	Corporate.clients@dahabshiil.com	Mohamed Osman Mohamed	+252907797736	Corporate.clients@dahabshiil.com
17	Salama Bank	khaliifganey@gmail.com	Abdulahi Abdulle Telle	+252907722368	mabdalle61@gmail.com

	Telecommunication Companies				
18	Somtel	Faysal.abshir@somtelnetwork.net	Faysal Abshir Nur	+252907740845	Faysal.abshir@somtelnetwork.net
19	Golis	abdinor.abdullahi@golis.so	Said Mohamud Farah	+252907792450	saidgas50@gmail.com
20	Amtel	nasruddin.yasin@amalbankso.so	Mohamed Farah Mohamed	+252907794019	nasruddin.yasin@amalbankso.so
	Cooperatives and Associations				
21	Puntland livestock professional association	Pulpavets@gmail.com	Mohamed Ali Abdullahi	0907793281	xarago77@gmail.com
22	Puntland women Veterinary Organization	fadumo.abdullaahi@gmail.com	Sumayo Bashir Muse	0907743395	Sumay770@gmail.com
23	Puntland Veterinary Board	puntlandveterinaryboard@gmail.com	Abdirizak Jama Mohamud	0907933265	geesdiir@gmail.com

Annexure 2. List of FGD participants

Nugaal Region					
No	**Name**	**Title**	**Region/District**	**Gender**	**Telephone**
1.	Ahmed Said Salah	RVO	Nugaal	M	0907756211
2.	Ahmed Abbas Ahmed	Elder	Hasbahale	M	0907740571
3.	Said Hussein Elmi	Elder	Burtinle	M	090 7768036
Mudug Region					
4.	Salad Ali Hussein	RVO	Mudug	M	0907756828
5.	Yassin Gelle Warsame	Elder	Bursalah	M	0907783555
Bari Region					
6.	Mohamed Ismail Warsame	RVO	Bari	M	0907740137
7.	Mohamud Abdullahi Hirad	DVO	Bosaso	M	0907794595
8.	Anfac Hassan Hange	PWVA	Bosaso	F	0907661824
Karkaar Region					
9.	Mohamed Abdirahman Mohamed	RVO	Karkaar	M	0907769121
10.	Abdi'Aziz Khalif Yusuf	Elder	Qardho	M	907627709
Sanaag Region					
11.	Feisal Abdullahi Ali	RVO	Sanaag	M	0907775322
12.	Khadro Abdirahman Mohamud	DVO	Badhan	F	0907695511
13.	Hassan Said Osman	Elder	Badhan	M	907222220
Haylan Region					
14.	Mohamed Ali Mohamed	RVO	Haylan	M	0907626897
15.	Faisal Jama Herzi	Elder	Dhahar	M	0907177770
16.	Farha n Aden Isse	Elder	Dhahar	M	0907747485
Sool Region					
17.	Said Muse Eid	Elder	Taleh	M	0907786946
18.	Mohamed Adan Gelle	Elder	Xudun	M	0906961244
Cayn Region					
19.	Saxardid Ismail Weyrah	Elder	Cayn	M	0907234090
20.	Mohamed Osman Bahalcade	Elder	Widhwidh	M	0907777525

Other Veterinary Professionals					
21.	Khadar Mohamud Abdullahi	Vet Practitioner	Gardafu	M	0907778892
22.	Ayuub Abdullahi Mohamud	Vet Practitioner	Galkio	M	0907854009
23.	Ahmed Ali Farah	Vet Practitioner	Jariiban	M	0907714567
24.	Ali Jama Yusuf	Vet Practitioner	Dangorayo	M	0907670540
25.	Ahmed Mohamud Aden	Vet Practitioner	Badhan	M	0907641551
26.	Idil Yassin Abdi	PWVA	Ufayn	F	0907364455
27.	Xaliye Jama Yusuf	Elder	Eyl	M	0906081064

Annexure 3. Computation of forage index and payouts in IBLI models

3A. NDVI extraction and computation of forage index

The current index-based livestock insurance is a type of parametric insurance whereby a policyholder is insured against the occurrence of drought events and payouts (to protect the livestock asset) are made based on the magnitude of the drought and not livestock losses incurred, as is the case under traditional indemnity contracts. Therefore, in setting up payout models for an area, the risk of drought occurrence, frequency and severity must be understood. The IBLI aims to provide payouts at the end of a drought season that results in low forage production, thus allowing pastoralists to protect their livestock, which are the main assets in these marginalized and vulnerable ecosystems.

To understand the drought risk in the Puntland state of the Federal Republic of Somalia, NDVI time series data from MODIS satellite was used. The data was analysed according to the well-established methods and procedures for estimating forage indices utilised in the Kenyan and Ethiopian rangelands, where IBLI is operational. Even though various remote sensing products including rainfall, evapotranspiration, soil moisture, land surface temperature, solar-induced chlorophyll fluorescence etc. (Jiao, Wang, & McCabe, 2021) have been applied in drought monitoring over the years, in this analysis the advanced IBLI model based on NDVI data to monitor drought events and estimate payouts in African pastoral systems where other datasets are limited or unavailable (Fava & Vrieling, 2021) was used. To estimate drought frequency and severity, which forms the basis of costing within an IBLI model, the NDVI data was transformed into usable and meaningful forage indices as drought indicators that can be translated into payouts.

To accomplish this, key analysis steps were followed (Figure A1) including:

i) The development of valid forage production area masks, done mainly by creating NDVI filters to identify pastoral lands with valid land areas and high NDVI intensity. This is because bare grounds and scarce/low vegetation areas have inconsistent signals that complicate index computation by generating unreliable results. The mask also incorporates areas with low seasonal variability of vegetation and dense woody cover as invalid forage production areas since seasonality is poorly defined, or they are hardly used as grazing resources. The satellite data-based masking approach was validated and improved using local expert knowledge to identify areas that may have been omitted and other land use characteristics that may not have been apparent from remote sensing data.

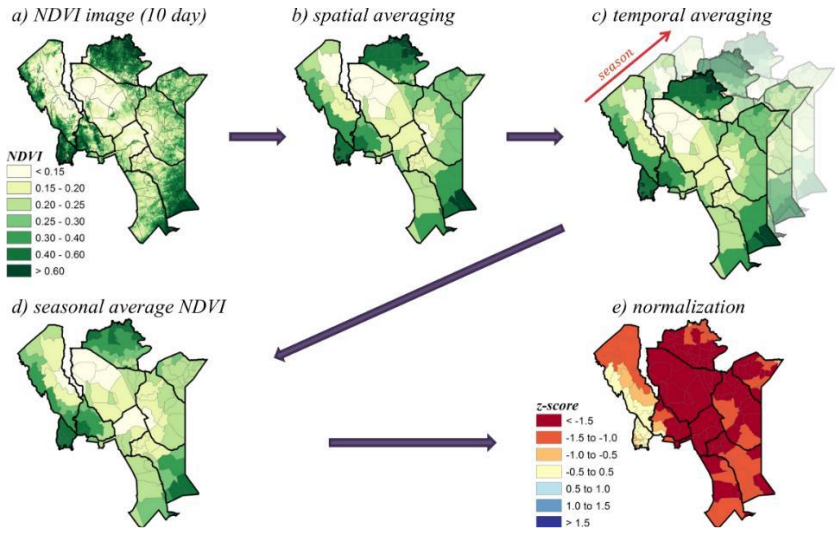
ii) Spatial aggregation was done using the predefined geographic zones with homogenous vegetation characteristics, climate/seasonality and extent of pastoral movement, commonly referred to as UAIs. In Puntland, nine UAIs were identified as described in Section 3.2. These were used as the units for spatial aggregation of the NDVI data available at 250 m spatial resolution.

iii) Temporal cumulation/aggregation, whereby the NDVI data available every 10 days were first averaged over a month and cumulated over the forage growth windows to estimate forage production over the entire season. Therefore, an area's seasonality must be characterized by clearly defining wet and dry seasons to accurately (allowing time lags of a few days) identify forage growth windows, which coincide with rainfall months. In Puntland, where a bimodal vegetation growth pattern was observed, the cumulation was specific to the LRS (Gu), occurring from May to June and the SRS (Deyr) from October to December (Figure 11).

iv) Forage index computation involving a normalization process whereby the current season's cumulated NDVI (used as a proxy for forage availability) was compared with the historical

average forage performance. The normalization (standardization) determines how far the current values deviate from normal, thus indicating a drought event.

Figure A1. Index based livestock insurance product design computation steps.



Source: Vrieling et al. 2016.

3B. Determining trigger and exit thresholds for estimating payouts

The payouts were determined after the standardization process using a linear payout function of the forage index value, applied based on predefined **trigger** (index value at which a payout is activated) and **exit** (maximum payout index value) thresholds. The thresholds were defined using drought occurrence and severity. Over the years, Puntland has experienced moderate to extremely severe droughts, with the most recent extremely severe droughts occurring in the 1990s. From the discussions with the pastoral community and local experts, major, severe and widespread droughts occurred in **1990-91** and **1995-96**, locally referred to as Arbaca and Nafaf, respectively. Other moderate to extremely severe drought events evident from the NDVI data from the year 2002 onwards and corroborated by local information are summarized in Table A 1.

Table A 1. Occurrence of moderate to extremely severe drought events in Puntland

Moderate to Extremely Severe Drought Events			
Year	LRS	SRS	Local Name
2002		-	
2003	**1**	**1**	**Kartoomaley**
2004	**1**	**-**	
2005	-	-	
2006	-	-	
2007	-	-	
2008	**1**	**-**	
2009	**1**	**1**	**Ariwarmaleh**
2010	**-**	**1**	
2011	-	-	
2012	-	-	
2013	-	-	
2014	-	-	
2015	-	-	
2016	**1**	**1**	**Sima**
2017	**1**	**1**	
2018	**1**	**1**	
2019	**1**	**-**	
2020	-	-	
2021	-		
Drought Events	***8***	***6***	
Total Seasons	***19***	***19***	

Key	
	Moderate
	Severe to Extreme

Using the severity results, three trigger thresholds were determined based on 7, 5 and 4-season drought return periods, i.e. 3.5, 2.5 and 2-year returns, respectively (Table A 2).

Table A 2. Example of trigger thresholds defining the level at which payouts may be activated in the forage index for IBLI models in Puntland based on drought recurrence and severity

Drought Severity	Seasonal Return Frequency	Trigger Thresholds	
		Fraction	*Index Percentile*
Extremely severe	7	0.14	14%
Severe to extrmely severe	5	0.2	20%
Moderate to extrmely severe	4	0.25	25%

To determine the maximum payout levels, the minimum forage index values are used per UAI for each season (LRS and SRS) using the entire NDVI data archive from July 2002 to June 2021 (

Table A 3).

Table A 3. Exit thresholds defining the level at which maximum payouts are reached based on minimum observed forage index values for IBLI models in Puntland.

UAI ID	UAI NAME	LRS	SRS
1	Bossaso	-1.5068	-1.6686
2	Burtinle	-2.1971	-1.9856
3	Gaalkacyo	-1.5558	-1.7833
4	Garoowe	-2.2419	-1.7119
5	Iskushuban	-1.4564	-1.5209
6	Lascaanod	-2.0408	-2.3691
7	Qardho	-1.3382	-1.4615
8	Sanaag	-1.1460	-1.5550
9	Taleex	-2.0246	-1.7663

3C. Alternative product options for determining micro-level index-based livestock insurance for varying beneficiary numbers and subsidy levels in Puntland

Table A 4. Cost of a 10 TLU per household program under 4-season (T4) and 7-season (T7) drought return cost options for varying household numbers, based on a 12-month coverage of USD 360 TSI per TLU

12-Month Coverage for a $360 TSI								
Description		Rates		APC (100%) 1 TLU	APC (100%) 10 TLUS	Subsidies (10TLUS/HH)		
Return Period	Trigger (Index P)	PBR	AP (30% CL)	TSI $360	TSI $360	25%	65%	90%
T7 (7 season/3.5 years)	14th	11%	14%	$50	$500	$125	$325	$450
T4 (4 Season/2 years)	25th	15%	20%	$72	$720	$180	$468	$648
				Option	No. Households			
				T7	1,000	$125,000	$325,000	$450,000
					5,000	$625,000	$1,625,000	$2,250,000
					10,000	$1,250,000	$3,250,000	$4,500,000
					20,000	$2,500,000	$6,500,000	$9,000,000
					50,000	**$6,250,000**	**$16,250,000**	**$22,500,000**
				T4	1,000	$180,000	$468,000	$648,000
					5,000	$900,000	$2,340,000	$3,240,000
					10,000	$1,800,000	$4,680,000	$6,480,000
					20,000	$3,600,000	$9,360,000	$12,960,000
					50,000	**$9,000,000**	**$23,400,000**	**$32,400,000**

Index P - Index Percentiles; PBR - Pure Burn Rate; AP- Annual Premiums; APC - Annual Premium Cost; CL - Commercial Loading; TSI - Total Sum Insured

Annexure 4. Socio-economic, physical and livestock characteristics of Puntland districts

District	Land cover/vegetation	Livelihoods	Type of livestock	Types of crops/ cultivation
Alula	▪ Shrubs ▪ Grass	▪ Fish ▪ Francene and Pastoral	▪ Shoats ▪ Few camels	▪ Date palms and ▪ Horticulture
Qandala	▪ Shrubs ▪ Herbs and grass ▪ Sporadic Canjeel trees along the valleys	▪ Pastoralism and fishing ▪ Francene	▪ Shoats dominate ▪ Few camels (10%)	▪ No
Bossaaso	▪ Shrubs ▪ Grass	▪ Fishing and cultivation (Qaw, Ceeldaahir, Borookhle, Laag, Karin and Yalho Dhud sare)	▪ Shoats and camels (10-15%)	▪ Date palms ▪ Cash (horticultural vegetable 3 months) ▪ Crops and fruits (lemons)
Iskushuban (Noobir area)	▪ Mixed of trees ▪ Shrubs and grasses ▪ Savannah	▪ Pastoral ▪ Fishing and ▪ Agricultural	▪ Shoats and camels (20-30%)	▪ Crops are grown in Dharoor area
Qardho	▪ Mixed trees ▪ Big trees ▪ Savannah	▪ Pastoralism	▪ Shoats ▪ Cattle (5%) ▪ Camels (35%) ▪ More grass and water enable cattle to survive	▪ Kuba village people are mainly agricultural dependent ▪ Horticulture
Bander Bayla	▪ Mixed trees ▪ Big trees ▪ Savannah	▪ Pastoralism ▪ Fishing ▪ Cultivation in mall areas like Dhur village	▪ Shoats and camels (32%)	▪ Horticulture
Garoowe	▪ A lot of grass and hay like production ▪ Open savannah grasses	▪ Pastoral ▪ Urban economics and ▪ Agriculture (Jibagale, Cuun, and Rabaable)	▪ Mainly shoats ▪ Cattle (<5%) and ▪ Camels (38%)	▪ Horticulture irrigated by spring and wells
Eyl	▪ Mixed grass (savannah grass and shrubs	▪ Fishing ▪ Pastoral and ▪ Agriculture	▪ Shoats mainly (75%) ▪ Camels (25%)	▪ Horticulture and ▪ Fruits
Burtinle	▪ Hawd: woodland, shrubs, and trees (>70%) and grass (30%)	▪ Pastoral	▪ Shoats and camels (40%)	▪ No cultivation at all
Jariiban	▪ Open grass land	▪ Pastoral ▪ Fishing	▪ Shoats ▪ Sheep (80%) ▪ Goats (20%) and ▪ Camels (10%)	▪ No cultivation
Godobjiiran	▪ Open grass land (80%)	▪ Pastoral fishing and ▪ Agriculture	▪ Shoats and camels	▪ Staple food ▪ Cowpeas

	▪ Small shrubs and trees or ▪ Woodland (20%)			▪ Maize, and ▪ Sorghum
Galkacyo	▪ Hawd: woodland, shrubs, and trees (>70%) and grass (30%)	▪ Urban economics ▪ Pastoral	▪ Shoats and camels(45%)	▪ Horticulture in Roox village
Badhan the northern part is pure vast grassland	▪ Open grassland (80%) and ▪ Shrubs woodland	▪ Pastoral ▪ Agriculture ▪ Fishing ▪ Francine	▪ Shoats ▪ Sheep (80%), higher than ▪ Goats ▪ Camels (15%) ▪ Cattle (<5%)	▪ Horticulture crops vegetables and ▪ Citrus fruits (Midigale and laako)
Taleh	▪ Savannah grass land (70%) and ▪ Shrubs, trees and woodland (30%)	▪ Purely pastoral and very few ▪ Agro-pastoral	▪ Shoats ▪ Sheep (40%) ▪ Goats (60%) and Camel (35%)	▪ Horticulture in Xalin area
Xudun	▪ Like Taleh	▪ As above	▪ As above	▪ No cultivation
Laascano	▪ Woodland (80%) ▪ Open grassland	▪ Urban ▪ Pastoral and ▪ Cultivation	▪ Shoats ▪ Sheep (40%) ▪ Goats (60%) and ▪ Camels (40%)	▪ Horticulture
Buhodle	▪ Purely woodland	▪ Purely pastoral	▪ Shoats ▪ Sheep (30%) ▪ Goats (70%) ▪ Camels (40%) ▪ Cattle (<5%)	▪ No cultivation