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STRENGTHENING FINANCIAL RESILIENCE TO DROUGHT:

A Feasibility Study

For An Index-Based Drought Risk Financing Solution For Pastoralists In Mali

ILRI | INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

Global Index Insurance Facility
MANAGED BY WORLD BANK GROUP

USAID FROM THE AMERICAN PEOPLE

1818 H Street NW

Washington DC 20433

Telephone: 202-473-1000

Internet: www.worldbank.org

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The Financial Resilience Program (FRP) is a World Bank partnership with the United States Agency for International Development (USAID) to enhance the capacity of policy makers for improved financial resilience of vulnerable rural households and businesses to climate shocks and natural disasters. The FRP provides technical assistance to governments in the development and implementation of policy to help rural populations and businesses prepare for—and recover more quickly from—the impacts of climate shocks, disasters, and crises; and develops and shares knowledge to inform practitioners and policymakers globally.

The Global Index Insurance Facility is a dedicated World Bank Group program that facilitates access to finance for smallholder farmers, micro-entrepreneurs and micro-finance institutions through the provisions of catastrophic risk transfer solutions and index-based insurance in developing countries. Funded by the European Union, the governments of Germany, Japan and the Netherlands, GIIF has facilitated approximately 9.6 million contracts, covering close to 48 million people, primarily in sub-Saharan Africa, Asia and Latin America and the Caribbean. The program is part of the International Finance Corporation's Financial Institutions Group department.

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List of Acronyms

ACF	Action Contre la Faim
AECF	African Enterprise Challenge Fund
AEED	Agency for the Environment and Sustainable Development
AfDB	African Development Bank
AGRIFED	Agriculture Women and Sustainable Development Framework
AGRHYMET	Centre Regional de Formation et d'Application en Agrométéorologie et Hydrologie Opérationnelle
APCAM	Permanent Assembly of Chambers of Agriculture of Mali
API	Agency for the Promotion of Investments
APSFD	Association of decentralized financial systems
ARC	African Risk Capacity
ARS	Assurance Récolte Sahel
ASAL	Arid and Semi-arid
BNDA	Banque Nationale de Développement Agricole
CCAFS	Climate Change Agriculture and Food Security
CCAM	Committee of Insurance Companies of Mali
CCS-SFD	Cellule de Contrôle et de Surveillance des Systèmes Financiers Décentralisés
CEP-MEPA	Cellule des Études et de la Planification, Ministère de l'Élevage et des Productions Animales
CHIRPS	Climate Hazards Group Infra-red Precipitation with Station
CIA	Central Intelligence Agency
CIMA	Conference Interafricaine des Marchés d'Assurances
CILSS	Comité Permanent Inter-Etats de Lutte contre la Sécheresse dans le Sahel
CIRAD	French Agricultural Research Centre for International Development
CLISS	Committee for Drought Control in the Sahel
CNAR	National Insurance and Reinsurance Fund
CRCA	Commission Régionale de Contrôle des Assurances
CSA	Food Security Commission
DFS	Digital Financial Services
DID	Développement International Desjardins
DIRISHA	Drought Index Insurance for Resilience in the Sahel and Horn of Africa
DNPIA	National Directorate of Animal Production and Industries
DNSV	National Directorate of Veterinary Services
DRFI	Drought risk financing and insurance

EARS	Environmental Analysis and Remote Sensing
ECHO	European Civil Protection and Humanitarian Aid Operations
ECOWAS	Economic Community of West African States
EMODIS	Enhanced Moderate Resolution Imaging Spectroradiometer
EM-DAT	Emergency Events Database
ENACTS	Enhancing National Climate Services
EO	Earth Observation
EOS	End of Season
EU	European Union
FADQDI	Financière agricole du Québec - Développement international
FANAF	Federation des Societes d'Assurances de Droit National Africaines
FAO	Food and Agricultural Organization of the United Nations
FAOSTAT	Food and Agricultural Organzation Statistics Division
FAPBEF-UEMOA	The Fédération des Associations des Banques et Établissements Financiers de l'Union Économique et Monétaire Ouest-Africaine
FARM	Agriculture and Rural Financing in Mali
FCDO	Foreign, Commonwealth and Development Office
FEBEVIM	National Livestock Federation of Mali
FEWSNET	Famine Early Warning Systems Network
FNAA	National Agricultural Support Fund
GDP	Gross Domestic Product
GIIF	Global Index Insurance Facility
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
GLAM	Groupes Locaux d'Assistance Meteorologique
GoK	Government of Kenya
GoM	Government of Mali
GTPA	Groupe de Travail Pluridisciplinaire d'assistance Météorologique
HOA	Horn of Africa
HSNP	Hunger Safety Net Programme
IBDRFI	Index-Based Drought Risk Financing and Insurance
IBLI	Index-Based Livestock Insurance
ICRISAT	International Crop Research Institute for the Arid and semi-arid tropics
IDB	Islamic Development Bank
IER	Institute of Rural Economy
IFAD	International Fund for Agricultural Development

IFC	International Finance Corporation
IGAD	Inter-governmental Authority on Development
ILRI	International Livestock Research Institute
INSAH	Sahel Institute of Meteorology
IPC	Integrated Food Security Phase Classification
IRI	International Research Institute for Climate and Society
ITCZ	Inter-Tropical Convergence Zone
IU	Insured Unit
JAMSI	Joint Agro-meteorological Services Incubator
KLIP	Kenya Livestock Insurance Program
L4G	Livestock for Growth
MAP	Mean Annual Precipitation
MFIs	Micro-finance Institutions
MNOs	Mobile Network Operators
NDGI	Next Generation Drought Index
NDVI	Normalized Difference Vegetation Index
NGOs	Non-governmental organizations
NGS	Number of Growing Seasons
NMS	National Meteorological Service
NPD	National Plan for Drought
NSIA	Nouvelle Societe Interafricaine d'Assurance
NUSAF	Northern Ugandan Social Action Fund
OPAM	Office des Produits Agricoles du Mali
OXFAM	Oxford Committee for Famine Relief
PADEL-M	Project for the Development of Animal Husbandry in Mali
PDDEPS	Project for Sustainable Development of Pastoral Farms in the Sahel
PDIRAAM	Program for the Integrated Development of Animal and Aquaculture resources in Mali
PPP	Public Private Partnership
PRAPS	Regional Support Project for Pastoralism in the Sahel
QUIIC	Quality Index Insurance Certificate
RBM	Réseau Billital Maroobé
SFSA	Syngenta Foundation for Sustainable Agriculture
SI	Stock d'intervention
SIIPE	Satellite Index Insurance for Pastoralists

SMS	Short Messaging Service
SNS	Stock National de Sécurité
SOS	Start of Season
SOTELMA	Société des Telecommunications du Mali
STAMP	Sustainable Technology Adaptation for Mali's Pastoralists
TLU	Tropical Livestock Unit
TWG	Technical Working Group
UAIs	Unit Areas of Insurance
UN	United Nations
UNCDF	United Nations Capital Development Fund
USAID	United States Agency for International Development
USD	United States Dollar
USSD	Unstructured Supplementary Service Data
WAAPP	World Bank's West Africa Agricultural Productivity Program
WBG	World Bank Group
WFP	World Food Programme
XOF	West African Communauté Financière Africaine Franc

Authors

Francesco Fava[1,2], Rupsha Banerjee[1], Njoki Kahiu[1,4], Assoumane Maiga[1], Felix Lung[3], Nathan Jensen[1], Tenin Fatimata Dicko[3] and John Plevin[3]

[1] International Livestock Research Institute (ILRI), Nairobi, Kenya

[2] University of Milan, Milan, Italy

[3] World Bank Group (WBG), Washington, USA

[4] Department of Plant and Environmental Sciences, New Mexico State University

Contacts:

1. Rupsha Banerjee (b.rupsha@cgiar.org)
2. Francesco Fava (francesco.fava@unimi.it)
3. John Plevin (jplevin@worldbank.org)
4. Tenin Fatimata Dicko (tdicko@worldbank.org)

Executive Summary

Why financial protection from drought shocks for pastoralists? The regional context

Livestock is fundamental to the national economies and welfare of households in Sahel countries. It is estimated that 50 million people, the majority of whom are extremely poor, rely on pastoralism[1] for their livelihoods in the Sahel. Indeed, livestock is a key economic factor in west African countries where it contributes 31, 35, 37 and 39% to the agricultural gross domestic product (GDP) in Senegal, Burkina Faso, Niger and Mali, respectively.

The Sahel is very prone to droughts and shifting climatic patterns. Drought costs in the Sahel region are extremely high, especially to the pastoralists. Between 1950 and 1970, the Sahel experienced abnormally high rainfall, well above the long-term 1898-93 average. However, between 1970 and 1990, there was a prolonged period of below average rainfall resulting in a series of major droughts, famines and huge livestock losses due to insufficient drinking water, lack of forage and grazing resources and diseases. Even though the average rainfall has increased the area is still affected by periodic drought shocks and climatic extremes. This has contributed to the huge cost burden arising from (a) economic losses of livestock and livestock-based products, (b) loss of livelihoods for pastoralists whose animals die and (c) humanitarian assistance.

In Mali, livestock is an extremely important economic sector that contributes about 19 and 30% to the national and agricultural GDP, respectively. Livestock rearing is practiced by at least 85% of Malian farmers and is the main Source of income for more than 30% of the population. Mali exports livestock to various countries in the region, notably Côte d'Ivoire, Senegal and Ghana. It ranks first in livestock (cattle, sheep and goats) export values among west African countries. Cattle and sheep are Mali's third and fourth largest exports, respectively, after gold and cotton.

Index-based drought financing for pastoralists – how it works

Drought risk financing and insurance solutions have emerged as powerful tools to protect vulnerable communities against drought impacts. The key idea is to link prearranged financing solutions to credible response plans, thus making funding available faster after disasters, strengthen predictability and improve cost effectiveness. Among the various solutions available, index-based drought risk financing and insurance (IBDRFI) approaches are particularly suitable for smallholder farming and extensive pastoral systems. These instruments trigger payouts/financial responses based on an 'objective' index approximating the impact/loss. The majority of IBDRFI instruments targeting extensive rangelands currently operational in Africa are based on drought indices derived from satellite normalized difference vegetation indices (NDVI) data. Among these, the index-based livestock insurance (IBLI) products have been specifically designed to protect pastoralists in the face of drought.

Recent developments in earth observation (EO) missions, technologies and analytics are opening new opportunities for designing innovative indices for IBDRFI initiatives suitable for rangeland and extensive pastoral systems. Initiatives such as the World Bank Next Generation Drought Index (NGDI) aim to expand the range of options for designing IBDRFI solutions by developing a practical framework for a set of indices or indicators that will better monitor, anticipate and trigger financial responses to severe drought events.

1.Throughout this report, the definition of 'pastoralists' includes all the herders that (i) mainly depend on livestock (i.e. ruminants) for their livelihood, (ii) rely primarily on rangeland resources for feeding their livestock and (iii) use some degree of mobility as a herd management practice. As such, our definition includes nomadic, semi-nomadic and semi-sedentary pastoral communities, including those that undertake some cropping activities (i.e. agro-pastoralists).

IBDRFI initiatives specifically designed to protect pastoralists in the face of drought shocks have 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 EO technologies and indices (i.e. based on NDVI data) and are generally designed with anticipatory response principles, e.g. early drought detection for early action and impact mitigation. Micro-level retail IBLI schemes have been implemented in northern Kenya and southern Ethiopia with private insurance companies involved in marketing, promoting and underwriting the scheme on a voluntary basis with individual pastoralists. Macro-level social livelihoods protection insurance schemes are currently operational at a national level in eastern Ethiopia, Zambia and Kenya (through the Kenyan Livestock Insurance Program, KLIP). Scalability mechanisms of safety net programs have also been implemented in Kenya and Uganda under the Hunger Safety Net Program (HSNP) and the Third Northern Ugandan Social Action Fund (NUSAF III), respectively. These social protection schemes can complement sovereign level products such as the ones being implemented by the African Risk Capacity (ARC).

Objective of the feasibility assessment

The feasibility study conducted jointly by the International Livestock Research Institute (ILRI) and the World Bank aims to inform development and implementation policies to increase the resilience of pastoralists in the Sahel against severe drought shocks. It provides the background knowledge required to make informed decisions on whether investing resources in the design and implementation of an IBDRFI program can achieve desired public policy objectives.

The feasibility assessment considers socio-economic (potential demand and value), technical (i.e. product design) and operational (supply chain) factors that are important for the design and implementation of IBDRFI solutions in Mali.

The socio-economic feasibility analysis assesses the presence of necessary preconditions to justify the launch of an IBDRFI scheme (i.e. vulnerability of livestock to drought) and the extend of demand for IBDRFI solutions from local institutions and pastoral and agro-pastoral households. It examines the relevance of the livestock sector, impact of drought on the national economy and pastoralists' socio-economic environment.

The technical feasibility analysis assesses whether the key conditions for the technical design of an accurate index and trigger mechanism for drought impacts on pastoral areas are met. The feasibility factors considered include coverage of rangeland, rangeland vegetation cover/density and seasonality, which are critical not only for the design of NDVI-based indices, but also for alternative EO drought indices. When conditions are not fully met, the assessment provides indications of the type of work required to design appropriate technical solutions to refine the product design for the specific context.

The operational feasibility analysis evaluates ethe conditions required for supplying IBDRFI solutions and to support the development of an enabling environment (institutional, regulatory and social) for its large-scale and sustainable provision. Thus, it seeks to assess the existing financial and insurance infrastructure and services, policy and regulatory environment, potential distribution channels and existing private and public stakeholders (insurers and financial service providers, pastoral associations, intermediaries, non-governmental organizations (NGOs) etc. and their capacity in the financial sector.

The scenario analysis presents historical payouts and hypothetical costings of proposed IBDRFI structures. This analysis is purely illustrative and showcases simple examples of how the technical product customization and the choices made on different programmatic options have fundamental cost-benefit implications. However, it should be noted that the proposed scenarios are not meant to be recommendations for a specific option nor to cover an exhaustive range of IBDRFI solutions. Thus, detailed analyses of alternative programmatic options and product design customizations need to be planned with local stakeholders during the early stages of implementation for future initiatives.

The feasibility study is largely built on technical solutions, experiences and programmatic options implemented in east African countries, which were used as benchmarks for the assessment. As such, the IBLI product design is used for the technical assessments, while IBDRFI programmatic options are based on the main ones tested thus far. Therefore, micro-level retail and macro-level social livelihood protection schemes that provide direct payouts/cash transfers to policyholders or beneficiaries were presented in the scenarios.

However, the feasibility conditions should be considered as widely applicable to alternative IBDRFI options that can and should be evaluated and tailored to the specific context, based on the country policy priorities in drought risk management and social protection. During the program design phase, alternative drought index product design[2] approaches might be considered, given that the Sahel pastoral regions have significant ecological and socio-economic

2. Henceforth, for simplicity, IBLI is used as a generic term to indicate drought index-insurance products based on NDVI satellite imagery designed specifically for pastoralists. Across different programs, the product design often changes, although the underlying technical design principles are largely similar.

differences to those prevailing in east Africa. More importantly, while alternative programmatic options such as meso or sovereign level insurance are not discussed in detail in this report because of the lack of direct implementation experiences in pastoral areas, these models might need to be considered depending on the country's policy priorities and context.

Key findings of the feasibility assessment

The feasibility assessment indicates that with targeted investments and supportive policies, an IBDRFI initiative targeting livestock keepers could be implemented in the extensive pastoral systems of Mali.

Table E.1 illustrates the key findings of this study with respect to the feasibility criteria considered

The socio-economic assessment (Table E.1, green) emphasizes the paramount role of the livestock sector to the Malian economy and the vulnerability of pastoralists to drought shocks. Drought is the major climate risk faced by the livestock sector and has severe impacts on food security, which is currently exacerbated by conflict and insecurity. No information is available on the insurance demand from pastoral communities, but given the poverty levels and inequality among pastoralists, social protection initiatives are a priority. The participation of Mali in the ARC pool demonstrates that IBDRFI is part of the government's strategic planning and could lay the foundation for a broader set of complementary initiatives at the micro or meso-levels.

The technical assessment (Table E.1, yellow) indicates that the geographic areas classified as feasible (green) or feasible but needing review (orange) for the implementation of a product tailored to extensive pastoral systems cover a vast portion of the country and host the majority of the national livestock herd (63%). For the areas needing review, it would be important to engage with local stakeholders to confirm the suitability of these areas for extensive herding. The central and western regions are especially characterized by mixed land use, therefore it would be important to confirm the presence of pastoral communities that depend on livestock and local rangeland resources. In the northern regions, it would also be necessary to confirm the vegetated areas' suitability for livestock herding (Figure E1).

The operational assessment (Table E.1, grey) shows that:

- **Mali has a promising environment for implementing IBDRFI solutions, based on the regulatory environment, private sector experience in agricultural index-insurance targeting crops good telecommunication and DFS networks** and strong presence of NGOs, international organizations and pastoral associations that support the livestock value chain and resilience interventions, e.g. Regional Support Project for Pastoralism in the Sahel (PRAPS II) in pastoral areas. However, implementation in pastoral regions might present significant challenges because of lack of infrastructure and the prevailing unsTable security situation.
- **Financial literacy is low and major investments should be made to stimulate the demand for insurance and its effective use in resilience building by individual pastoralists or communities.** In addition, while telecommunication companies indicated their capacity to operate in insecure regions, other actors have found it challenging in recent years to access some pastoral regions, especially those bordering Niger and Burkina Faso, due to heightened terrorism/jihadism-related conflicts. This could be a hurdle in awareness creation and product distribution initiatives during the implementation of IBDRFI solutions in some of these areas.

Table E.1. summarizes the critical areas that require targeted investments for IBDRFI implementation (red dots). These include:

- Low financial literacy and demand for financial services would be a major barrier for IBDRFI implementation in Mali. This is a common feature of most pastoral areas in Africa that can be addressed by developing a capacity development and awareness creation strategy targeting not only pastoralist but also institutions involved in distribution and management of the product. Pastoral associations can play a key role in supporting this task.
- The limited capacity and experience of national institutions to handle satellite data products and models used for IBDRFI is another relevant gap to address in Mali. This challenge could be overcome by well-structured capacity development efforts and investments to develop data management infrastructures within national authorities specialized in agrometeorological and agricultural extension services. Support from regional bodies such as AGHRYMET, ACF, ARC would be instrumental for this purpose.
- The There is no national electronic registration system in place to support beneficiary targeting and product distribution in the framework of potential future IBDRFI initiatives. However, existing efforts such as the Unified Social Registry could lay the ground for further development targeting pastoral regions.

The scenario analysis carried out under the study provides illustrative costing scenarios for two alternative 5-year IBDRFI programmatic options aimed at providing a safety net to vulnerable pastoralists in the face of drought. Both scenarios are designed on the experiences of Kenya and Ethiopia, where ongoing initiatives have demonstrated positive impacts on pastoralists' welfare and income, private sector development and government budgets and contingent liability.

- **The global cost of supporting a microlevel retail scheme with 50% subsidies targeting to insure 25 000 pastoralists (from year 5) is estimated to be 5.2m, including $4.5 million subsidies and $0.75 million for ,rogram support activities.** This option should stimulate both demand for the insurance product while simultaneously increasing the incentives for insurance providers to invest in marketing and support chains, leading to broader access and longer-term sustainability. At the same time, this option can fail to meet its objectives if the private sector does not invest in the product delivery or on the complementary activities such as marketing and awareness creation, which are critical to creating a sustainable market and meeting the target coverage.
- **The global cost of a social protection program that provides insurance for 5 cattle equivalent for 50,000 pastoralists (from year 5) is estimated to be $17.6 million, including $15.8 million premium subsidies and $1.75 million for program support activities.** This option assures meeting target coverage levels but may not stimulate private investment in product marketing or awareness creation; it may not necessarily create access to insurance for those that do not receive the insurance transfer. The long-term fiscal sustainability poses a second important risk, as this scheme requires considerable medium-term budget allocation commitments by the government

TABLE E.1 FEASIBILITY ASSESSMENT ON THE COUNTRY'S READINESS FOR IMPLEMENTATION OF IBDRFI PRODUCTS TARGETING PASTORALISTS

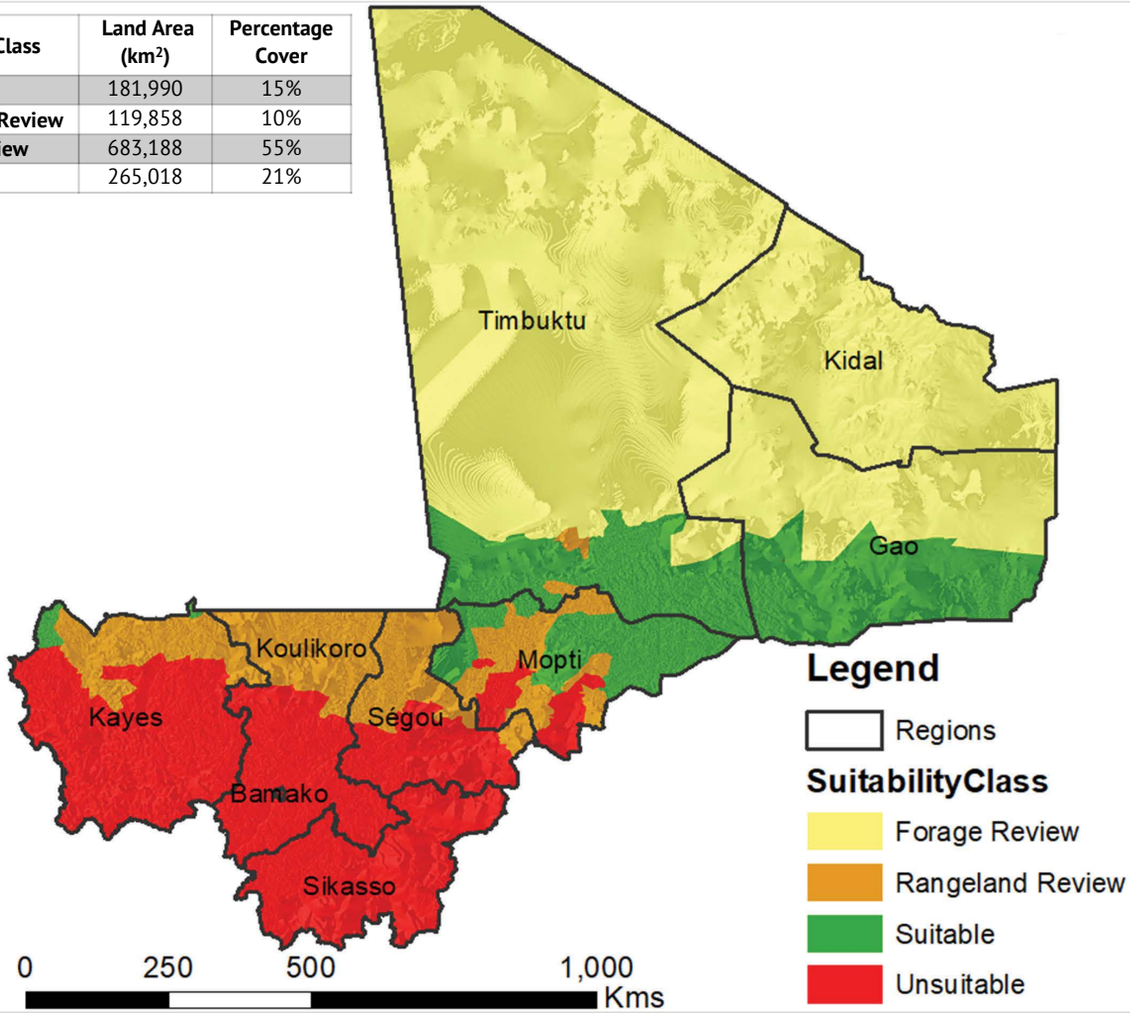
			Justification
Socio-economic Feasibility	Importance of pastoral livestock to the local economy		The livestock sector is particularly important to the Malian economy. It contributes around 19% to the national GDP and is the main Source of livelihood for more than 30% of the population. While agro-pastoralism is practiced by the majority of the population, the national livestock herd is almost equally split between pastoralists (45%) and agro-pastoralists (55%).
	Impact of drought on the livestock sector		Droughts lead to recurrent food security crises in Mali and the pastoral regions are particularly affected. There is limited data on the costs of droughts, especially the livestock sector. Anecdotal evidence shows, however, that costs can be extremely high. During the severe drought in the 1970s, more than 40% of the national herd was estimated to have died due to lack of water and forage resources. In addition, a recent World Bank Group (WBG) study revealed that pastoral areas may expect losses as high as 3.7% of the rangeland production annually, and up to 20.6% in 100 years.
	Vulnerability of pastoralists to drought		The northern pastoral regions are not only the most arid parts of the country, but they are also the most susceptible to recurrent droughts. Pastoralists depend largely on livestock (over 80% of their income) and inequality among pastoralists in these regions is very high. The poorer half of the population has on average only 2.5 TLUs per capita or less at their disposal. As a result, vulnerability to droughts is highest among those poorer pastoralists.
	Pastoralist demand for livestock insurance		This study did not have sufficient elements to make this assessment.
	Pastoralist financial literacy		Pastoralist communities have been exposed to insurance and, therefore, have some understanding of the concept. However, agricultural and index-insurance are largely unknown in the pastoral areas and their introduction would require investments in awareness creation.

			Justification
Technical Feasibility	Rangeland dominance	🟠	Extensive rangelands dominate a large portion of the central and northern parts of Mali. However, in the northern part of the country extending into the Sahara desert, vegetation growth is limited by rainfall. Conversely, the more productive southern and southwestern parts of the country are dominated by croplands and human settlements.
	Seasonality and signal intensity	🟠	Vegetation in the rangeland-dominated regions of Mali show a well-defined single growing season, allowing for the definition of one distinct drought risk period. The pasture and rangeland vegetation growing season consistently runs from June/July to October/November.
	Overall feasibility of product design	🟢	The final suitability classification of Mali's administrative units indicates that 15, 10, 55 and 21% of the country is classified as suitable (green), suitable but needs rangeland review (orange), suitable but needs forage review (yellow) and unsuitable for IBLI product design, respectively. Pastoral regions where IBLI is suitable or feasible but needing review host about 62.6% of Mali's total livestock population.
Operational Feasibility	Technical capacity on index calculation and quality assessment	🔴	National-level institutional capacity in handling data components of index-insurance initiative seems limited. However, there are a few institutions that support agro-meteorological and extension services. Regional institutions such as AGHRYMET, ACF or ARC could support data management tasks and capacity building at national level.
	Legal and regulatory insurance environment	🟢	Mali is a member of Conference Interafricaine des Marchés d'Assurances (CIMA), which already has regulations in place for IBDRFI. The CIMA recently introduced regulations for Sharia-compliant products, even though there is no evidence of demand for them at present.
	Insurance market development	🟠	Mali has a growing insurance sector. There are several development organizations which have partnered with insurance companies to provide traditional crop and weather-indexed insurance products against droughts and climate related losses. However, no initiatives have been conducted in the pastoral regions to date.
	Interest from insurers in IBDRFI	🟠	Companies such as Inclusive Guarantee and OKO Insurance offer crop insurance services, including index-based products and have expressed interest in solutions targeting pastoral areas.
	Effective distribution channels	🟠	The insurers' presence in pastoral areas is limited or absent. However, the good DFS networks currently used for cash transfer programs might offer opportunities to support effective distribution channels if targeted investments are made.
	Existing pastoralist beneficiary registries	🔴	A Unified Social Registry has been established to facilitate the national shock-responsive social protection program. However, the coverage of this registry is still limited and its expansion in pastoral areas requires targeted investments.
	Finance available for premiums	⚪	This study did not have sufficient elements to make this assessment.
	Interest from government	🟠	The government has shown interest in IBDRFI initiatives targeting pastoral systems and has a proactive approach toward drought risk management, through the National Plan for Drought and consistent participation in the ARC drought risk pool. More engagements are necessary to understand specific objectives and levels of commitment toward implementation of IBDRFI initiatives in pastoral areas.
	Conflicts and insecurity	🟠	While telecommunication companies indicated their capacity to operate in regions affected by terrorism/conflicts, other actors have found it challenging in recent years to access some pastoral regions, especially the ones bordering Niger and Burkina Faso, due to heightened insecurity issues. This could be a hurdle in implementing IBDRFI in some of these areas, especially awareness creation and product distribution. However, a detailed review of potential constraints arising from the country's security situation was not conducted in this study Therefore, a comprehensive assessment of potential operational constraints was not possible as this is highly context-specific..

🔴 = low; 🟠 = medium; 🟢 = high. ⚪ This study did not have sufficient elements to make this assessment

FIGURE E.1 TECHNICAL FEASIBILITY OF IBLI STANDARD PRODUCTS IN MALI

Feasibility Class	Land Area (km^2)	Percentage Cover
Suitable	181,990	15%
Rangeland Review	119,858	10%
Forage Review	683,188	55%
Unsuitable	265,018	21%



Recommendations

Considering the limited scope of a feasibility study, the next steps toward implementing an IBDRFI initiative require in-depth engagement with stakeholders in Mali and analytical studies to address the knowledge gaps identified. Further details are provided in Chapter 6 of the main report.

Photo credit: EAP Photo Collection/ World Bank

Next Steps

Stakeholder engagement and policy support

R1: Begin a more structured national dialogue or roundTable discussions on the scope for alternative IBDRFI implementation options, given the consensus by public and private sector stakeholders on the need and value of IBDRFI initiatives targeting pastoralists and the livestock sector's importance to the country's economy. The primary objective of this dialogue should be to define IBDRFI objectives and policy priorities.

R2: Defining policy objectives and evaluating alternative IBDRFI programmatic options. The dialogue should primarily define policy objectives and evaluate alternative IBDRFI programmatic options. The options to be considered might include tailored micro and macro-level approaches targeting individual pastoralists, similar to those implemented in east Africa and innovative schemes involving meso-level distribution channels.

Follow up actions on some of the identified priority areas

R3: Cost–benefit analysis

- **A review of government expenditures on emergency responses to inform the cost-benefit analysis of alternative IBDRFI options.** This study was unable to identify recent and accurate data on the costs associated with Malian drought responses and other climate crises, particularly in the pastoral areas. This is an important gap that needs to be filled. This step informs the decision-making process that is needed to select a set of potential IBDRFI options for a detailed review, which includes a cost-benefit analysis.

R4: Distribution channels

- **A study on the distribution model in pastoral areas should be done by considering the country's existing DFS initiatives from public, private and international development actors.** It is recommended that organized structures such as RBM, local pastoral associations and NGOs be the entry points for distribution of any IBDRFI product. Besides direct distribution to pastoral households, meso-level approaches should also be evaluated as a potential alternative, with pastoral groups or associations acting as risk aggregators.

R5: Product design

- **A product design review and customization study.** Even though a large portion of Mali was considered suitable, a product design review with local stakeholders is required. It is recommended that a product review/customization exercise be undertaken during the early stages of implementation, with input from pastoral associations, national institutions providing extension service and development organizations operating in pastoral areas.
- **A systematic review of ongoing pastoral development interventions to identify priority geographic clusters for initial intervention**. Lessons learned from existing programs indicate the importance of linking financial protection efforts with complementary livestock value chain (feed and fodder, markets, animal health and water management) and resilience interventions (e.g. PRAPS II) from the beginning to maximize benefits. This review can also identify priority clusters for IBDRFI implementation, starting with regions where livestock services are more developed.

R6: Conflict mitigation

- **An in-depth analysis of the conflict/security situation in the pastoral/agro-pastoral regions and the potential operational implications for IBDRFI initiatives.** Even though IBDRFI schemes for pastoralists have previously been implemented in regions with high levels of insecurity, such as Mandera in Kenya or Somali in Ethiopia, the next stages of implementation should carefully consider security-related constraints in the demand, supply and scaling up of the product in Mali. In addition, mitigation strategies for inter-community (farmers versus pastoralists) clashes over land resources should be evaluated.

R7: Capacity development and Learning

- **An awareness creation campaign for pastoral communities and a capacity building strategy targeting institutional and private sector actors.** Stakeholders engaged in this study strongly emphasized the need for awareness creation and capacity building of local institutions, private sector actors and pastoral communities.
- **A monitoring and evaluation strategy as part of a broader learning framework to ensure that appropriate mechanisms for quality assurance and impact evaluation are in place**. Considering the lack of IBDRFI experience and the limited financial literacy in the country, it is essential for effective monitoring mechanisms to be established.

Glossary of IBDRFI Terminology

Agricultural Insurance	Insurance applied to agricultural enterprises. Types of business include forestry, crop, livestock and aquaculture insurance, but normally excludes building and equipment insurance, although these may be insured by the same insurer under a different policy.
Basis Risk	Basis risk is the difference between an index and the shock that the index is supposed to be a proxy for. A payout triggered by an index may be higher or lower than the beneficiary's losses, leading to overpayment or shortfalls, respectively.
Ex Ante Risk Mechanism	Action taken prior to a potential risk event. Advance preparations for disasters help to avoid inefficient response coping decisions. If ex ante strategies are not in place, short-term coping strategies will be utilized that have no significant long-term benefit.
Ex Post Risk Mechanism	Risk management strategies developed in reaction to an event without prior planning. While ex post strategies have a role to play, risk management mechanisms can be more effective when introduced ex ante.
Exposure	The cover amount or sum insured for peril(s) at any one time. In crop insurance, exposure may fluctuate during the coverage period, in line with the crop's growth stages from planting to harvest completion.
Hazard	A physical or moral feature that increases the potential for loss arising from an insured peril or that may influence the degree of damage.
Indemnity	The amount payable by the insurer to the insured, either in the form of cash, repair, replacement or reinstatement in the event of an insured loss. This amount is measured by the extent of the insured's pecuniary loss. It is set at a Figure equal to, but not exceeding the actual value of the subject matter insured just before the loss, subject to the adequacy of the sum insured. For many crops, an escalating indemnity level is established as the growing season progresses, in line with crop growth stages.
Index-Based Livestock Insurance	Satellite index insurance for livestock holders. Index-based livestock insurance originated from Mongolia in 2006 with the launch of a micro-level livestock mortality index insurance cover based on a county-level livestock mortality index. In 2010, IBLI was launched in Kenya as a micro-level predicted drought-related livestock mortality index, combining satellite imagery (based on the NDVI) and county-level livestock mortality data. Subsequent micro-level and modified macro-level IBLI programs in Kenya and Ethiopia have used satellite NDVI as a proxy for forage availability in pastoral regions.
Index Insurance	Insurance that does not make indemnity payments based on an assessment of the policyholder's individual loss, but rather on measures of an index that is a proxy of actual losses. The two types of agricultural index insurance products are based on (i) area yields, where the area is some unit of geographical aggregation larger than the farm and (ii) measurable weather events.
Insurance	A financial mechanism that aims to reduce the uncertainty of losses by pooling many uncertainties so that the burden of loss is distributed. Generally, each policyholder pays a contribution to a fund in the form of a premium, commensurate with the risk they introduce. The insurer uses these funds to pay the losses (indemnities) suffered by any of the insured parties.
Insurance Agent	The person who solicits, negotiates or implements insurance contracts on behalf of the insurer.
Insurance Broker	The person who represents the insured in finding an insurer(s) for a risk and negotiates the terms of the insurance contract. A broker may also act as an agent (i.e. for the insurer) for the purposes of delivering a policy to the insured and collecting premiums from the insured parties.
Insurance Policy	A formal document including all clauses, riders and endorsements, which expresses the terms, exceptions and conditions of the insurance contract between the insurer and the insured. It is not the contract itself but evidence of the contract.

Insured Peril	The cause of loss stated in the policy document, which on its occurrence entitles the insured party to make a claim.
Loss Adjustment	Determination of the extent of damage resulting from occurrence of an insured peril and subsequent settlement of the claim. Loss adjustment is carried out by the appointed loss adjuster who works on behalf of the insurer.
Loss Ratio	The proportion of claims paid (or payable) to the premium earned. A loss ratio is usually calculated for each class of business in which an insurer participates. The analysis of loss ratios can be useful in assessing risks and designing appropriate insurance structures.
Macro-Level	The economic level at which countries and large donor agencies working with these countries experience risk of weather-induced humanitarian crises or economic instability caused by price volatility.
Meso-Level	The economic level at which banks, micro-finance institutions, producers, traders, processors and input providers experience risk due to the vagaries of weather and price.
Micro-Level	The economic level at which individual farm households experience risks due to shocks such as adverse weather events, price fluctuations or disease.
Premium	The monetary sum payable by the insured to the insurers for the period (or term) of insurance granted by the policy. The premium is calculated as the product of the premium rate and total sum insured. It is also the cost of an option contract paid by the buyer to the seller.
Premium Rate	The price per unit of insurance. Normally expressed as a per cent of the sum insured.
Reinsurance	When the total exposure of a risk or group of risks presents the potential for losses beyond the limit that is prudent for an insurance company to carry, the insurance company may purchase reinsurance i.e. insurance of the insurance. Reinsurance has many advantages including (i) balancing the financial results of the insurance company over a period, (ii) limiting the exposure of individual risks and restricting losses paid out by the insurance company and (iii) possibly increasing an insurance company's solvency margin (per cent of capital and reserves to net premium income), hence the company's financial strength. The reinsurer not only benefits from profits of the insurance company, but also covers the losses, the net result being a more sTable loss ratio over the insurance period.
Risk Aggregation	The process of creating a risk-sharing arrangement, which pools risks, thereby reducing overall transaction costs and giving small households or other participants a stronger bargaining position.
Risk Management	Care to maintain income and avoid/reduce loss or damage to a property resulting from undesirable events. Risk management involves identifying, analyzing and quantifying risks then taking appropriate measures to prevent or minimize losses. Risk management may involve physical mechanisms, such as vaccinating animals or improving the management of grazing lands. It can also involve financial mechanisms, e.g. hedging, insurance and self-insurance (carrying sufficient financial reserves so that a loss can be sustained without endangering the immediate viability of the enterprise).
Risk Mitigation	Actions taken to reduce the probability or impact of a risk event or to reduce exposure to them.
Risk Retention	Risk retention is the process whereby a party retains the financial responsibility for loss in the event of a shock.
Risk Transfer	Risk transfer is the process of shifting the burden of financial loss or responsibility for risk-financing to another party through insurance, reinsurance, legislation or other means.
Risk Coping	Strategies employed to cope with a shock after its occurrence. Some examples of risk-coping strategies include the sale of assets, seeking additional Sources of employment and social assistance.

Risk Financing	The process of managing risk and the consequences of residual risk through products such as insurance contracts, catastrophe bonds, reinsurance or options.
Risk Layering	The process of separating risk into tiers that allow for more efficient financing and management of risks. High probability, low-consequence events may be retained by households to a certain extent. The market insurance layer is characterized by the ability of the market to manage risks through insurance or other contracts. Low-probability, high-consequence events characterize the market failure layer and at this layer of risk, government intervention may be necessary to offset the high losses.
Risk Pooling	The aggregation of individual risks for the purpose of managing the consequences of independent risks. Risk pooling is based on the law of large numbers. In insurance terms, the law of large numbers demonstrates that pooling large numbers of roughly homogenous, independent exposure units can yield a mean average consistent with actual outcomes. Thus, pooling risks allows an accurate prediction of future losses and helps to determine premium rates.
Scalable Safety Net	A social protection program that can increase its caseload and/or its intensity of support in response to catastrophic events.
Shock	An unexpected traumatic event such as death in the family or loss of land and livestock, which can be caused by catastrophic weather events or another unexpected phenomenon. Price shocks occur when the price of commodities changes dramatically due to changes in local or global supply and demand, affecting the households' livelihoods, as they are dependent on the commodity either for income or caloric intake. Economic shocks can occur at the micro, meso and macro levels and can have long-term consequences for the economic well-being of actors at each level.
Social Safety Net	Various services usually provided by the government that are designed to prevent individuals or households from falling below a certain level of poverty. Such services include free or subsidized health care, childcare, housing and welfare, etc.
Subsidy	A direct or indirect benefit granted by a government for the production or distribution (including export) of a good or to supplement other services. Generally, subsidies are thought to be production and trade distorting and cause rent-seeking behaviour, resulting in inefficient use of resources.
Underwrite	To select or rate risks for insurance purposes.

1. Introduction

1.1 Background

This report was prepared for the project entitled, "Feasibility analysis for a pre-arranged drought risk financing and insurance (DRFI) solution for livestock in the Sahel," conducted by ILRI and the WBG. The aim of the project was to assess the feasibility of implementing financial protection solutions against drought in the pastoral regions of four Sahelian countries (Burkina Faso, Niger, Mali and Senegal) and to discuss the most effective implementation modalities (as part of wider drought risk management and pastoral development initiatives) with local stakeholders (public and private sectors).

Among the various DRFI solutions, index-based approaches are particularly suitable for smallholder farming and extensive pastoral systems. Index-based drought risk financing instruments trigger payouts/financial responses based on an 'objective' index approximating the impact/loss. Indices can be based on ground measurement networks (e.g. meteorological or crop yield data) or by EO satellite data (e.g. rainfall estimates, vegetation indices and soil moisture).

The study was conducted against the background of ongoing discussions to scale-up regional or national-level IBDRFI initiatives in the Sahel and Horn of Africa (HOA) as part of a comprehensive agenda to increase the pastoralists' resilience to climatic shocks (see Footnote 1). Over the last decade, IBDRFI solutions for pastoralists have been implemented and scaled up in east Africa (Kenya and Ethiopia) using different modalities, including micro-insurance, macro-level social livelihood protection, scalable safety nets and sovereign-level insurance programs. The positive impacts and overall success of these initiatives have resulted in growing demand and interest from African governments and development organizations that are keen to explore the possibility of introducing similar approaches across other pastoral regions on the continent. In addition to the countries targeted by this project, feasibility and pilot studies have been conducted or are ongoing in Djibouti, Somalia, Sudan, Uganda, South Africa and Zambia.

This report presents the main findings and recommendations of the feasibility of implementing an IBDRFI solution for pastoralists in Mali. This study was conducted from March 2020 to February 2021 by a joint team of ILRI and WBG experts, using a combination of literature review, in-country data collection, key informant interviews with local public and private sector stakeholders and dedicated technical analysis using satellite imagery and risk modelling approaches.

The objective of the feasibility assessment was to inform the government of Mali, private sector stakeholders and development institutions about the potential of launching IBDRFI initiatives in the country as a contribution towards sustainable solutions that cushion the pastoral households against the impacts of severe drought shocks. The study also provides background knowledge required to make informed decisions on whether investing resources in the design and implementation of an IBDRFI program can achieve the desired public policy objectives.

The feasibility investigated the context, needs and challenges and their potential solutions for implementing IBDRFI initiatives targeting pastoralists in Mali. Therefore, the following three main areas were analysed:

1. **The socio-economic context and potential demand for IBDRFI products (socio-economic feasibility, Chapter 2).** From a national perspective, extensive livestock systems are an important component of the rural economy, making IBDRFI solutions for pastoralists a worthwhile investment. From a development and demand perspective, livestock assets are important to rural households' livelihoods and welfare, therefore, their protection is critical for resilience building. These conditions are important in understanding the type of IBDRFI solutions that would be more relevant (i.e. commercial micro-insurance, social livelihood protection coverage and social safety net etc. see next section).
2. **The technical design of a satellite-based drought index for extensive rangeland systems (technical feasibility, Chapter 3).** A simple, robust, low-cost index design resulting in an accurate IBDRFI product is a critical pre-condition for implementation. Satellite-based indices have been proven to be reliable indicators of the impact of droughts on forage resources. The assessment, therefore, evaluates the geographic extent of the area where the technical design of an accurate satellite IBDRFI index would be possible. The feasibility factors considered include the rangeland coverage, vegetation cover/density and seasonality, which are critical for the design of EO drought indices.
3. **The operational conditions for an IBDRFI scheme (operational feasibility, Chapter 4).** Designing and implementing an efficient supply chain for IBDRFI solutions in extensive pastoral areas is challenging and often requires substantial initial investments. The assessment of existing infrastructure and networks for financial services

delivery, institutional and private sector capacity and interest, existing legal and regulatory frameworks and technical and financial constraints is, therefore, essential to determine the level of investment required to launch the initiative.

In addition, this study provides a simple scenario analysis to illustrate historical payouts and hypothetical costings of typical IBDRFI structures (scenario analysis, Chapter 5). This analysis aims to provide the Malian government, private sector and development institutions with an overview of the costs and benefits of the proposed insurance scheme based on multiple scenarios. This is done for illustrative purposes only, with the aim of demonstrating how the technical product customizations and different programmatic options have fundamental cost/benefit implications. As such, it should be noted that the proposed scenarios are not meant to be recommendations for specific options, nor do they represent an exhaustive range of IBDRFI solutions. Thus, a detailed analysis of alternative programmatic options and product design customizations needs to be planned with local stakeholders at the early stages of implementation for future initiatives.

Findings from the different components of the study are summarized (Section 6) in a set of recommendations for the next stage of implementation. It should be noted that the scope of this assessment was limited to the determination of whether important requirements for the development and introduction of an IBDRFI initiative for pastoralists were met and to further provide recommendations for the subsequent planning and preparatory stages of implementation. The feasibility study is largely built on technical solutions, experiences and programmatic options implemented in east African countries, which were used as benchmarks for the assessment. As such, the IBLI product design was used for the technical assessments, while IBDRFI programmatic options were based on the main ones tested thus far. Therefore, micro-level retail and macro-level social livelihoods protection schemes that provide direct payouts/cash transfers to policyholders or beneficiaries are presented in the scenarios.

T**he feasibility study is largely built on technical solutions, experiences and programmatic options implemented in east African countries, which were used as benchmarks for the assessment.** As such, the IBLI product design[3] was used for the technical assessments, while the main IBDRFI programmatic options presented in this report were based on the main ones tested thus far. Therefore, micro-level retail and macro-level social livelihood protection schemes that provide direct payouts/cash transfers to policyholders or beneficiaries are presented in the scenarios.

However, the feasibility conditions should be considered as widely applicable to alternative IBDRFI options that should be evaluated and tailored for each specific context according to the country's policy priorities in drought risk management and social protection. During the program design phase, alternative drought index design approaches might need to be considered, given that the Sahel pastoral regions present significant ecological and socio-economic differences to those prevailing in east Africa. While alternative programmatic options, such as meso or sovereign level insurance are not discussed in detail in this report because of the lack of direct implementation experiences in pastoral areas, these models might need to be considered.

1.2 Index-based drought risk financing solutions for pastoralists

Drought risk financing and insurance refers to mechanisms that aim to reduce adverse socio-economic or ecological impacts of potential drought crises. This can include early financing to prevent and reduce the risk profile or preparing for and responding to a shock. Drought risk financing and insurance is becoming an integral part of climate risk management frameworks as a key component of financial protection strategic planning for low and middle-income countries.

Multiple DRFI approaches exist, including market-based instruments (e.g. insurance schemes, catastrophe bonds and swaps), contingent financing (e.g. credit) and/or budgetary tools (i.e. dedicated reserve funds or contingency budgets). These approaches are all designed to increase financial resilience to climate-related crises, linking the response actions to predefined mechanisms for timely release of financial resources. In this way, they aim to ensure rapid and cost-effective preparation, assistance, recovery and reconstruction efforts.

Different IBDRFI solutions for pastoralists including micro-level retail insurance products, macro-level social livelihoods protection coverage, scalable safety net programs and sovereign-level drought risk financing solutions, have been developed and implemented since 2010 in east Africa (see Appendix 1 for differences between micro and macro-level products).

3.Henceforth, for simplicity the term IBLI is used as a generic term to indicate drought index-insurance products based on NDVI satellite imagery, designed specifically for pastoralists. Across different programs, the product design often changes, although the underlying technical design principles are largely similar.

- A micro-level retail insurance product (IBLI) has been sold and scaled-up by local insurance companies across northern Kenya and southern Ethiopia from 2010 and 2012, respectively.
- Macro-level social livelihoods protection programs have been implemented in Kenya from 2015, under the Kenya Livestock Insurance Program (KLIP) launched by the government of Kenya (GoK) with technical support from the WBG and ILRI. In Ethiopia, the program was launched under the Satellite Index Insurance for Pastoralists in Ethiopia (SIIPE) program and implemented by the World Food Programme (WFP) and the government of Somali Region. In 2020, the WFP, International Fund for Agricultural Development and the Ministry of Fisheries and Livestock launched a similar scheme (currently at pilot stage) targeting 5,000 livestock keepers in Zambia.
- Scalability mechanisms for safety net programs have since been implemented in Kenya under the HSNP and in Uganda, under the NUSAF III. In 2015, the GoK implemented a flexible scalability mechanism for the HSNP, an unconditional cash transfer program in the arid and semi-arid counties (ASAL), which expands rapidly to cover additional households if droughts occur. Similarly, the NUSAF III program was launched in 2016 in Uganda as a social safety net that includes a scalable public works mechanism, that allows it to rapidly increase financial assistance to affected people when droughts occur.
- A sovereign-level drought risk financing solution for rangelands designed for east Africa and the Sahel has been piloted by the ARC in collaboration with ILRI in Kenya.

Besides the operational options just listed, alternative IBDRFI programmatic implementation schemes have potential in the pastoral context if the lessons learnt from implementation in east Africa and the context-specific policy objectives are considered (ILRI 2021). For example, while never tested in the extensive pastoral regions, the potential for meso-level insurance may hold the greatest promise. This entails selling policies to risk aggregators such as pastoralist cooperatives, rural finance institutions or livestock services organizations (e.g. veterinary, drug and feed supplements suppliers). Meso-level distribution also offers the potential of de-risking lending to pastoralists and thus boosting investments in pastoral value chain upgrades. Box 1.1 presents an overview of micro, meso and macro-level distribution approaches.

Currently, there are several major parallel initiatives in east Africa assessing the feasibility of regional scaling up of IBDRFI solutions for pastoral communities, which should provide useful insights into the design and planning of an IBDRFI program in Mali and the Sahel. In 2020-21, the Foreign, Commonwealth and Development Office of the government of the United Kingdom funded a study under the Drought Index Insurance for Resilience in the Sahel and Horn of Africa (DIRISHA) to scale up IBDRFI solutions for pastoralists in the eight Inter-governmental Authority on Development (IGAD) countries. This study was implemented by an ILRI research team and the findings were published in the second quarter of 2021. In addition, the African Development Bank (AfDB), WBG and the European Union intend to launch a major investment program in the HOA, estimated at about 15 billion United States Dollars (USD). The intended investment pillars include: (i) regional infrastructure networks, (ii) trade and economic integration, (iii) building resilience and (iv) strengthening human capital. The third pillar includes the development of a regional pastoralist livestock insurance scheme. Insurance would be the entry point to enhance the financial inclusion of pastoralists (through promotion of savings and access to credit) and to strengthen their resilience to drought by protecting their livestock assets, which in turn protects their livelihoods. Ultimately, the delivery of insurance products with complementary programs designed to improved pastoral production systems would increase productivity and incomes (WBG 2020a). These two initiatives should provide useful insights relevant to the design and implementation of IBDRFI products and programs in Mali and other Sahel countries with large pastoral communities (ILRI 2021).

Photo credit: EAP Photo Collection/ World Bank

1.3 The IBLI product design

All IBDRFI solutions for pastoralists currently operational in Africa rely on similar EO technologies and general principles. Satellite indicators of forage condition (i.e. the NDVI, Box 1.2) are elaborated to derive an index of forage production in a given area and to calculate payouts using a predefined payout function and trigger mechanism. The NDVI is a low-cost, accessible and widely used satellite indicator of drought. There is well-documented evidence of a strong relationship between rangeland biomass and NDVI for ASAL rangelands. The NDVI has been successfully used to measure the effect of progressive drought conditions on forage and grazing availability over time (Fava and Vrieling 2021).

Among those solutions, the IBLI index design, used in this study for technical analysis, was developed for anticipatory action and livestock asset protection in times of severe droughts that lead to forage scarcity.[4] The forage-deficit estimated by the satellite index was used as an early indicator of drought conditions that negatively impact forage availability, livestock health and ultimately pastoralists' livelihoods (Appendix 2). As the satellite data provide near real-time assessment, payouts are triggered at the end of the rainy period (i.e. the most critical period for pastoralists to plan herd management) in the event of a drought. These payouts can support pastoralists to make informed and financially-backed tactical decisions to better protect their livestock assets and thus cope with the shock. Pastoralists can protect their livestock assets through purchase of fodder and animal feed supplements on time to keep the core breeding animals alive well before major livestock losses are incurred. Studies in east Africa suggest that anticipatory responses are significantly more cost-effective in protecting assets and livelihoods than humanitarian aid in later stages of crises (USAID 2018).

Box 1.1. Applications of index insurance at different levels of aggregation

Micro-level (direct):

Policyholders are individuals, e.g. farmers, market vendors or fishers, who hold policies and receive payouts directly. These policies are often sold at the local level and retailed through a variety of channels, including micro-finance institutions, farmers' cooperatives, banks, NGOs and local insurance companies. Premiums are either paid in full by clients or subsidized (or both).

Meso-level (indirect):

Policyholders are risk aggregators such as associations, cooperatives, mutuals, credit unions or NGOs, whereby a (re)insurer makes payments to the risk aggregators that then provide services to individuals.

Macro-level (indirect):

Policies are held by governments or other national agencies, within the international/regional reinsurance market. Payouts can be used to manage liquidity gaps, maintain governmental services or finance post-disaster programs and relief efforts for predefined target groups. Beneficiaries of these programs can be individuals. These schemes can be operationalized through regional risk pools.

Source: Schaefer and Waters (2016)

The IBLI product design is specifically tailored for pastoralists in extensive pastoral systems where mobility is an important herd management practice and livestock depend on rangeland resources. The insurance coverage is offered to relatively large geographical units (unit areas of insurance/UAIs) where the wet season grazing areas are located. The UAIs are designed in collaboration with local pastoral communities to reflect typical short-range livestock grazing and mobility patterns during the wet season. The product is currently not designed for transhumance corridors or long-distance dry season grazing areas.

4.It should be noted that satellite NDVI is sensitive to multiple factors affecting the vegetation, including some perils other than drought, e.g. floods, fires and pests etc. The IBLI index is, however, designed to specifically target drought effects on vegetation and minimize the impact of other factors, which might affect the NDVI signal. As such, while the NDVI might also be used to design multi-peril insurance coverage, this was not the case for the IBLI design in this study.

Box 1.2: Satellite NDVI information box

The NDVI is a relative indicator of green vegetation cover or vigour, obtained by measuring the difference between visible and near infra-red light reflectance. Higher NDVI values indicate denser cover or healthier vegetation and vice versa. In the context of operational NDVI-based IBDRFI products for pastoralists, the NDVI is used as a proxy for forage availability, since during a normal wet year/season, vegetation has higher NDVI than during a drought year/season.

While alternative satellite indices of drought exist, e.g. satellite rainfall estimates and soil moisture products, the NDVI is currently the most widely used operational systems indicator related to drought early warning, monitoring and index insurance in African rangelands. This is because of the well-established relationship between NDVI and vegetation condition, which is in turn directly related to forage resources available for livestock.

Recent developments in EO missions and technologies are opening new opportunities for designing innovative indices for IBDRFI initiatives, including rangelands and extensive pastoral systems (Fava and Vrieling 2021). Alternative EO-derived indicators (e.g. rainfall estimates, evapotranspiration and soil moisture) or drought indices, provide a wide range of options to design new products (Fava and Vrieling, 2021). Initiatives such as the NGDI aim to expand the range of options for designing IBDRFI solutions by developing a practical framework for a set of indices or indicators that will better monitor, anticipate and trigger financial responses to severe drought events. Others, such as the University of California Davis/USAID Quality Index Insurance Certification (QUIIC), aim to establish effective approaches for IBDRFI product assessment and to define minimum quality standards. These efforts are expected to allow the development of innovative indices, tailored to specific needs, co-generated with stakeholders and validated with high quality scientific standards.

1.4 Impacts and lessons learned from implementation

The IBDRFI initiatives implemented by ILRI in Kenya and Ethiopia have thus far produced valuable implementation lessons and evidence of livelihoods protection for pastoral communities. The key impacts are summarized in Figure 1.1. They have also provided proof of concept using different implementation schemes tailored for specific country needs, ranging from commercial insurance programs with various premium subsidy levels to fully subsidized macro-level social livelihoods protection programs targeting the most vulnerable pastoralists. This has created strong demand for IBDRFI instruments from several countries across the region and increased interest from development partners.

Photo credit: EAP Photo Collection/ World Bank

FIGURE 1.1 SUMMARY OF IMPACTS OF IBDRFI SOLUTIONS IMPLEMENTED UNDER KLIP

1. **Protect Gov budget**		Risk-transfer to the private sector	Premium Payment reduces public financial burden in case of drought PredicTable and budgeted expenditures allow better reSource allocation and harmonization with complementary initiatives	10 million USD payouts since inception made by the private sector
2. **Expand markets**		Public investment on subsidies and infrastructure	Public sector premiums guarantees regular profit. Investment in infrastructure facilities and crowds-in additional services. More awareness on the product increases the potential for retail sales.	IBLI coverage expanded from 3 to 8 countries Number of IBLI policies increased from 4k to over 20k
3. **Protect vulnerable**	Good Seasons	Reduced drought risk	Intensification: Increased investments in higher-returns production strategies. Strategic livestock sales when prices are high. 1 Increased investments in veterinary services. 1 Reduced precautionary savings. 1,2	Greater income 1,2
	Drought Seasons	Reduced income loss during drought	Less reliance on determental coping strategies during drought. Less distress selling of productive assets.[?] Less "skipping" meals during drought.[?] Maintained investments in human capital.	Improved post drought economic and welfare outcomes.
		Payments in anticipation of drought	Early action to mitigate the impact of drought Destocking in aniticipation of price and reSource shocks. Early purchase of inputs to sustain remainig herd during the coming drought.[4]	

Source: Fava et al. (2021) [1]Jensen et al. 2017; [2]Matsuda et al. 2019; [3]Janzen and Carter 2019 and [4]Taye et al. 2019

The IBDRFI solutions for pastoralists are still evolving in response to lessons learnt and growing demand from new countries. While there are consolidated operational implementation experiences in east Africa, new programs can utilize the vast knowledge capital accumulated over the last 10 years to further improve the existing solutions, tailoring them to the local context and pastoral systems and supporting their harmonization into broader risk management, resilience building and pastoral development policy frameworks. In defining resilience building objectives, multiple aspects of resilience need to be taken into careful consideration, including financial, ecological (i.e. to guarantee the maintenance of healthy rangelands and soils) and social resilience (e.g. in relation to conflict mitigation, social norms and inequality etc.). This holistic approach to resilience targets will be critical when planning future IBDRFI initiatives.

Evidence from multi-year impact evaluation surveys on the retail micro-insurance IBLI programs in Kenya and Ethiopia shows that these programs generated considerable social and welfare benefits for pastoralists who insured their livestock (Figure 1.1, Box 3: Protect vulnerable). During the good years, insured households respond to their insurance coverage by increasing investments in livestock veterinary and vaccination services, selling more livestock and reducing their herd size (Jensen et al. 2017; Matsuda et al. 2019). These changes in production strategies result in positive impacts on indicators of well-being such as increased household income per adult equivalent and reduced reliance on costly ex ante risk reducing strategies (distress selling of livestock or skipping meals) even during drought periods (Janzen and Carter 2018; Jensen et al. 2017; Matsuda et al. 2019).

Analyses of the use of payouts from pastoralists in Kenya and Ethiopia indicated that payouts influenced the pastoralists' decision-making on coping strategies. These payouts were used for both livelihoods protection and livestock input purchases. Using data from a survey of over 1,000 KLIP beneficiaries in Marsabit and Isiolo after the 2016-17 drought, a study examined how KLIP beneficiaries altered their coping strategies in anticipation of payments and how they spent those funds once received. A large majority (70%) of respondents reported using some of the payouts for human food consumption, while others used them to pay for forage/fodder, water and veterinary services for their livestock (Taye et al. 2019).

The experience with KLIP has provided evidence that the establishment of a public-private partnership (PPP) model for implementing IBDRFI is effective in transferring risk to the private sector while crowding-in private sector capacity and stimulating market expansion. The PPP model was preferred for KLIP because private sector-only implementation proved difficult to scale-up while maintaining private sector appetite for retail coverage due to the high distribution costs and relatively low uptake. The PPP assisted in the development of a new model for implementing IBDRFI solutions. Lessons learned from the implementation of KLIP are summarized as follows:

- Government leadership and direct investment in IBDRFI initiatives are possible and can be effective when there is strong partnership with the private sector where roles and incentive structures are clearly defined. A mechanism for long-term public commitment needs to be established to guarantee the stability of the scheme.
- Subsidies for scaling up and consolidating the scheme are important and instrumental, but they also need to be associated with smart targeting mechanisms and private sector incentives for market development and expansion.
- Awareness creation and capacity strengthening at all levels are fundamental and require sufficient resources for such schemes to achieve sustainability.
- Impact assessments require investment, planning and preparation. It is, therefore, recommended that a rigorous impact study and cost-benefit analysis of the program be included during the design phase to ensure that lessons learnt are documented and evidence is gathered.
- The introduction of an anticipatory logic in the IBLI and KLIP index design (for early drought detection and livestock asset protection) has been a fundamental step in improving the value and cost-effectiveness of the scheme.
- Accurate insurance product design is critical to create trust and achieve desired impacts but currently the data infrastructure for product quality assessments and comparisons is weak, if not absent. Therefore, there is an urgent need for the establishment of robust, transparent and actionable strategies and methodologies for quality assessment of index insurance products.
- Engaging with local and international stakeholders and tailoring the IBDRFI product to specific agro-ecological and socio-economic contexts as well as evolving environmental conditions is necessary, not only during the program design phases but throughout the entire program implementation cycle.
- Effective implementation is just as important as the technical design. It is important to ensure that premium collection and payment infrastructure is robust prior to the launch of similar schemes. Leveraging existing financial service infrastructure is crucial in ensuring that development impact is achieved, trust is built and the scheme is sustainable.
- Scaling up IBDRFI initiatives requires strong coordination efforts and harmonization of the different drought risk management instruments to optimize their finance mechanisms, targeting approaches and data and management infrastructure.

However, lessons learnt so far show that there are still significant challenges to be addressed in implementing IBDRFI in extensive pastoral regions, particularly in terms of financial sustainability and effective product distribution. The micro-level insurance retail schemes still face significant challenges such as low adoption rates and high marketing and distribution costs. These challenges make the products unattractive to private insurance companies unless they are significantly subsidized. In addition, the macro-level and safety net schemes for social livelihoods protection face challenges around the long-term commitment of government budgets and efficiency of the distribution model.

A recent study conducted under the DIRISHA program clearly shows that there is need to identify new low-cost IBDRFI distribution channels in east Africa (ILRI 2021) and that meso-level channels might be feasible options. This is likely to apply equally in Mali and other parts of the Sahel. Over the past decade, the micro-level IBLI programs in Kenya and Ethiopia have operated at a financial loss because of very high administration and operating costs of implementing insurance with individual pastoralists, who often reside in very remote areas. The unit costs of promotion, awareness

and education, policy issuance and premium collection from individual pastoralists exceeded the premiums generated from each micro-level policy sale. For micro-level IBLI programs to operate at a commercial profit, they require new and more cost-effective ways of marketing and delivering cover to clients.

The experience of IBLI and KLIP in Kenya and Ethiopia demonstrates the need for parallel investments in resilience building and market development for pastoral communities. Insurance by itself cannot build drought resilience and protect livelihoods. Insurance is only one of many essential elements of a comprehensive risk management framework. On one hand, building resilience requires broader investments in risk information (e.g. probabilistic drought risk assessments), risk reduction (e.g. improved natural reSource management practices) and preparedness building (e.g. live animal offtake markets). On the other hand, index-based insurance requires certain elements to function well. Not only is there a need for more concerted financial literacy and insurance training for pastoralists, but systems for targeting and registering pastoralists also require improvements. Strengthening of private sector markets for fodder and feed supplements and provision of veterinary services are also required as without these, pastoralists receiving payouts are unable to use the money to sustain their livestock (ILRI 2021).

Overall, evidence from operational insurance programs suggests significant benefits can be derived from IBDRFI instruments, both in terms of establishing mutual benefits between the public and private sector and delivering positive outcomes for the welfare and livelihoods of pastoralists during crisis and non-crisis periods. There is still need for better understanding of the short and long-term impacts of these programs on individual, community and environmental outcomes. Investments in robust monitoring and evaluation infrastructure and rigorous impact assessment studies are necessary to assess and increase the product value to ensure the development of tailor-made initiatives for resilience building of pastoral communities.

2. Socio-economic assessment

This section aims to review the main socio-economic conditions that may justify IBDRFI initiatives in Mali. It examines the relevance of the livestock sector and the impacts of drought shocks to the country's economy and pastoralists' livelihoods. The prevailing socio-economic environment in terms of the importance of livestock for livelihoods and welfare, vulnerability to drought shocks and impacts of drought and other shocks on livestock assets, is also assessed. The analysis was conducted through a combination of desk reviews and key informant interviews with stakeholders in the country (see Appendix 4).

2.1 General socio-economic context

Mali is a large, agricultural-based, low-income country with a rapidly growing population (Table 2.1). Mali's vast land area stretches over 1.24 million km2 and is home to 19.7 million people (2019 estimate). Around 90% of the population lives in the southern parts, which receive a lot more rainfall than the northern parts of the country. Gao, Kidal and Timbuktu regions in the north are largely desert. The median age is only 16 years and population's annual growth rate is approximately 3%. The average annual GDP growth was 4.3% during the period 2011-19, despite the large dips in GDP that occurred during the civil war in 2012 and 2013. Most of the population (57%) lives in rural areas where agriculture is the most important Source of livelihood. In total, agriculture contributes around 37 and 62% to GDP and employment, respectively (WBG 2021a). Given that most agricultural production systems are subsistence-based, the actual proportion of the population working in agriculture is likely to be much higher, estimated to be around 80% (e.g. CIA 2021).

Poverty remains a main concern especially in rural areas, with human development indicators among the lowest in the world. National poverty decreased from 50.9 to 41.1% of the total population between 2001 and 2009, attribuTable mainly to advances in the agricultural sector. Thereafter, the political and security crises from 2012-15 and the impacts of severe droughts resulted in poverty levels rising to 47.2% in 2015. However, poverty levels have since declined to 42.1% in 2019. The vast majority of the poor (90%) live in rural areas in the south of the country, where population density is at its highest (WBG 2015). The GDP per capita is estimated at USD 879. Accordingly, Mali has one of the lowest human development index values in the world, ranking 184 out of 189 countries in 2020.

TABLE 2.1 SELECTED ECONOMIC AND AGRICULTURE INDICATORS IN MALI

Indicator	Value	Period
Population (million)	19.7	2019
Rural population (%)	56.9	2019
Annual GDP growth (%)	4.3	2011-19
GDP / capita (USD million)	879.0	2019
National poverty (% of total)	42.1	2019
Agricultural GDP (% of total GDP)	37.3	2019
Agricultural employment (% of total)	62.4	2019

Source: WBG 2021a

2.2 Importance of livestock to the national economy

Livestock is an extremely important economic subsector for Mali (Table 2.2). The livestock subsector contributes about 19 and 30% to national and agricultural GDP, respectively. Livestock rearing is practiced by at least 85% of Malian farmers and is the main Source of income for more than 30% of the population (MEP 2010). Mali exports livestock to various countries in the region, especially Côte d'Ivoire, Senegal and Ghana. It ranks first among west African countries in terms of livestock export values for cattle, sheep and goats (FAOSTAT 2021). Cattle and sheep are Mali's third and fourth largest exports after gold and cotton. The importance of livestock exports has been growing such that between 2008 and 2017, cattle export revenue rose by about 37% (WITS 2021). Around 30% of the population is estimated to be pastoralists or agro-pastoralists (UNECA 2017).[5]

TABLE 2.2 SELECTED LIVESTOCK SECTOR INDICATORS IN MALI

Indicator	Value	Period	Source
Livestock sector, contribution to GDP (% of total)	19.2	2009	MEP 2010
Livestock sector, contribution to agriculture GDP (% of total)	30	2009	MEP 2010
Rural households rearing livestock (% of total)	>85	2009	MEP 2010
People for whom livestock rearing is the main Source of income (% of total population)	>30	2009	MEP 2010
Pastoralists and agro-pastoralists (% of total population)	30	2015	UNECA 2017

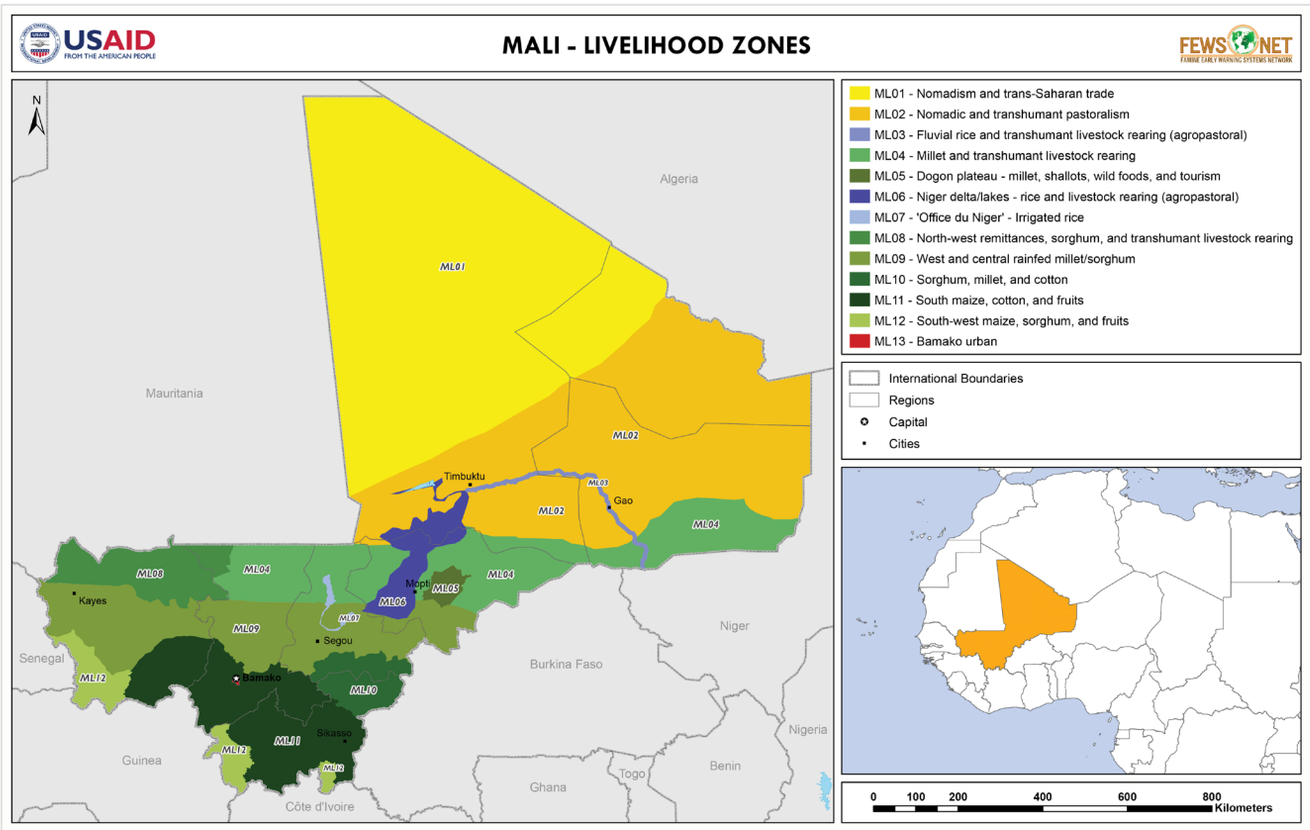
There are three overarching livestock production systems in Mali: pastoral, agro-pastoral, and semi-intensive livestock rearing:

1. ***Pastoral*** systems are characterized by exclusive reliance on livestock rearing for practitioners' livelihoods, extensive communal grazing practices and varying degrees of mobility. Transhumant pastoralism[6] is based on regular, seasonal movements (ML02, Figure 2.1). Conversely, nomadic pastoralism is characterized by the continual and unpredicTable movements of members of a family or a group (OECD 2014) (ML01, Figure 2.1). Pastoralists are mainly found in the arid and semi-arid zones in the country's north, where rainfall is less than approximately 400 mm per year, e.g. Tombouctou, Gao, and Kidal.
2. ***Agro-pastoral*** systems in Mali are traditional sedentary crop farming systems that include some livestock keeping. These producers include some semi-transhumant elements, particularly in northern areas of Kayes, Koulikoro and Ségou, Mopti and southern Gao (ML04, Figure 2.1). Agro-pastoralists are concentrated in the southern parts of the country, where rainfall is higher than 400 mm per year (ML04, ML08 and ML09, Figure 2.1).
3. ***Semi-intensive*** livestock rearing systems mainly exist in peri-urban areas, covering mostly poultry production, ruminant fattening and dairy farming (WBG 2015).

5. Specific data on the different livestock subsectors are scarce. One reason is that all general censuses conducted by the National Institute of Statistics (four censuses between 1976 and 2009) excluded major pastoral areas for varying reasons (Randall 2015). The Ministry of Livestock and Fisheries conducted a diagnostic assessment of the state of the livestock sector in 2009, which serves as basis for much of the data provided (MEP 2010).

6. Transhumant pastoralism is one of the dominant livestock production systems in West Africa. It is characterized by seasonal and cyclical movements of varying degrees between complementary ecological areas.

FIGURE 2.1 LIVELIHOOD ZONES OF MALI



Source: FEWSNET (2010)

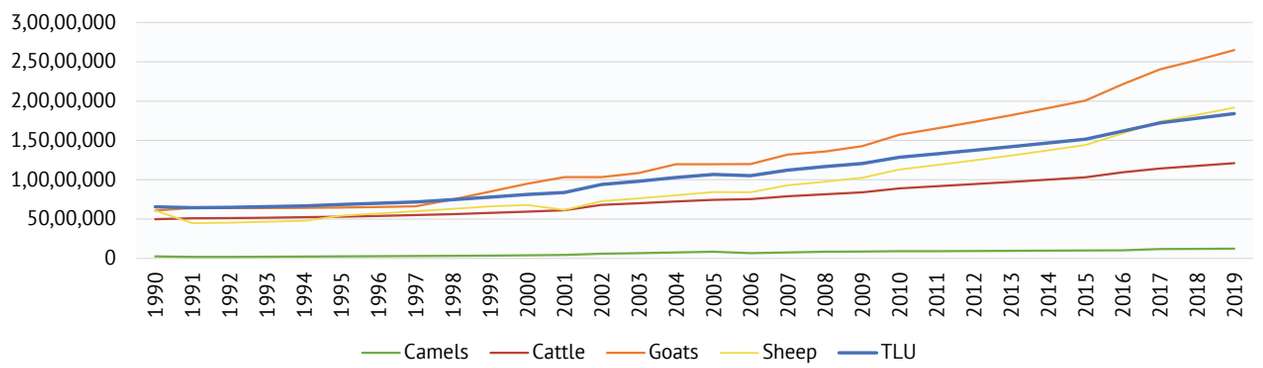
Most livestock producers in Mali are agro-pastoralists. It is estimated that only 10 and 9% of people involved in agricultural production in Mali are sole livestock and crop farmers, respectively, while 78% are agro-pastoralists (FAO 2017b). Assuming that 80% of the Malian population of 19.7 million are engaged in agriculture, this translates into about 1.5 and 1.2 million sole livestock (most of whom are likely pastoralists) and crop farmers, respectively. This also means that there are about 12.2 million agro-pastoralists in Mali.

Mali has the second largest herd of livestock in the Economic Community of West African States (ECOWAS) region after Nigeria.[7] In 2019, there were an estimated 60.1 million head of livestock (excluding poultry) in Mali (FAOSTAT 2021). This national herd is largely composed of goats (43%), sheep (31%) and cattle (20%), while camels, donkeys, chicken, horses and pigs comprise the remaining 6% of the live animal population. The estimated ruminant herd size in 2019 was thus equivalent to 18.4 million TLU.[8] Livestock numbers have been growing consistently over the years, with average annual ruminant TLU growth rate amounting to 3.7% between 1990 and 2019. Notably, the average annual growth rate of live goats (5.3%) and sheep (4.4%) is much higher than that of live cattle (3.1%) (Figure 2.2). One explanation is that frequent droughts and other pressures force livestock owners to focus on producing smaller ruminants, which have a shorter life cycle and thus offer quicker returns from a business perspective. Cattle accounted for 30 and 20% of the national herd in 1970 and 2019, respectively, demonstrating the shift in herd composition.

7. Mali has a larger livestock herd than Niger (60.1 million versus 50.6 million head of livestock). It should, however, be noted that given its higher share of cattle, Niger has a larger herd in terms of total livestock units (TLU) (20.9 million versus 18.4 million in Mali) (FAOSTAT 2019).

8. Tropical livestock units allow comparisons of nutritional requirements across livestock species. Using the ILRI's classification, 1 adult cow weighing on average 250 kg is deemed to be equivalent to 1.0 TLU. In terms of nutritional requirements, a camel is equivalent to 1.4 TLUs while sheep and goats are equivalent to 0.1 TLU. It is noted that different institutions use different TLU conversion factors. For example, Houerou and Hoste (1977) use the following conversion factors for pastoral/nomadic herds: 1 cow = 1 TLU; cattle in a herd = 0.7 TLUs; sheep = 0.1 TLUs; goats = 0.08 TLUs and camels = 1.25 TLUs.

FIGURE 2.2 TOTAL NUMBER OF SELECTED LIVESTOCK SPECIES IN MALI



Source: FAOSTAT (2021)

Livestock has significant cultural importance in Mali. As in other Sahelian cultures in the region, livestock ownership is associated with social prestige, especially in rural areas. Besides animal products, livestock offer transport, draught power and means of preserving wealth/savings. They also play an important role in traditional events and ceremonies such as baptisms, weddings, Tabaski and Christmas (MEP 2010).

2.3 Government support in the livestock sector

Of the total annual agricultural budget, 13% is allocated to the ministry of livestock. In 2019, the ministry set up a unit for prevention and crisis management to coordinate the support offered to livestock producers when disasters occur. Under the ministry of livestock, there are two directorates namely the National Directorate of Animal Production and Industries (DNPIA) and the National Directorate of Veterinary Services (DNSV).

The mission of the DNPIA is to implement the national policy on animal production and industries for intensification of production and ensuring quality. The directorate is responsible for organizing farmers, providing advisory services and disseminating good practices and technologies, excluding veterinary services and vaccinations. Extension and service delivery are offered through collaborations with various ministries and departments. The DNPIA is often called upon by development programs and organizations to monitor fodder plots, collect data and evaluate fodder distribution campaigns whenever they take place.

The DNPIA works with the ministry of civil protection to coordinate efforts to prevent and manage natural disasters (floods, drought and cattle rustling), which impact the livelihoods of the livestock producers. Through the Agency for the Environment and Sustainable Development, attached to the ministry of environment, the DNPIA receives technical support. The DNPIA also collaborates with the Ministry of Social Development (responsible for the creation of cooperatives, cooperative societies and, associations etc.) and the ministry of health, on the 'One Health' program to preserve the health of humans and animals.

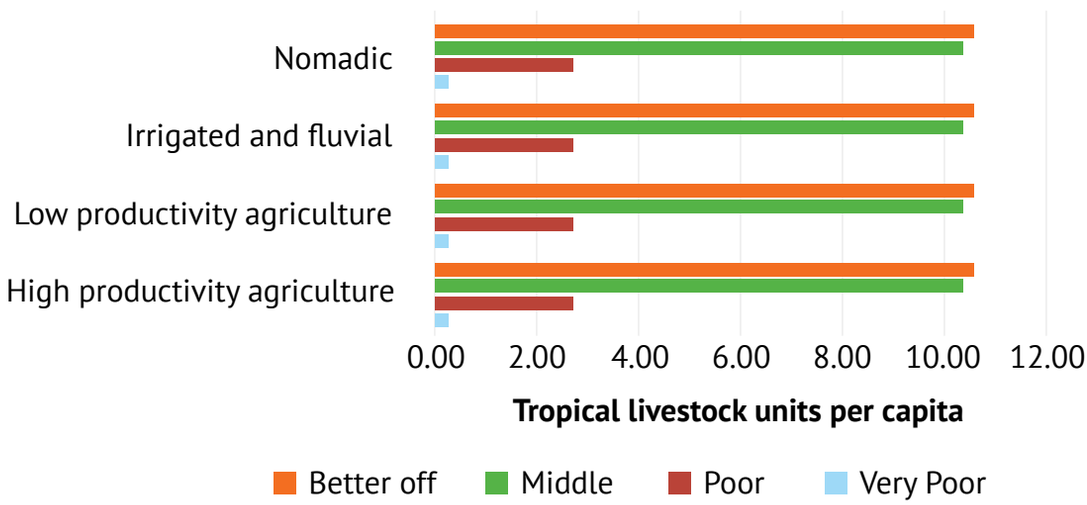
The DNSV is responsible for developing and monitoring the implementation of laws and regulations protecting animal and veterinary public health. It is responsible for developing national programs to prevent and control diseases, including zoonoses, and participates in the development of animal protection standards. It should be noted that the unit for Crisis Prevention and Management in the Ministry of Livestock and Fisheries has a coordinator and members from different national livestock and fisheries services, who work with the DNSV when conducting visits and surveys from time to time.

However, the DNSV experiences human reSource challenges, leading to the privatization of several services such as epidemiological surveillance missions, herd visits and monitoring markets and weekly dissemination of information and statistical data on animal protection and veterinary public health. Currently there are about 165 private agents working in the central and southern parts of the country carrying out the above-mentioned services.

2.4 Pastoral livelihoods, challenges and issues

There is major inequality among livestock producers in Mali with a few rich producers owning the majority of animals. Only 14% of livestock producers own more than 20 head of livestock each, however, their holdings account for around 53% of the national herd (Ministry of Livestock and Fisheries, undated). Conversely, 43% of livestock-owning households own fewer than 10 head of livestock each (MEP 2010). This disparity is confirmed by poverty data from the World Bank showing that among nomadic livestock keepers, the lower two quartiles are far worse off than the upper ones, owning on average less than 3 and 1 TLUs, respectively (Figure 2.3). It is estimated that livestock-dependent households require about 3.5 TLUs per capita to sustain their basic livelihoods (Cervigni and Morris 2016), suggesting that at least half of nomadic pastoralists in Mali are unable to meet their basic needs.

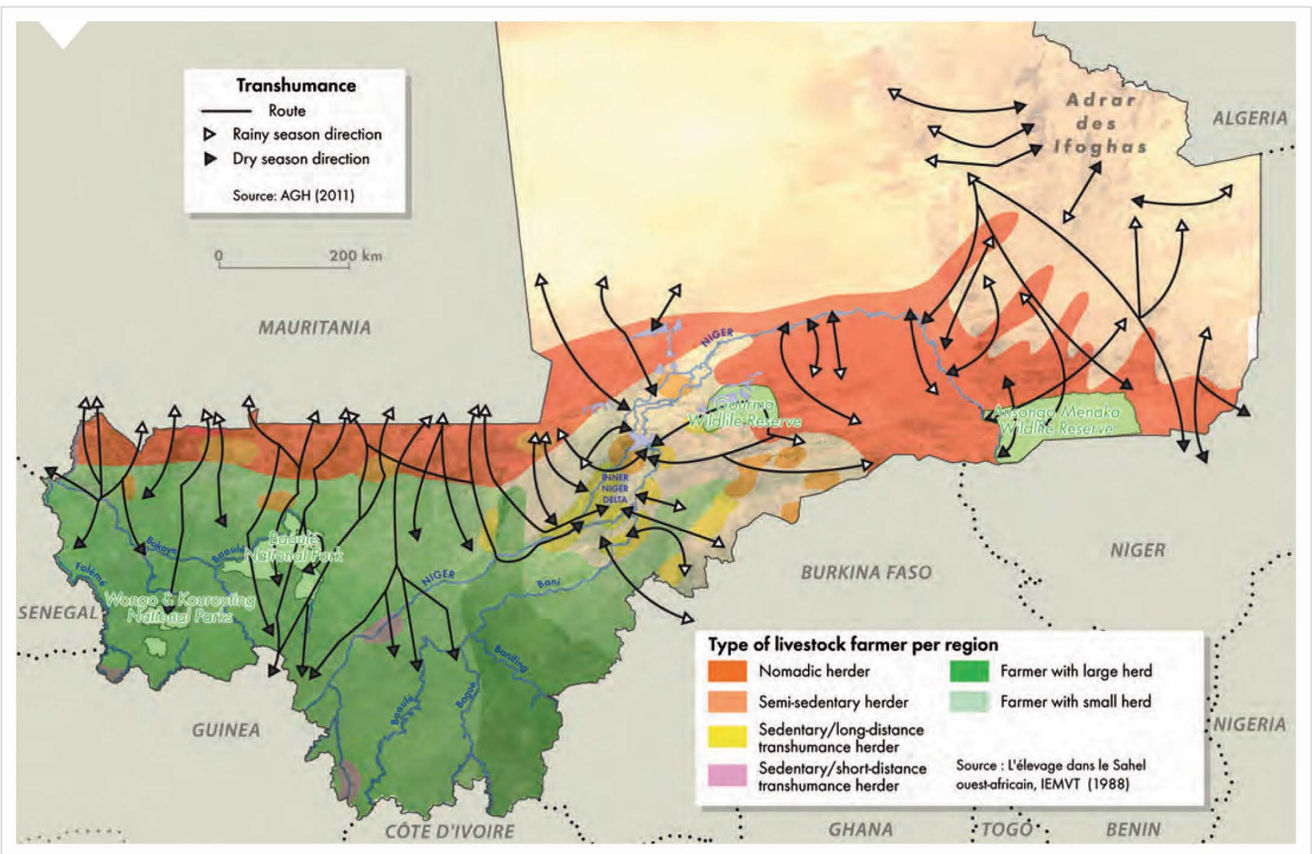
FIGURE 2.3 TOTAL LIVESTOCK UNIT HOLDINGS PER CAPITA IN MALI



Source: WBG 2015

Similar to other Sahel countries, pastoral communities in Mali practice livestock mobility in response to changes in availability of pastoral resources, i.e. water, pasture and salt licks (Adriansen 2008; Turner et al. 2016). These livestock migratory movements are, therefore, seasonal and cyclical within traditionally defined routes, although they vary spatially in routes followed and distance/area covered from year to year depending on the availability of resources (Bassett 1988; Bassett and Turner 2007; Umutoni and Ayantunde 2018). The migratory movements are generally north to south, with pastoralists staying in the central north and northern areas during the rainy season until October/November and then migrating south toward and across the crop belt during the final months of the year. In some areas, migratory patterns are more localized, for instance, pastoral systems around the Niger Delta zone use the delta as a dry season grazing area during the November to June dry season and migrate to the dryland pastures at the beginning, moving northeast or northwest (Figure 2.4).

FIGURE 2.4 MIGRATORY MOVEMENTS OF PASTORAL HERDS IN MALI



Source: Touré et al. 2012

Livestock keepers in Mali are subject to a long list of challenges. These include:

- **Poverty and lack of access to basic services:** Given the remoteness of the northern regions, many pastoralists lack access to basic social and sanitary services, means of transportation and access to markets. Formal financial services are mostly non-existent, as the banking sector considers investments in these regions to be too risky (WBG 2015; 2018a).
- **Growing land pressures:** The growing frequency and severity of droughts (see next section), degradation of soils and high population growth reduces the size of rangelands, thus increasingly putting pastoralists under pressure. This negatively affects the previously mutualistic relationship between pastoralists and sedentary farmers. In the past, when pastoralists moved south after the rainy season and crop harvest, crop farmers benefited from organic fertilizer and animal traction while pastoralists' animals had access to crop residues. In addition, both sets of farmers benefited from barter trade with animal and crop products. Today, crop farmers are increasingly investing in livestock and pastoralists take up crop farming as their herd sizes fall below the minimum required to sustain their livelihoods. The former mutually beneficial relationship is thus often replaced by competition for land or pastures, often resulting in violent conflict between migrating herders and sedentary crop farmers (De Haan et al. 2016; Jones-Casey and Knox 2011). This further exacerbates the pressure on pastures, as the limited mobility can contribute to overstocking and overgrazing.

- **Lack of political support and weak institutions:** The government has adopted a series of laws and policies targeting the livestock sector over the last two decades.[9] However, in many pastoral areas, the state has not often been effective in implementing the legal framework. For example, livestock theft continues to be a major problem for many herders, who continue to lose many animals. There is also no enabling business environment for trans-boundary mobility (people, goods and services), disease control and livestock trade facilitation (WBG 2015). Public service capacity tends to be low, the relevant laws are often weak and/or unenforced, databases are inadequate and systems for planning, information gathering and monitoring and evaluation are weak (WBG 2018a). De Haan et al. (2016) describe in detail the example of Mali's Kidal region, where explicit major public commitments to pastoralists to improve pastoralism systems in the area were made but not acted upon. Indeed, the lack of public support in the livestock sector is also reflected in the lack of financial commitment from the government. The sector receives less than 2% of the national budget and only about 8-12% of the share of the budget allocated towards rural development (National Directorate of Animal Production and Industries 2016).[10]
- **As a result, a growing number of livestock producers are currently forced to adopt a sedentary lifestyle.** Many farmers are forced to give up pastoralism and adopt agro-pastoralism, which in turn further increases land pressures and potential for conflict.
- **Despite several interventions over the years, the country still experiences ethnic and regional tensions, which have led to deepening insecurity within government structures, creating political divisions.** A significant portion of the population in the northern region is constituted by nomadic and pastoral groups, including Tuareg tribes and Fulani communities who continue to suffer from repression and marginalization, leading to conflicts. Moreover, the escalation of Jihadist insurgencies from 2017 has further led to ethnic tensions and violence especially in the central regions. One of the contributory factors to the tension are the clashes between the Fulani and farming communities over land use at the border between rangeland dominated areas in the north and the crop belt in the south. These tensions have been exacerbated by recurrent droughts in recent years.

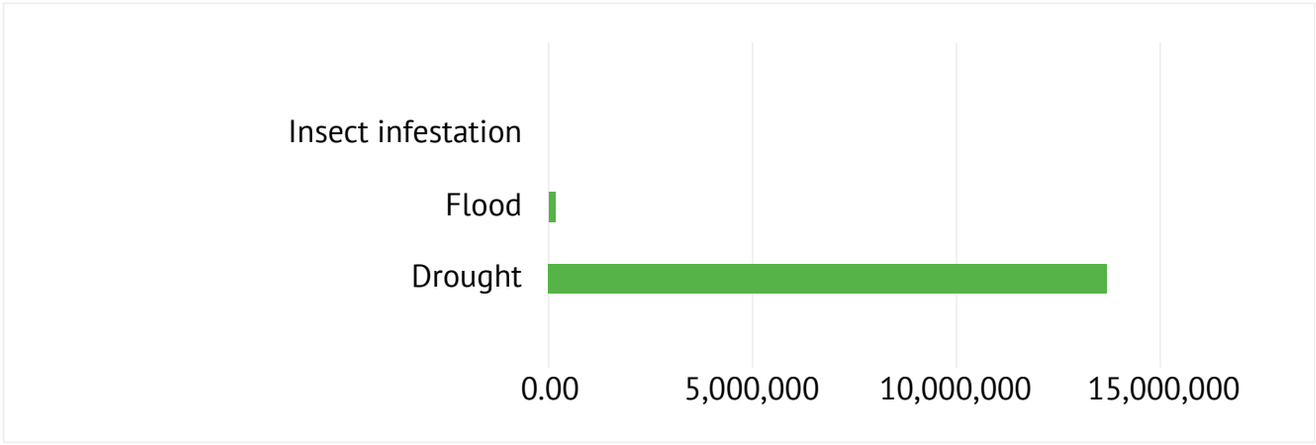
2.5 Impact of drought and other shocks on the livestock sector

Mali is severely exposed to recurrent droughts. According to the emergency events database (EM-DAT), the country has experienced 40 major floods, droughts and locust infestations between 1970 and 2020. Floods accounted for most of the reported events, occurring 26 times during this period. Even though major droughts only occurred 9 times during this period, their impact has by far been the greatest, affecting around 14 million people, while floods and locusts had little to no impact (Figure 2.5). Of note, during the locust infestations of 1985-88 and 2003-05, millions of hectares of crops were destroyed even though EM-DAT records do not reflect any impacts on people (Figure 2.5). This may be due to lack of data. Given that EM-DAT often underestimates the difficult-to-quantify drought impacts, the actual Figure is likely to be much higher. Major droughts occurred in the following years: 1972-74, 1983-85, 2002-04, 2011-12 and 2014-18.

9. These include the Charte pastorale (2001), guaranteeing migratory rights to pastoralists; the Politique Nationale de Développement de l'Elevage (2004); the Loi d'Orientation Agricole (2006), calling for the establishment of protected pastoral development zones and hydraulic works in the pastoral areas; the Politique du Développement Agricole and the Programme d'Investissement Prioritaire dans le Secteur Agricole (2010), which focused primarily on intensive livestock farming but were allocated only 18% of financial resources compared to 43% to the rice sector; the Decree No. 10-602 fixant les modalités de la transhumance en République du Mali (2010); the Cadre Stratégique de Croissance et de Réduction de la Pauvreté (CSCRP 2012-2017); the Stratégie de valorisation du lait cru local.

10. Evidence from other countries in the region (e.g. Ancey and Monas 2005; De Haan et al. 2016), suggests that pastoralists are frequently subjected to aggressive government policies attempting to push them to adopt sedentary lifestyles. Such policies were not identified as part of this study for Mali. Instead, the evidence seems to suggest a deliberately neglectful approach by the government (APESS 2014).

FIGURE 2.5 NUMBER OF PEOPLE AFFECTED BY DISASTER TYPE IN MALI (1970 TO 2020)



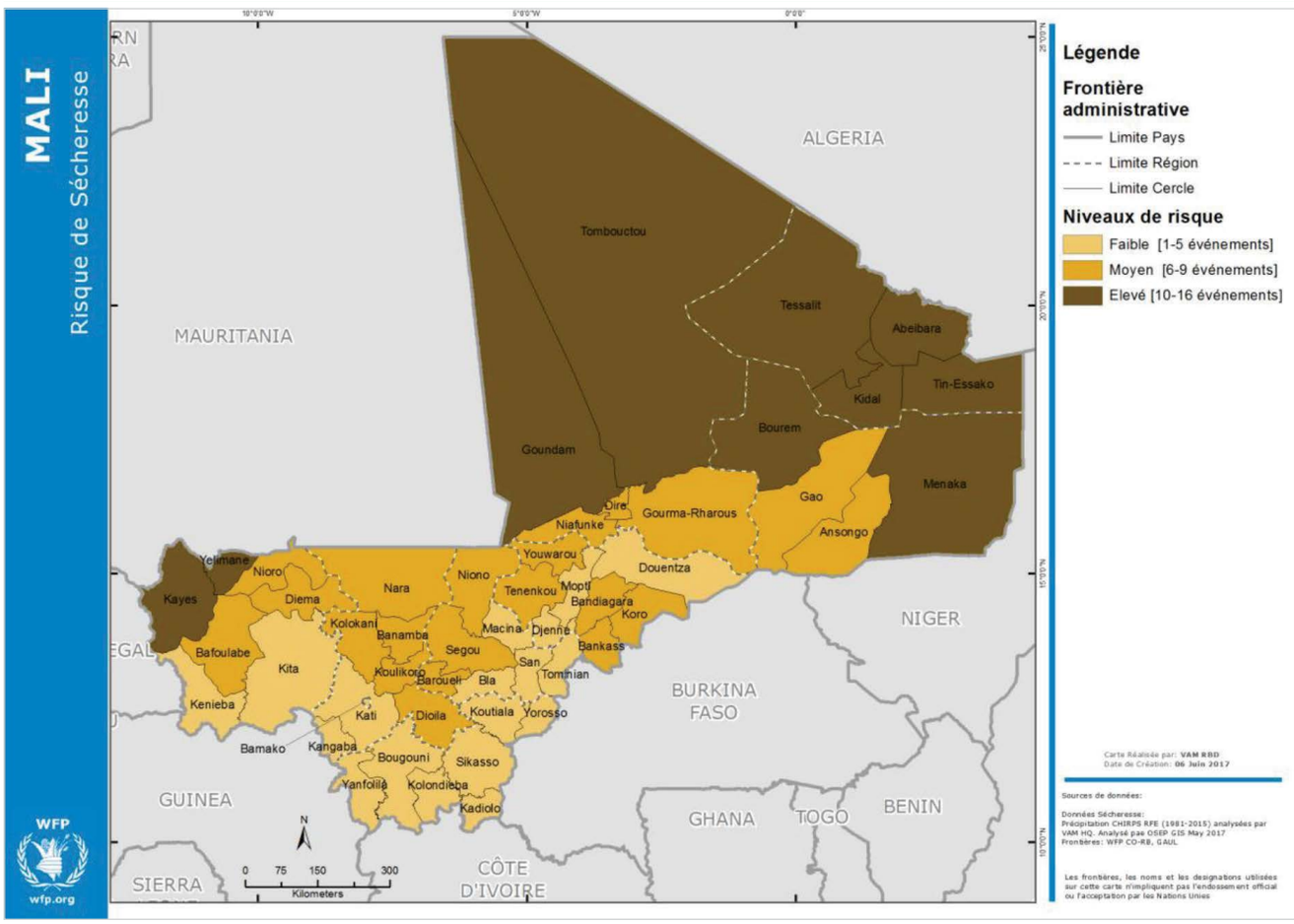
Source: EM-DAT database

The pastoral areas in the central north and north-eastern regions tend to be most affected by droughts. Analysis by WFP shows that the central north and north-eastern parts of the country, i.e. the pastoral areas, experience the highest risk of drought. In the areas indicated in brown, between 10 and 16 drought events were registered during the period 1981 to 2015 (Figure 2.6, WFP 2017).[11] By deduction, droughts in these areas occur approximately once every 2.2-3.5 years.

11. Drought was defined as an agricultural season in which average rainfall, as measured by Climate Hazards Group Infra-red Precipitation with Station data (CHIRPS) in the respective area, was below 80% of the long-term mean. For a detailed description of the methodology refer to WFP (2017) and WFP (2018).

Photo credit: EAP Photo Collection/ World Bank

FIGURE 2.6 LOCATIONS OF DROUGHTS IN MALI (1981-2015)



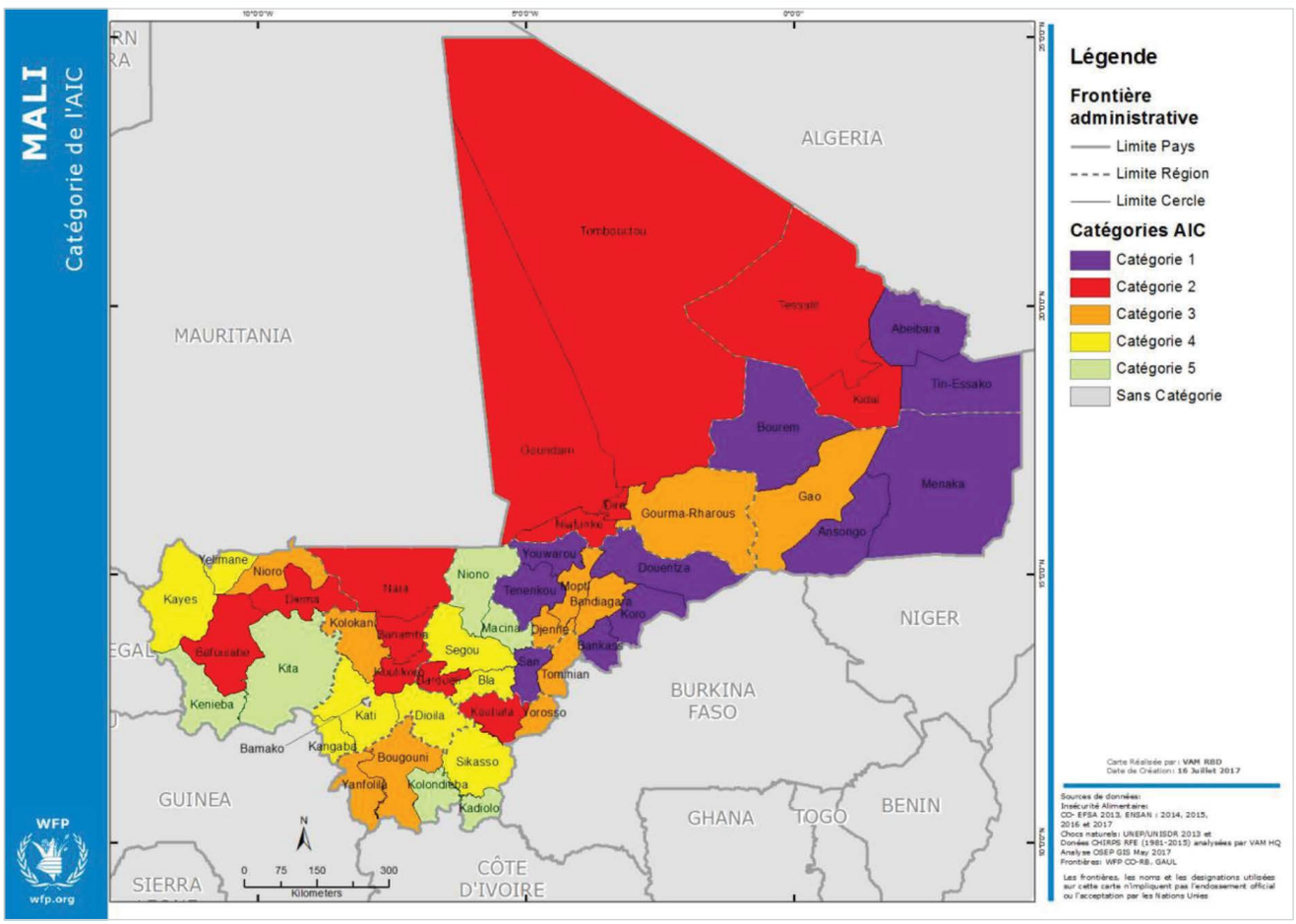
Niveaux de risqué = level of risk; faible = weak; moyen = average and élevé = high

Source: WFP (2017)

Pastoralists are particularly vulnerable to droughts. While extensive grazing practices in the low-precipitation regions in the central north can be extremely productive, droughts invariably lead to reduced forage and water availability. This directly reduces livestock productivity and causes massive losses of productive assets and wealth and by extension, the income of those dependent on them. Droughts can also lead to increased conflict as herders migrate into regions being used by others, such as cropping zones or rangelands used by neighbouring pastoralists (Jones-Casey and Knox 2011).

Droughts have had long-lasting and adverse effects on households' livelihoods and significantly contributed to the food security crises over the last few decades especially in pastoral regions. For example, the major droughts of 1972-74 and 1983-85 resulted in severe food scarcity where an estimated 100,000 humans died due to hunger. A further 750,000 became completely dependent on foreign food aid and about two-thirds of livestock was decimated due to drought-induced water and pasture shortages. Another major drought was experienced in 2002-04 resulting in more than 2 million people across almost every region of the country being food insecure. Indeed, the 1972-74, 1983-85 and 2002-04 droughts are used by the government of Mali (GoM) as benchmarks for drought severity (O'Brien et al. 2018). In fact, for its scenario planning, the government's Food Security Commission/Commissariat à la Sécurité Alimentaire (CSA) uses the drought of 2002-04 to forecast the number and distribution of households that might suffer from food insecurity in the event of an extreme, large-scale drought affecting most of the country. In 2009, about 20% of the population were affected by drought and the resultant food security crisis. The 2011-12 drought left about 3.5 million people vulnerable (O'Brien et al. 2018). Analysis by the WFP shows which areas are most at risk of experiencing food insecurity due to natural hazards, particularly drought (Figure 2.7).

FIGURE 2.7 ZONES AT RISK OF EXPERIENCING FOOD INSECURITY AND NATURAL HAZARDS IN MALI [12]



Exposition aux Chocs Naturels	Recurrence de l'Insecurite Alimentaire au-dessus du seuil de 20%		
	FAIBLE	MOYENNE	ELEVEE
FAIBLE	Zone 5	Zone 3B	Zone 3A
MOYENNE	Zone 4 B	Zone 2 B	Zone 1 B
ELEVE	Zone 4 A	Zone 2 A	Zone 1 A

Source: WFP 2017

More recently, droughts in 2011-12, 2014, 2017 and 2019 and the volatile security situation in the region have exacerbated the vulnerability of pastoralists.[13] The loss of productive assets and looting linked to violence and security incidents have resulted in the disruption of markets and livelihoods for households in affected areas. To cope with the adverse effects of these droughts, pastoralists resorted to fleeing their drought-stricken villages in search of alternative water and pasture resources. For example, the 2011-12 drought led to more than 100,000 people abandoning their livelihoods and migrating to other rural localities. Whereas mobility is viewed as an effective strategy for pastoralists to protect their assets, especially during droughts, it leads to conflicts with farmers in sedentary agricultural production systems. Therefore, in many cases herders opt for quick/emergency sales of their animals at low prices to buy food as a primary coping strategy. This strategy is detrimental, as it often depletes key assets that are difficult to recover after the crises, thus increasing the households' vulnerability to the next drought.

12. To determine how exposed a zone is to natural hazard shocks, the frequency of drought recurrence and floods in that zone is determined and divided according to Jenks' natural breaks method. For a detailed description of the methodology refer to the WFP (2017) and WFP (2018).

13. Source: Key informant interview, ministry of livestock

There is little data available on the general and livestock sector-specific costs of droughts in Mali. The World Bank conducted a disaster risk profile for Mali in 2019, including droughts and floods, however, the analysis excludes costs on the livestock subsector. The model estimates that drought affects about 400,000 people per year and reduces crop-related agricultural income by USD 9.5 million. In the next 10 years, these Figures are estimated to rise to 650,000 and USD 35 million, respectively (WBG 2019). Given the lack of systematic analysis, only anecdotal evidence on impacts of droughts and other perils on the livestock subsector is available (Table 2.3).

A recent study performed by the WBG for the ECOWAS region indicates that Mali could suffer rangeland production losses of 3.67% annually and up to 19.3% in 100 years (WBG 2021b). The WBG study also reveals that pastoral areas could suffer losses as high as 3.70% of the rangeland production annually and up to 20.6% in 100 years.

TABLE 2.3 REPORTED DROUGHT IMPACTS ON THE LIVESTOCK SECTOR IN MALI

Drought period	Reported impact
1972-74	◆ "In the Sahel, the 1972-73 dry season will be long remembered as the time when livestock died like flies," (Derrick 1977). ◆ At least 40% of livestock died, an estimated 5 million at the time in Timbuktu. Nationally 80% of livestock were estimated to have died (Derrick 1977). ◆ At least half of the country's population of about 5 million people were directly affected by the drought (Derrick 1977).
2002-04	◆ More than 2 million people across almost every region were estimated to be food insecure due to the 2004 drought (O'Brien et al. 2018). ◆ Locust infestations in 2004 following droughts in previous years particularly affected pastoral areas, reducing pastures by 18 and 7% in Gao and Koulikoro, respectively (WFP and FAO 2004).
2011-12	◆ More than 4 million people were estimated to be food insecure due to a combination of drought and other factors (socio-political, security and institutional crises) in 2011-12 (PNSM 2020).

Key takeaways from Chapter 2: Socio-economic assessment	
Economic importance	◆ The livestock sector is of key to the Malian economy. It contributes around 19% to the national GDP and provides the main Source of livelihood for about 30% of the population.
Production systems	◆ The two main livestock production systems are pastoralism and agro-pastoralism. Semi-intensive livestock farming also exists, but it is found in peri-urban areas only and thus relevant for a few people. Agro-pastoralism is by far the most practiced production system by livestock producers. Approximately 10% of all livestock producers live in the northern parts of the country and follow migratory pastoralist lifestyles. Given the many pressures on their livelihoods, many pastoralists are forced to become sedentary and adopt agro-pastoralist lifestyles.
Vulnerability	◆ The pastoral regions in the central north and east are not only the most arid parts of the country, but also the most exposed to recurrent droughts. Inequality among pastoralists in these regions is very high, and the poorer half of the population has on average ⩽ 2.5 TLUs per capita at their disposal. As a result, vulnerability to droughts is highest among the poorer pastoralists.
Cost and impact of droughts on pastoral livelihoods	◆ Droughts lead to recurrent food security crises in Mali, especially in the pastoral regions. There is little data available on the general and livestock subsector-specific costs of droughts in the country. However, anecdotal evidence shows that these costs can be extremely high. For example, during the severe drought in the 1970s, more than 40% of the national herd was estimated to have died due to lack of feed and water. In addition, a recent WBG study reveals that pastoral areas could suffer rangeland production losses as high as 3.70% annually and up to 20.6% in 100 years.

3. Technical assessment

This section illustrates the results of the technical feasibility assessment, aimed at evaluating the possibility of designing an IBDRFI product for the extensive pastoral areas of Mali. An IBLI product design has been used for the assessment (Appendix 2). However, the feasibility analysis could also inform the development of alternative drought indices based on NDVI or other EO satellite indicators. The datasets and methodology used are described in Appendix 3.

3.1 Agro-ecological characterization and rangeland distribution

Mali is characterized by a single rainfall season with a gradual increase in precipitation from north to south. Extremely dry climate is observed in the northern part of the country towards the arid Sahara desert. It gets wetter as one moves southwards with a north-eastern to south-western gradient (Figure 3.1a). The wet and dry seasons are clearly defined, with the wet season observed from June to October in the northern region and a dry period from late October to late June. In the south, more abundant rains start earlier from May to October, thus making the south wetter with a dry spell running from November to April. These rains are controlled by movements of the Inter-Tropical Convergence Zone (ITCZ), peaking in August (Rian et al. 2009). The region suffers frequent and recurrent droughts due to the variations in latitudinal movements of the ITCZ from one year to another, causing large interannual variability in rainfall (Nicholson 2001; Rian et al. 2009).

Three major bioclimatic regions characterize Mali: the Sahara, Sahelian and Sudanian regions (CILSS 2016; Patrice et al. 2017).

1. ***The Saharan region*** covers almost half of the northern part of the country, and consists of hyper-arid landscapes that receive mean annual precipitation (MAP) below 150 mm (Funk et al. 2015). The vegetation cover is sparse or absent except in depressions, wadis and oases, where water/moisture is present. Nomadic pastoralism is the main practice in this region since the climate does not support crop agriculture.
2. ***The Sahelian region*** is a semi-arid belt that receives 150-600 mm MAP. The belt dominates the central part of Mali from the west to the east. This region is largely dominated by pastoral lands, while in some areas agro-pastoralism is practiced. The vegetation is broadly characterized by open herbaceous cover types often mixed with relatively low woody plant species. This region is a home to many small wetlands, with the biggest wetland in the inland Niger delta (the Macsina), comprising of fluvial wetlands, lakes and floodplains in central Mali.
3. ***The Sudanian region*** forms the southernmost part of Mali, falling immediately south of the Sahel towards Guinea and Côte d'Ivoire. This region receives more precipitation than the Saharan and Sahelian regions, with MAP ranging between 600 and 1 500 mm (CILSS 2016), benefitting from a slightly longer wet season (May to October). Therefore, vegetation is denser, ranging from open/wooded savannas to open woodlands towards the south-western region. This region is dominated by agricultural lands (CILSS 2016; Samasse et al. 2020).

Photo credit: EAP Photo Collection/ World Bank

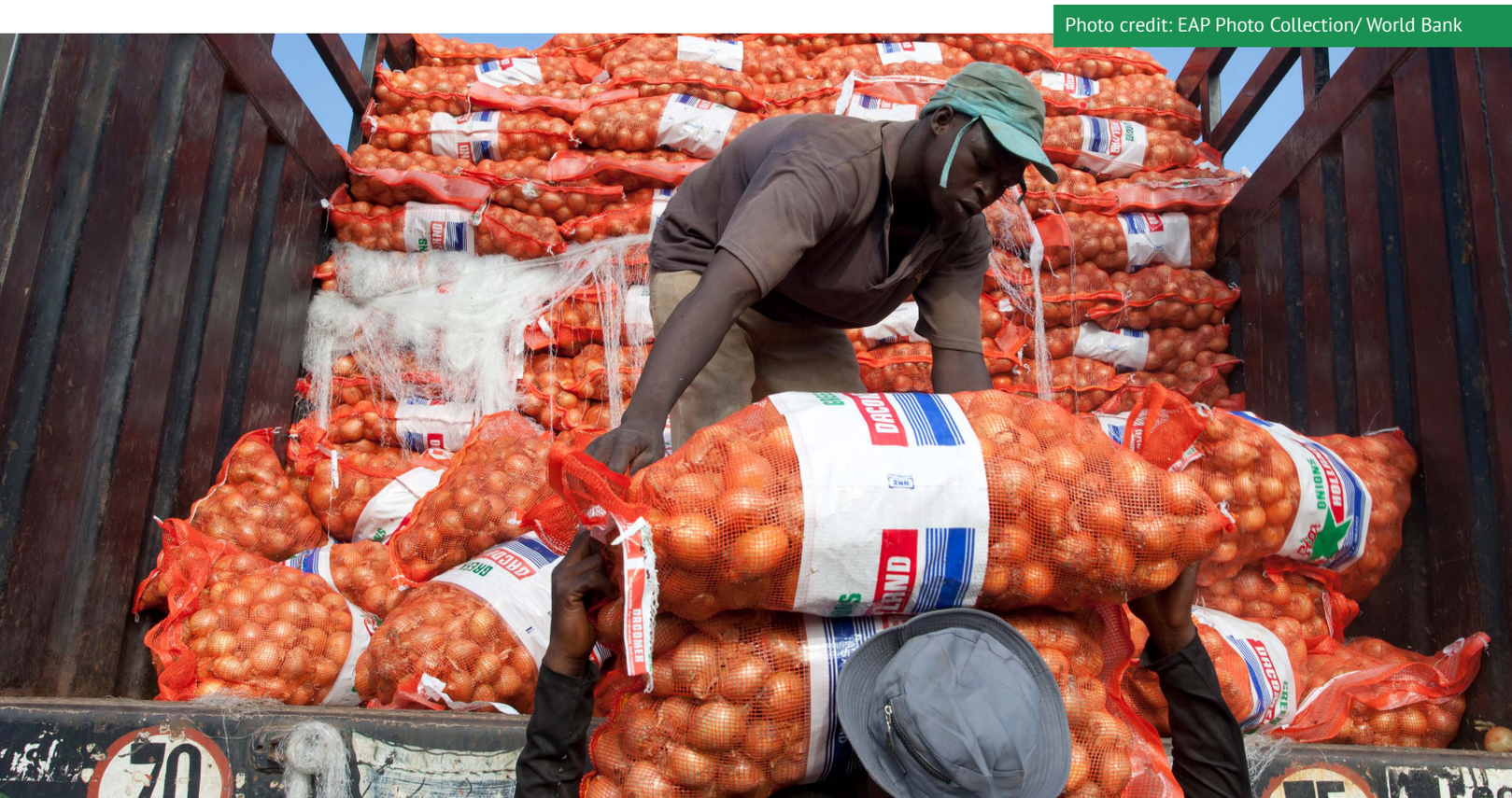
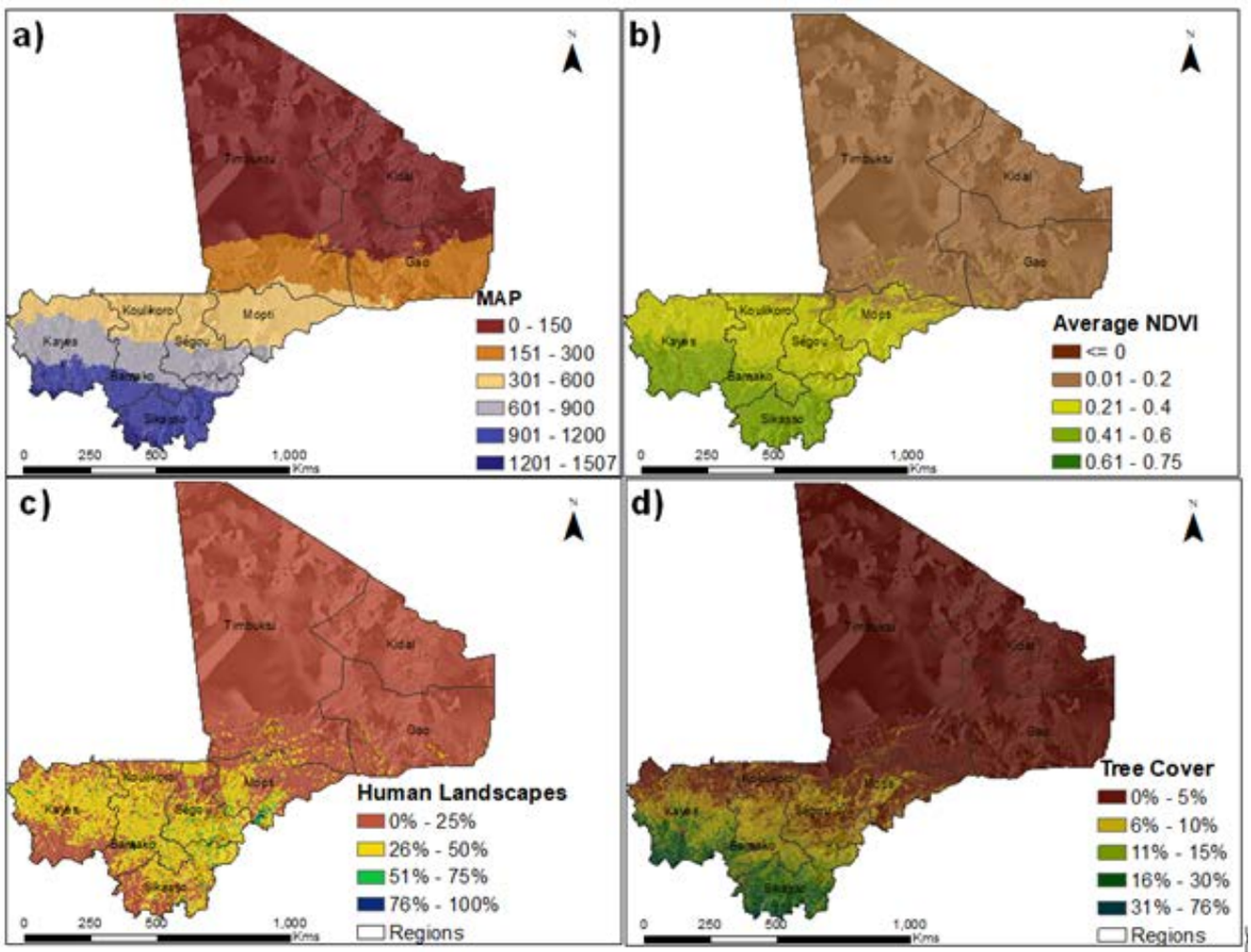


FIGURE 3.1 MEAN ANNUAL PRECIPITATION (MAP) (A), LAND COVER CLASSES FROM THE COPERNICUS GLOBAL LAND SERVICE FRACTIONAL COVERS (B), PERCENTAGE FRACTIONAL COVER FOR BUILT-UP AND CROPLAND, TOGETHER REFERRED AS HUMAN LANDSCAPES (C) AND FRACTIONAL PERCENTAGE WOODY COVER (D)



Source: Author's own illustration.

Fractional covers are derived from the Copernicus Global Land Service Fractional Covers, i.e. percentage of ground cover for the four main classes used in the analysis, centred around 2019.

Open savannah ecosystems, typically the most favorable for IBLI design, dominate the Sahelian and northern Sudanese regions (Figure 3.1b). The vegetation is broadly characterized by open herbaceous cover types often mixed with relatively low woody plant species. The woody cover increases gradually southwards (Figure 3.1d). This region also has some important wetlands, particularly the Niger delta. The Sudanian region, where precipitation is higher, is more favourable for human settlements and crop production (Figure 3.1c) (Samasse et al. 2020).

Land cover/use change has been a major challenge in Mali leading to steppes and savanna losses over the last couple of decades (Figure 3.2). The steppes in the Sahara region have diminished mainly due to the expansion of sandy areas southwards. More recently, savannah conversion into agricultural lands have resulted in the decimation and fragmentation of pasture lands in the Sahelian and Sudanian regions (Patrice et al. 2017; Ruelland et al. 2010; Spiekermann et al. 2015). Most natural landscapes have been converted into croplands and settlement areas to cater for rising needs of the growing human population.

In Mali, the biggest changes caused by agricultural expansion and development of settlements occurred during the 2000-13 period. These changes are mostly found along the Niger river basin, its tributaries and the densely populated

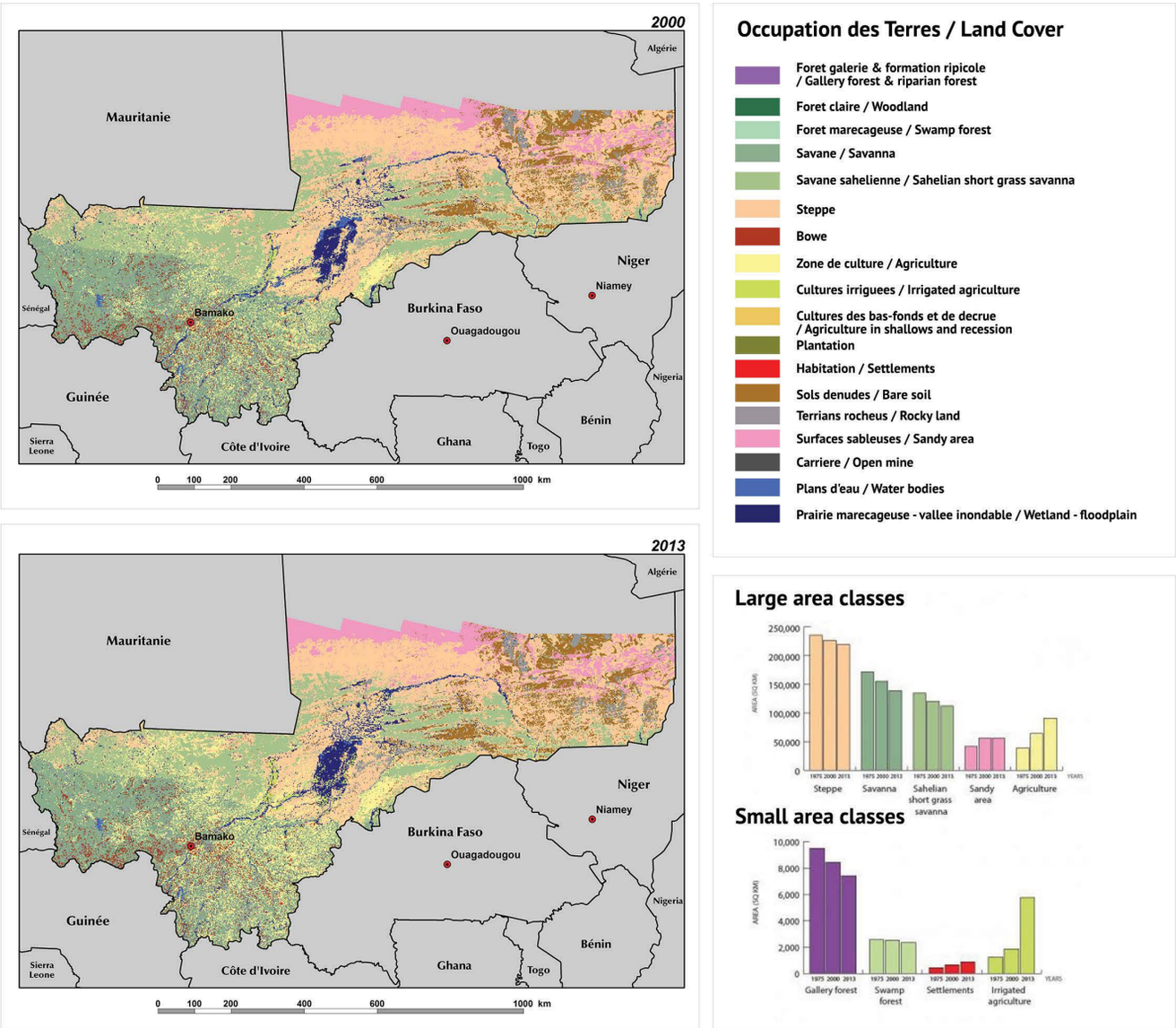
and highly cropped Seno Plain in the Sahel, running from the middle of the country towards the Burkina Faso border (CILSS 2016). However, land cover/use in the inland Niger delta has remained relatively sTable for the last four decades except for smallscale encroachment by irrigated croplands in the southern delta (CILSS 2016). Even though human activities have caused the biggest changes in land cover/use in Mali, climate variability has also had an important contribution to these changes (Ruelland et al., 2010; Spiekermann et al., 2015).

Natural and anthropogenic bush fires are recurrent phenomena in the eastern part of the country within the high herbaceous cover savanna ecosystems (Archibald et al. 2013; CILSS 2016; Giglio et al. 2013; Kahiu et al. 2018). These are important as they maintain the savannah's structure by keeping the tree layer/cover low, thus preventing forests from encroaching onto the grassland (Bond 2001; Bowman et al. 2009), allowing rejuvenation and re-sprouting of more nutritious grass for herbivores (livestock/wildlife). However, uncontrolled bush fires are also a relevant risk to pastoralism as they deplete fodder reserves, cause soil degradation and decrease rangeland productivity (Garba et al. 2012).

Recurrent droughts have also contributed to changes in vegetation characteristics and composition in Mali. The country experiences recurrent droughts caused by low, erratic and variable rainfall with widespread inter-annual negative precipitation anomalies, particularly in the northern regions of the country within the Sahara and Sahelian bioclimatic regions (CILSS 2016). Over the years, drought events coupled with overgrazing have led to the degradation of the savanna structure, vegetation cover and productivity, creating steppe-like characteristics or bare and unproductive land in extreme cases.

Photo credit: EAP Photo Collection/ World Bank

FIGURE 3.2 LAND COVER/USE CHANGES IN MALI



Source: CILSS (2016)

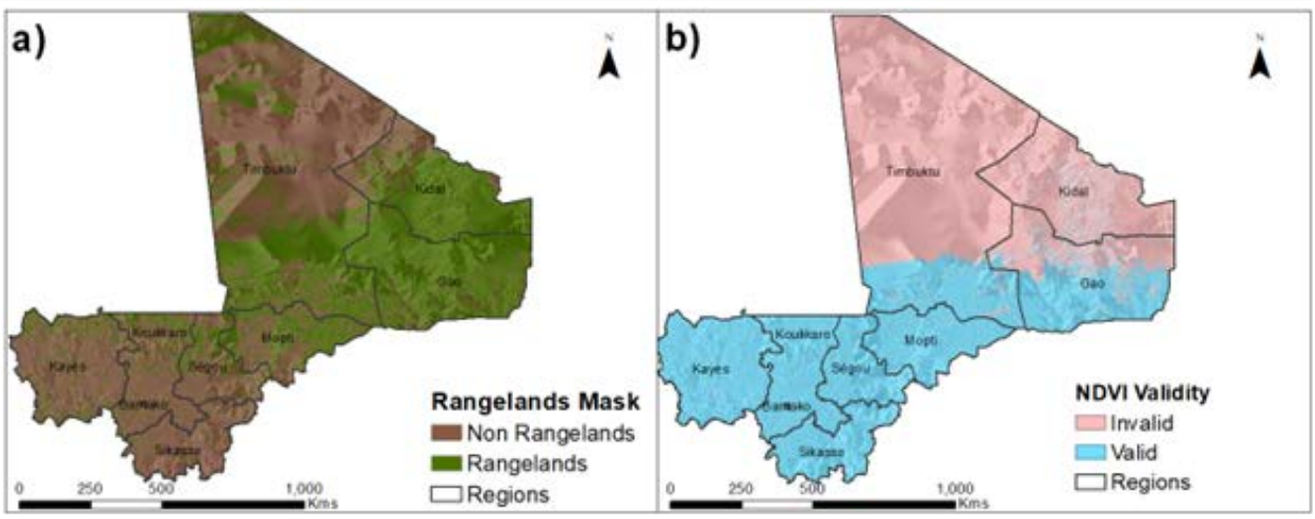
3.2 Assessment of feasible areas for IBLI product design

The feasibility assessment for IBLI design is based on three main criteria: rangeland dominance, vegetation cover (i.e. NDVI intensity) and seasonality (Appendix 3). The analysis was conducted at administrative unit level and classified Mali into four suitability classes: suitable, suitable but needing forage review, suitable but needing rangeland review and unsuitable. The suitable areas match all the criteria for IBLI design and should be seen as the most favorable for initial implementation. The suitable areas needing review can be considered suitable from a technical perspective, but it is recommended that a more detailed review with local stakeholders and experts be conducted to confirm their use and eventually tailor the product design to their specific conditions. Specifically, forage review indicates that a vast portion of an area within an administrative unit is non-productive or has very low NDVI. Thus, it would be important to verify the relevance of the areas as wet season pastures. Instead, rangeland review is required when a unit is characterized by relatively high fractions of crops and/or woodlands, in addition to rangelands. Therefore, while the technical design would be possible, it is recommended that these units be reviewed with local stakeholders or experts to determine the extent to which livestock depend on the units for rangeland resources and not crop residues. This approach is necessary, otherwise using rangeland condition indicators to design the insurance product without this review would not be accurate. Units classified as unsuitable do not match the criteria for IBLI design, thus implementation of an IBDRFI product in those areas would require an alternative index design and approach.

The technical assessment for IBLI design is conducted at administrative unit level (Appendix 3), but the definition of the units for spatial aggregation of the index is a key step for the customization of the product, which should be undertaken during the preparatory phases for implementation. The aggregation at administrative unit level is a logical choice for the feasibility assessment at national level, given the limited possibility to customize the units for specific regions. However, it should be noted that the definition of units is a fundamental step for accurate customization of the IBLI design. The units need to correspond to regions that are recognized by local stakeholders as important for wet season livestock grazing and should be large enough to include wet season livestock mobility patterns.

Extensive rangelands dominate a large portion of the central, eastern and northern parts of Mali (Figure 3.3a). This is an important requirement for the implementation of the IBLI design. However, in the northern parts of the country extending into the hyper-arid Sahara Desert, vegetation growth is limited by rainfall. On the other hand, the more productive southern and south-western parts of the country are dominated by croplands and human settlements. Forests and cropland-dominated areas are considered unsuitable for IBLI coverage because NDVI would be influenced by vegetation that is not directly used by livestock (i.e. tall trees or crops). Instead, dense woody cover savannas require review with local stakeholders to ascertain their utilization as extensive grazing lands.

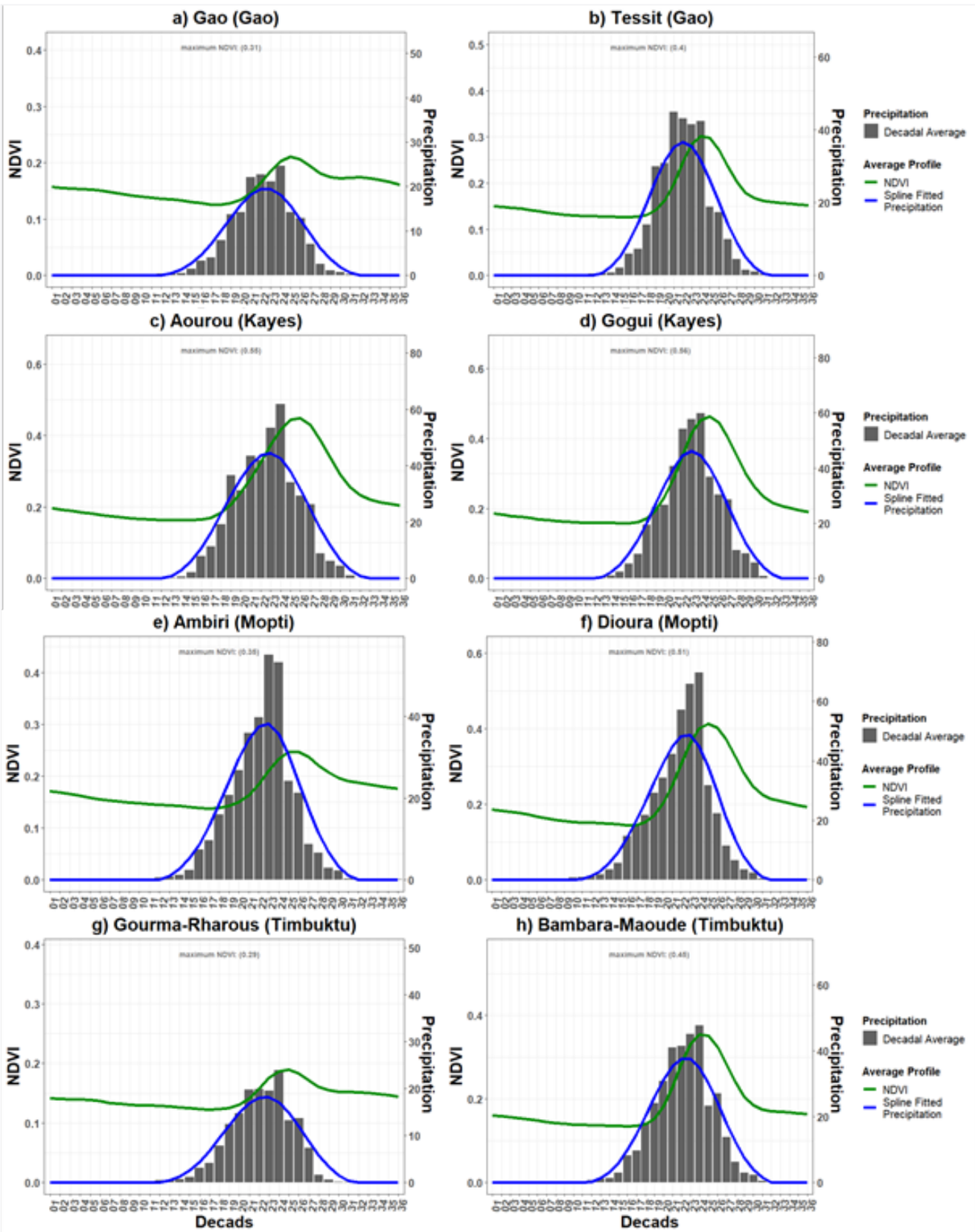
FIGURE 3.3 RANGELAND EXTENT (A) AND NDVI VALIDITY MASKS GENERATED FOR MALI (B) (APPENDIX 3)



The NDVI signal intensity is sufficient for most of the rangeland-dominated ecosystems in central Mali but too weak in large areas in the north (Figure 3.3b). The average NDVI across the country shows sufficiently high NDVI intensity for product design. However, in large parts of Timbuktu and Kidal regions, the NDVI intensity is too low as the vegetation cover is extremely limited. When the signal is very low, NDVI might not be a reliable indicator of forage deficit.

The rainfall and vegetation growth patterns in the rangeland-dominated regions of Mali show a well-defined unimodal seasonality, allowing for a clear definition of one distinct insurance coverage period designed to protect against failure of the normal wet season rainfall and corresponding loss of forage and grazing resources. The pasture and rangeland vegetation growing season has a 1-month lag time with respect to onset of precipitation and runs from June/July up to October/November, showing clear and geographically consistent patterns (Figure 3.4). This allows the definition of forage availability risk period (June to November) within the pastoral areas in Mali. The NDVI decadal averages reflect the vegetation growth over the season, which is quite consistent within the Malian rangeland areas. This is despite the variability in the intensity of the signal, which increases from north to south, in line with the precipitation patterns.

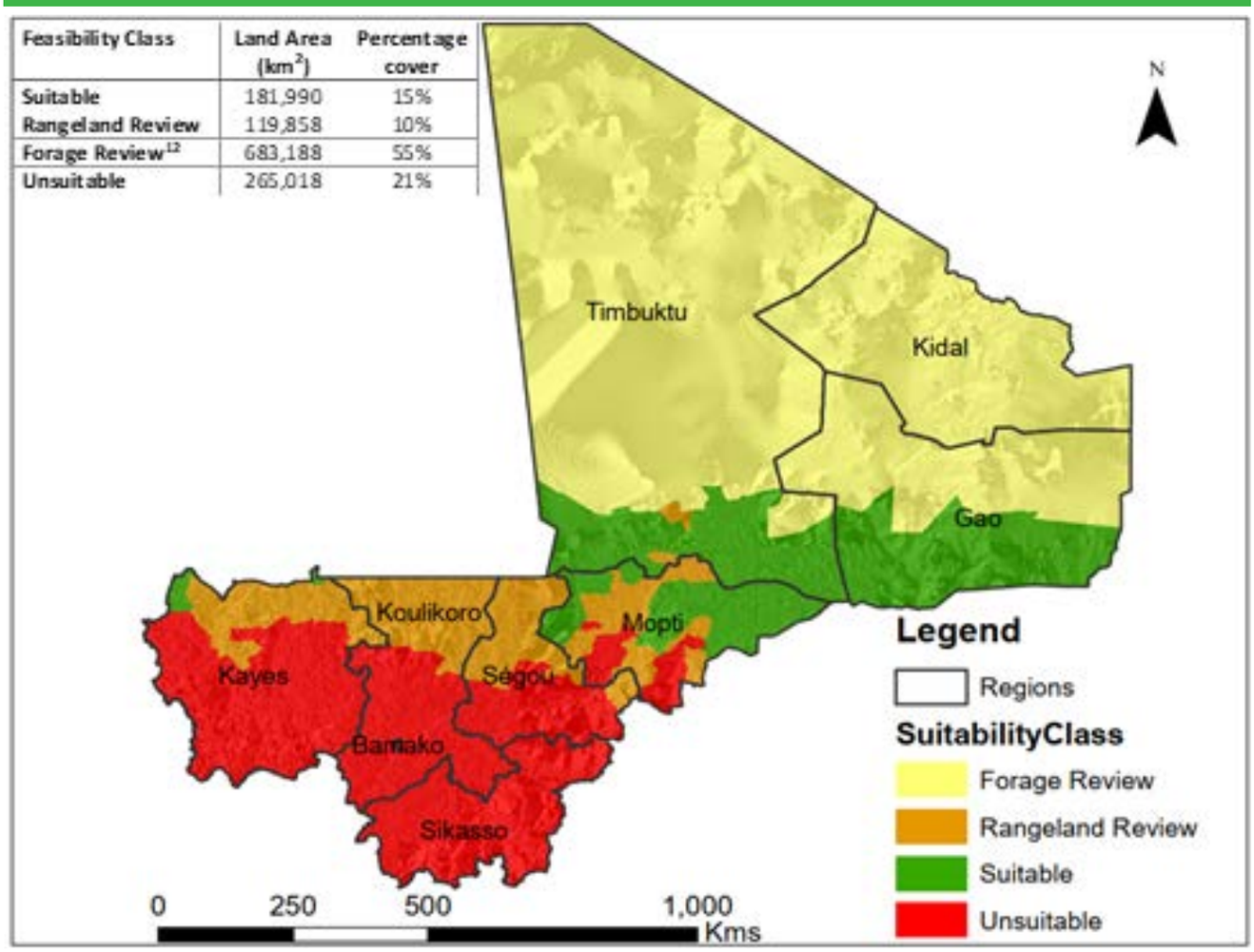
FIGURE 3.4 ANNUAL AVERAGE VEGETATION AND PRECIPITATION CLIMATOLOGY FOR SELECT ADMINISTRATIVE UNITS WITHIN PASTORAL AREAS IN MALI



The final suitability classification of Mali's administrative units indicates that 15% of the country is fully suitable (green), 10% is suitable but needs rangeland review (orange) and 55% is suitable but needs forage review (yellow)[14] and 21% is unsuitable for IBLI product design (Figure 3.5). The central part of the country, including portions of Gao, Mopti and Timbuktu is characterized by fully suitable units. Rangeland review units are mainly in the central west regions, including Kayes, Koulikoro, Segou and Mopti. These units meet all the technical criteria, but need to be further reviewed with local stakeholders to confirm their suitability for extensive livestock herding because the land cover in these regions is mixed and includes crops. Forage review units are located mainly in the north, including northern Timbuktu, northern Gao and Kidal. These units have limited rangeland cover (as large portions are covered by bare lands) and signal intensity, suggesting that a refinement with local experts on the geographic borders of the units for index calculation might be useful. It should be noted that forage review areas may also include vast portions of land that are unsuitable for product design because of the low signal intensity (see Footnote 26).

FIGURE 3.5 TECHNICAL FEASIBILITY OF IBLI PRODUCTS IN MALI

Feasibility Class	Land Area (km^2)	Percentage cover
Suitable	181,990	15%
Rangeland Review	119,858	10%
Forage Review[12]	683,188	55%
Unsuitable	265,018	21%



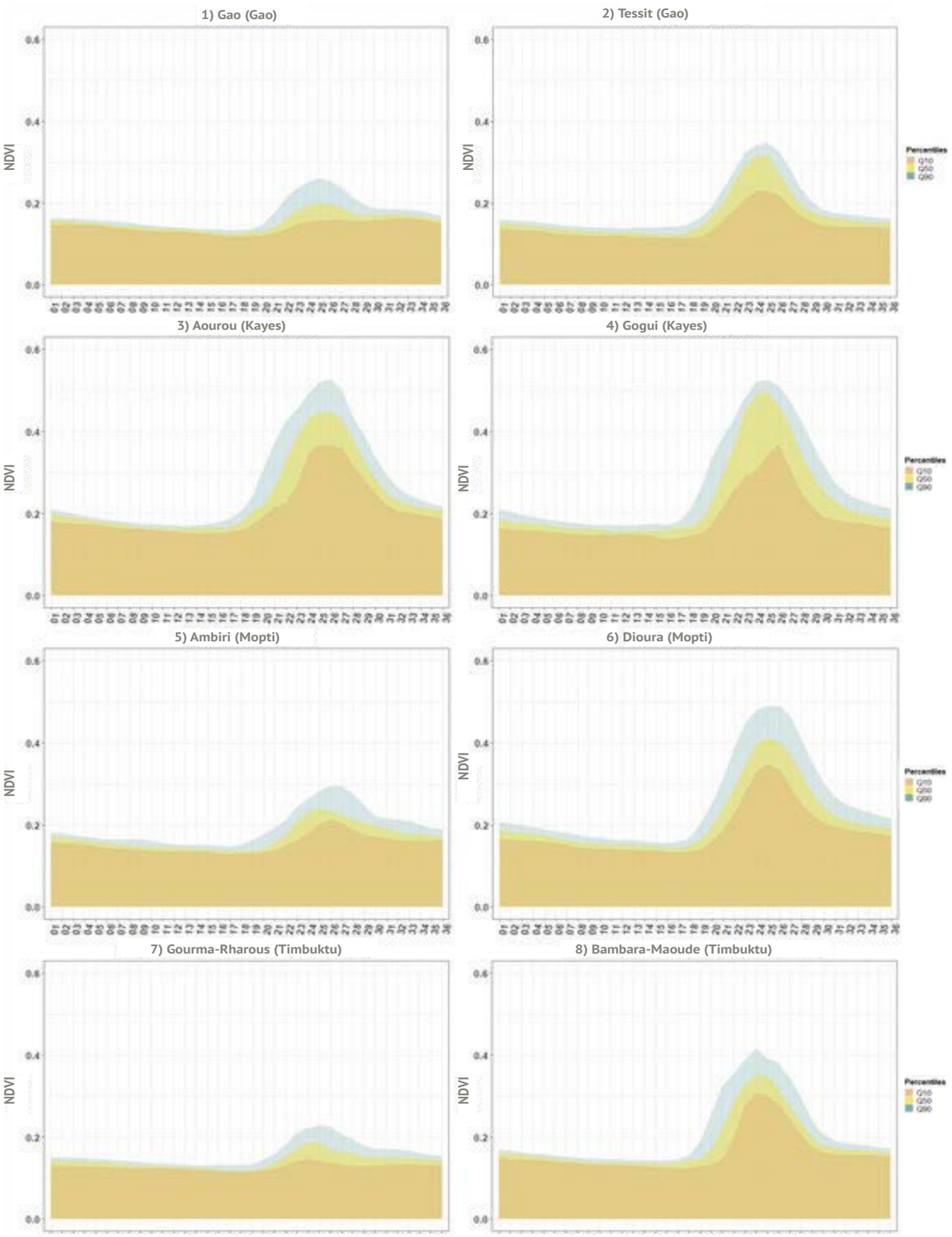
14. The 55% can be misleading as it is the result of unit-level aggregation of the index. While an entire unit can fall withing the forage review class, this does not mean that the whole area within that unit is feasible. In reality, a large portion of the land falling in this class is unsuitable because of low signal intensity.

3.3 Characterization of the feasible units

While seasonality remains rather similar across the units that are suitable for IBLI design, there are substantial differences in intensity and inter-annual variability of the NDVI. This largely matches the rainfall and vegetation production patterns. Figure 3.6 illustrates examples of seasonal vegetation patterns across Timbuktu (central north), Gao (central eastern), Mopti (central) and Kayes (central west) regions. For each region, examples of low and high rangeland production areas are shown. In the central, eastern and northern areas, such as Gao, Ambiri and Gourma Rharous, the NDVI is very low while during droughts, vegetation production is practically absent. Droughts are associated with both a reduction of the peak production and a shorter growing season. Moving southwards in the same regions (i.e. Tessit, Dioura and Bambara Maoudé), the vegetation production significantly increases in response to increase in precipitation. In the western region of Kayes, vegetation production is generally higher in accordance with the general precipitation patterns (Figure 3.1a).

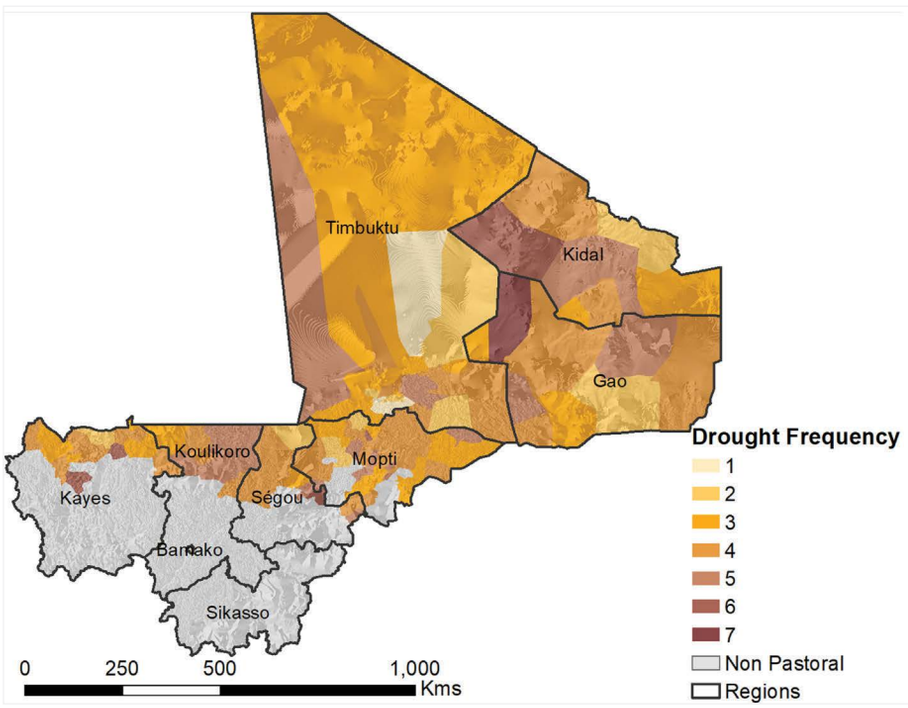
Photo credit: EAP Photo Collection/ World Bank

FIGURE 3.6 VARIABILITY IN NDVI ACROSS THE PASTORAL AREAS IN MALI, SHOWN USING THE 10TH, 50TH AND 90TH PERCENTILE RANGES



Over an 18-year period (2003-20), drought-induced forage deficits were observed every 5-6 years on average (Figure 3.7). The frequency of drought incidences was spatially and temporally variable across Mali, with most areas experiencing 3-4 episodes, which translates to one drought incident every 5-6 years. This analysis was conducted by applying a fixed threshold to the index values to identify the drought events (Appendix 3), therefore, it should be interpreted with caution.

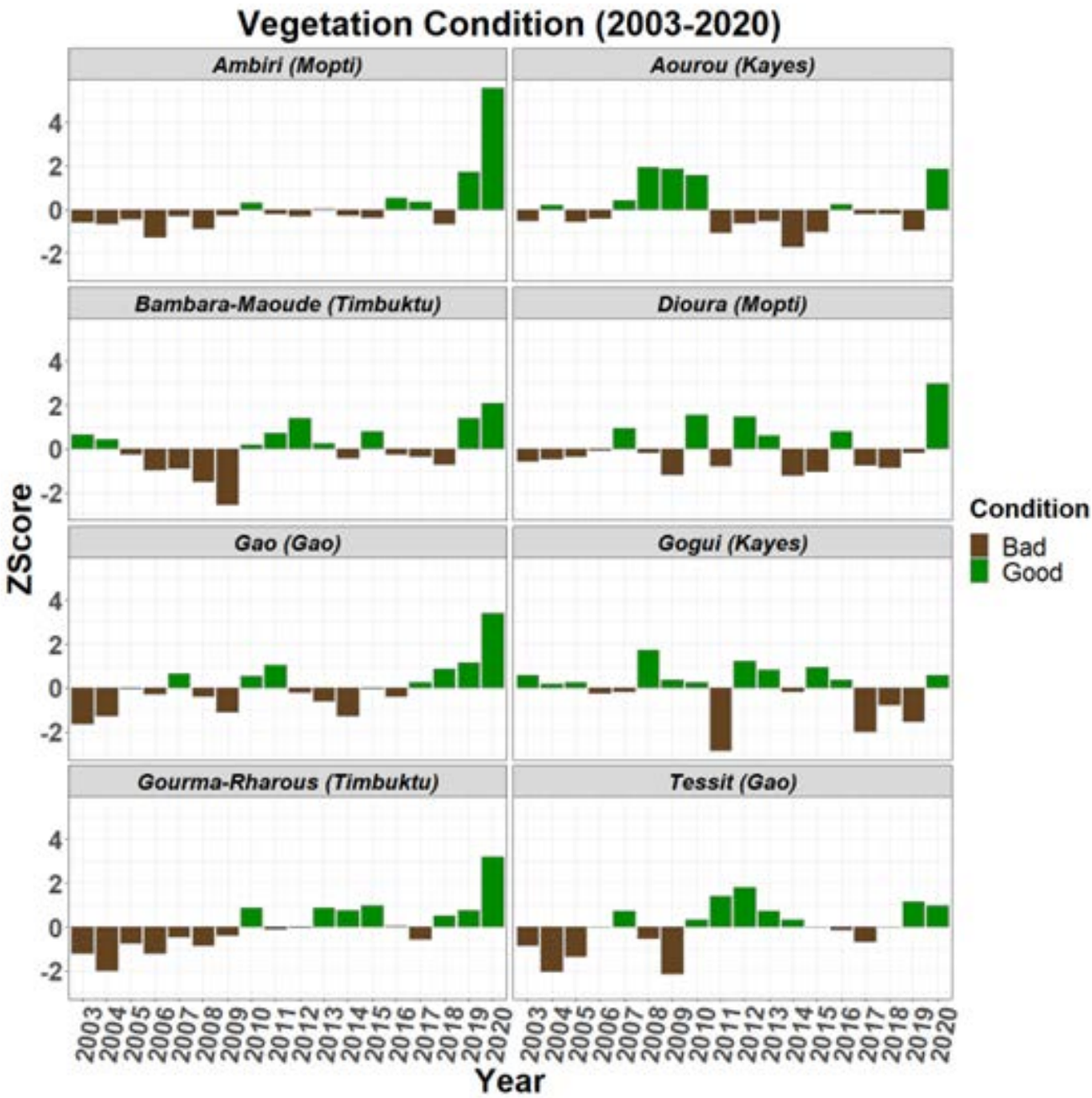
FIGURE 3.7 DROUGHT FREQUENCY IN MALI FOR THE 2003-20 PERIOD:TOTAL (A) FREQUENCY OF EPISODES BY GEOGRAPHICAL DISTRIBUTION WITHIN THE PASTORAL AREAS AND (B)NUMBER AND PERCENTAGE OF DROUGHT-AFFECTED ADMINISTRATIVE UNITS PER YEAR



Year	Affected Units (n=132)	Percentage Affected
2003	42	31.8%
2004	72	54.5%
2005	59	44.7%
2006	51	38.6%
2007	14	10.6%
2008	19	14.4%
2009	47	35.6%
2010	4	3.0%
2011	27	20.5%
2012	3	2.3%
2013	5	3.8%
2014	40	30.3%
2015	16	12.1%
2016	1	0.8%
2017	31	23.5%
2018	38	28.8%
2019	12	9.1%
2020	0	0.0%

Spatially, forage deficit conditions are not regularly distributed while the impact of drought tends to persist for more than one season (Figure 3.8). From 2003 to 2020, significant droughts causing forage deficits in more than 20% of the units were observed in 2003-06, 2009, 2014 and 2017-18 periods (Figure 3.7b).

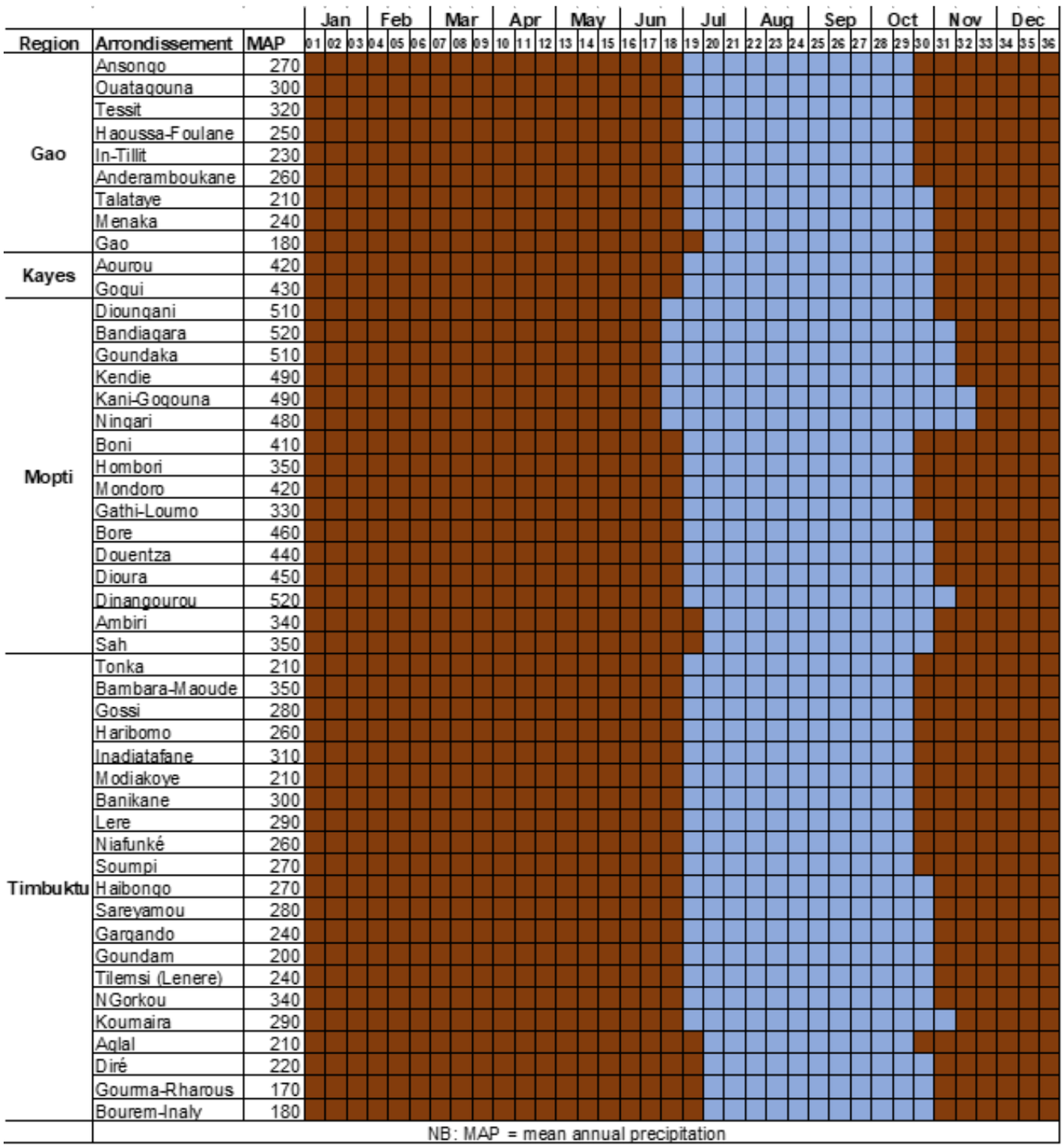
FIGURE 3.8 VEGETATION PERFORMANCE FOR SELECTED UNITS ACROSS FOUR PASTORAL REGIONS IN MALI BASED ON 18-YEAR EMODIS NDVI OBSERVATIONS (2003 TO 2020)



Green and brown bars indicate above and below average vegetation production, respectively.

Based on the seasonality of forage growth (estimated by NDVI) that spans from late June/July to October/November (Figure 3.9), a single risk period can be defined in Mali. A June to November risk period could be uniformly applied across the country to capture early start and late end of the growing seasons.

FIGURE 3.9 NDVI-BASED GROWING SEASON FOR THE SUITABLE UNITS (SHADED IN LIGHT BLUE)

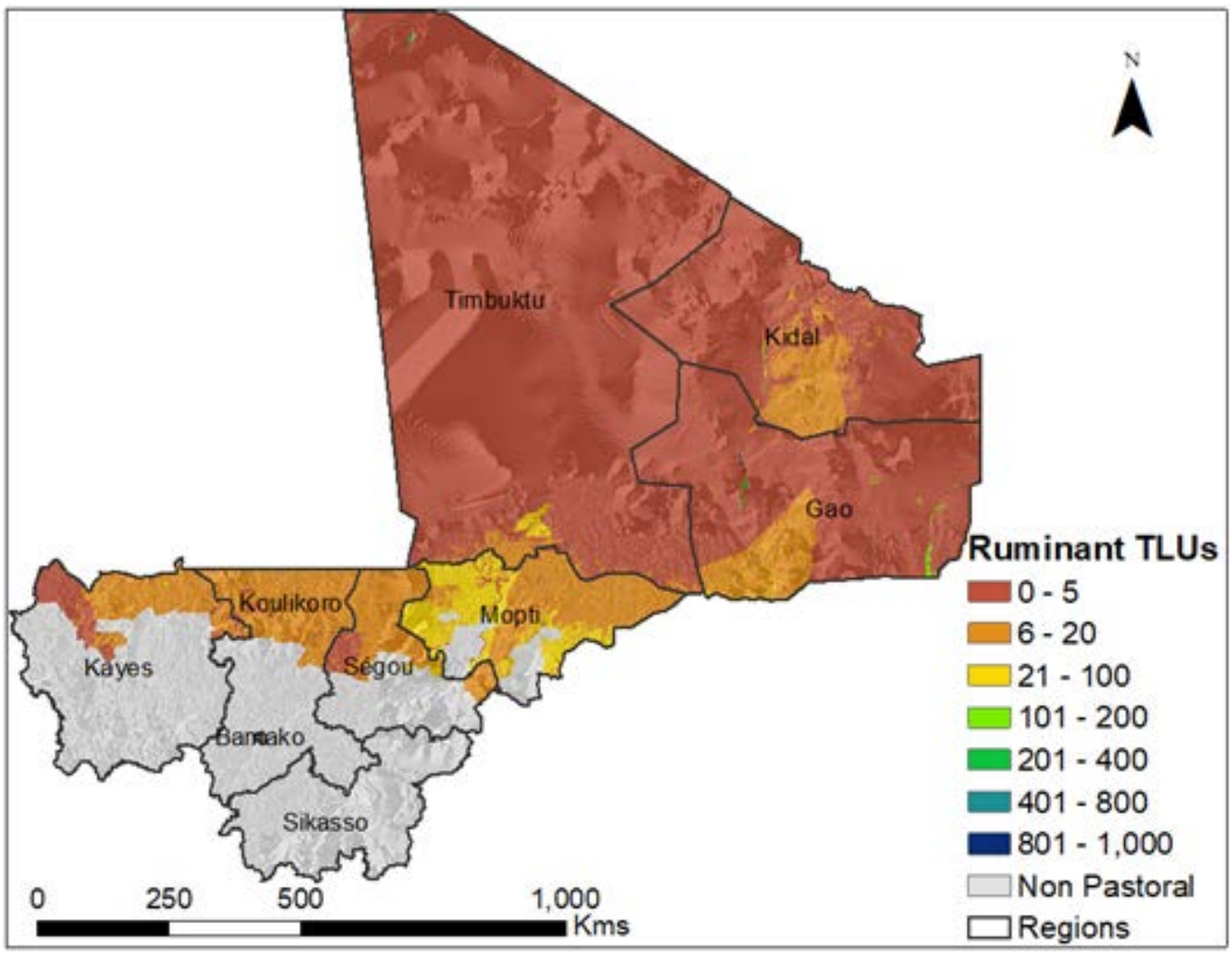


Region	Arrondissement	MAP
Gao	Ansongo	270
	Ouataqouna	300
	Tessit	320
	Haoussa-Foulane	250
	In-Tillit	230
	Anderamboukane	260
	Talataye	210
	Menaka	240
	Gao	180
Kayes	Aourou	420
	Goqui	430
Mopti	Diounqani	510
	Bandiaqara	520
	Goundaka	510
	Kendie	490
	Kani-Gogouna	490
	Ninqari	480
	Boni	410
	Hombori	350
	Mondoro	420
	Gathi-Loumo	330
	Bore	460
	Douentza	440
	Dioura	450
	Dinangourou	520
	Ambiri	340
	Sah	350
Timbuktu	Tonka	210
	Bambara-Maoude	350
	Gossi	280
	Haribomo	260
	Inadiatafane	310
	Modiakoye	210
	Banikane	300
	Lere	290
	Niafunké	260
	Soumpi	270
	Haibonqo	270
	Sareyamou	280
	Garqando	240
	Goundam	200
	Tilemsi (Lenere)	240
	NGorkou	340
	Koumaira	290
	Aqlal	210
	Diré	220
	Gourma-Rharous	170
	Bourem-Inaly	180

NB: MAP = mean annual precipitation

Pastoral regions where the IBLI design is suitable or suitable but needing review host about 62.6% of Mali's total livestock population (Figure 3.10 and Table 3.1). Within this region, about 22.6% of livestock is included within the units classified as fully suitable, while the remainder is in the units needing review. The Mopti region has the highest livestock density, while the Timbuktu region has the lowest. This could be explained by favourable forage production and water availability in Mopti (due to the presence of the Niger Delta), compared to Timbuktu, where livestock population is limited by forage/water availability.

FIGURE 3.10 LIVESTOCK (EXCLUDING POULTRY) POPULATION DENSITY DISTRIBUTION (TLU/KM^2) WITHIN PASTORAL AREAS WHERE IBLI-IBDRFI IS SUITABLE



Source: Modified from FAO (2015)'s ruminants tropical livestock units (TLUs) data (Gilbert et al. 2018)

TABLE 3.1 DISTRIBUTION OF LIVESTOCK ACROSS SUITABILITY CLASSES IN MALI[15]

Suitability Class	Percentage
Suitable	**22.6%**
Forage Review	**19.0%**
Rangeland Review	**21.0%**
Unsuitable	**37.4%**

15. Data Source is the same that of Figure 3.10

Key takeaways from Chapter 3: Technical feasibility assessment	
Rangeland dominance	Extensive rangelands dominate a large portion of the central, eastern and northern parts of Mali. However, in the northern part of the country, rangeland vegetation growth is limited by rainfall and large areas are deserts. The more productive southern and south-western parts of the country are instead dominated by croplands and human settlements.
Seasonality and vegetation growth	The rainfall and vegetation growth (i.e. NDVI) patterns in the rangeland dominated regions in Mali show well-defined seasonality, allowing for clear definition of one distinct drought risk period. The pasture and rangeland vegetation growing season runs from June/July up to October/November, showing geographically consistent patterns. The vegetation cover (i.e. NDVI intensity) is too low in the north of the country and these areas are likely to be irrelevant for forage production.
Overall feasibility	The final suitability classification of Mali's administrative units indicates that 15% of the country is suitable (green), 10% is suitable but needs rangeland review (orange) and 55% is suitable but needs forage review (yellow), while 21% is unsuitable for IBLI product design. Pastoral regions where IBLI design is suitable or suitable but needing review host about 62.6% of Mali's livestock population. The areas needing review should be considered feasible for IBDRFI products implementation, but should be carefully reviewed with local stakeholders to customize the product design
Factors requiring further analysis	Significant land cover changes were reported in the last 30 years, resulting from the conversion of rangelands into croplands. In addition, ongoing rangeland degradation has been reported in the pastoral regions. The potential impact of these factors on the index and risk profiling should be carefully evaluated during the early implementation stages.

Photo credit: EAP Photo Collection/ World Bank

4. Operational assessment

4.1 Drought risk management and financing institutional policies

4.1.1 Drought response mechanisms for the livestock sector

Given Mali's experience with shock exposures, there are several standard shock response instruments in the country. The Ministry of Security and Civil Protection is responsible for disaster risk management and emergency response. However, the disaster response programs are spread across multiple ministries that are supported and implemented by the GoM, United Nations (UN) organizations, the World Bank and NGOs (O'Brien et al. 2018). A selection of the most typical shock response mechanisms employed by the government is listed below:

- **Food aid distribution:** The Food Security Commission (CSA supports the free distribution of food rations in response to food crises. The food comes from the national food reserve, which is discussed below in Section 4.1.2. Temporal and spatial targeting for these programs is provided by the unit within the CSA that runs the early warning system based on national surveys to estimate the size of the vulnerable population in each 'commune'. The UN organizations, donors and NGOs supplement the CSA's humanitarian responses. For instance, during the 2011-12 crisis, the Central Emergency Response Fund allocated over USD 6 million to three UN agencies in Mali to support the distribution of aid by the CSA (UN Office for the Coordination of Humanitarian Affairs 2017).
- **National shock-responsive social protection**: Since 2012, several large-scale safety net programs have been launched in Mali, the main one being the 2013 World Bank Emergency Safety Nets Project, also called Jigisemejiri (Tree of Hope). The objective of the Jigisemejiri project was to provide predicTable social safety nets to 62,000 poor and food-insecure households over 5 years. In 2018, it obtained additional financing to scale up activities (WBG 2018b). Within the Jigisemejiri project, a shock-response safety net to provide emergency cash transfer payments to over 32,000 vulnerable households affected by drought was tested in 2018 on the request of the Malian government.[16] Each household received a single cash transfer payment of XOF 60,000. Geographic targeting was done according to two criteria: (i) areas affected by droughts according to the Cadre Harmonisé and (ii) existing and former intervention zones of the Jigisemejiri project. The retained regions were Kayes, Koulikoro, Mopti, Segou and Gao. Household targeting was done through the Unified Social Registry. Payments were made through banks or NGOs.
- **Donor shock-responsive social protection**. Some donors such as the WFP are also active in this space. For example, school feeding programs led by the WFP have continued to offer support in some regions but can also expand into other regions when needed.
- **Response programs specifically targeted at pastoralists.** There have also been drought responses specifically aimed at supporting pastoralists and their livelihoods, but to the authors' knowledge, those programs have been limited in scope and have not been formalized. For example, during the 2011-12 humanitarian crisis, donor funds were used to vaccinate millions of animals, drill water holes, distribute animal fodder and implement destocking programs (IRIN 2012).
- **National platform:** In May 2005, in response to the various natural disasters (droughts, floods and epidemics) in recent decades, the GoM set up a platform for managing natural disasters.[17] Thus, a national multi-risk contingency plan for disaster preparedness and responses was developed and adopted to: (i) clarify the relationships/responsibilities between the various state technical services and humanitarian partners, (ii) facilitate the coordination of actions and consistency in sectoral plans, (iii) identify and reduce the most likely risks (iv) provide a general framework for joint planning on how to respond to emergency risks, (v) integrate the process of prevention, preparedness and response to emergencies in national development plans and programs and lastly to (vi) reduce response times and loss of life. The platform was further formalized through the decree 2016-0974/P-RM of 27th December 2016.[18]

16. According to the Cadre Harmonisé, in 2018, Mali had 348,770 people who needed assistance and reinforcement (phase 1); 932,651 people in need of food and nutrition assistance, (phases 3-5) and 3,416,119 people requiring assistance with building resilience and livelihoods.

17. Government of Mali, 2005. Plan National Multi-Risques de Préparation et de Réponse aux Catastrophes. (Available from http://extwprlegs1.fao.org/docs/pdf/mli144901.pdf).

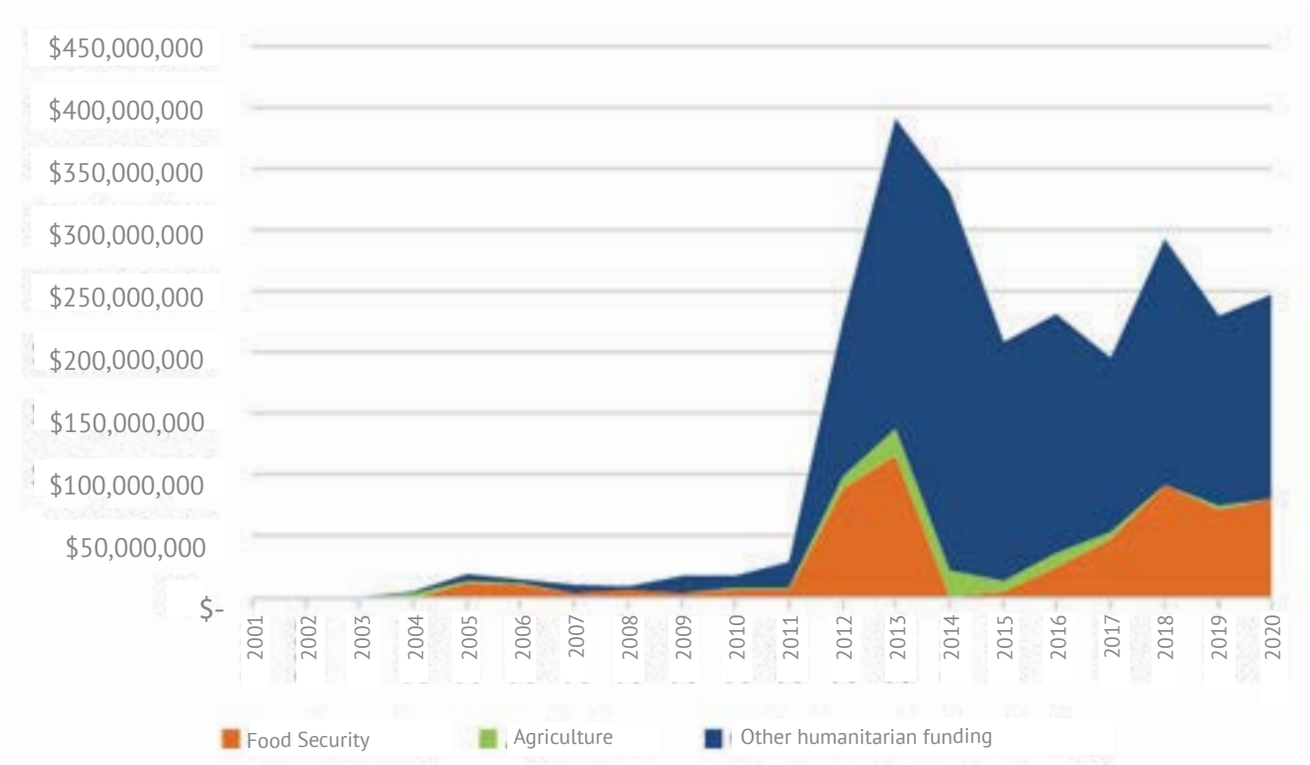
18. Government of Mali, 2016. 'Decree 2016-0974/P-RM of 27 December 2016. Journal Officiel de la République du Mali. (Available from http://extwprlegs1.fao.org/docs/pdf/Mli191674.pdf.)

In 2020, the Malian Ministry of Environment, Ministry for Sanitation and Sustainable Development and the UN Convention to Combat Desertification produced a 2021-25 National Plan for Drought (PNS-Mali 2020). The plan aims to develop an integrated drought risk management approach for the country to prepare adequate response strategies using existing knowledge on drought impacts. In the plan, there is clear reference to drought preparedness, early warning, response and impact mitigation. The plan presents a detailed overview of historical droughts and their impacts in the country and a programmatic vision towards drought risk management that includes regional and national response plans. However, drought risk financing mechanisms are not mentioned among the instruments.

4.1.2 Disaster risk financing framework

Mali relies heavily on humanitarian assistance to manage the immediate consequences of natural disasters and on donors to finance its framework for disaster risk management. Figure 4.1 shows the total reported international humanitarian support extended to Mali from 2001 to 2020, excluding funds directed towards the agriculture and food security sectors. The large spike from 2012 can be attributed to the political and security crisis, which started during that time.

FIGURE 4.1 TOTAL INTERNATIONAL HUMANITARIAN FUNDING RECEIVED IN MALI FROM 2001 TO 2020



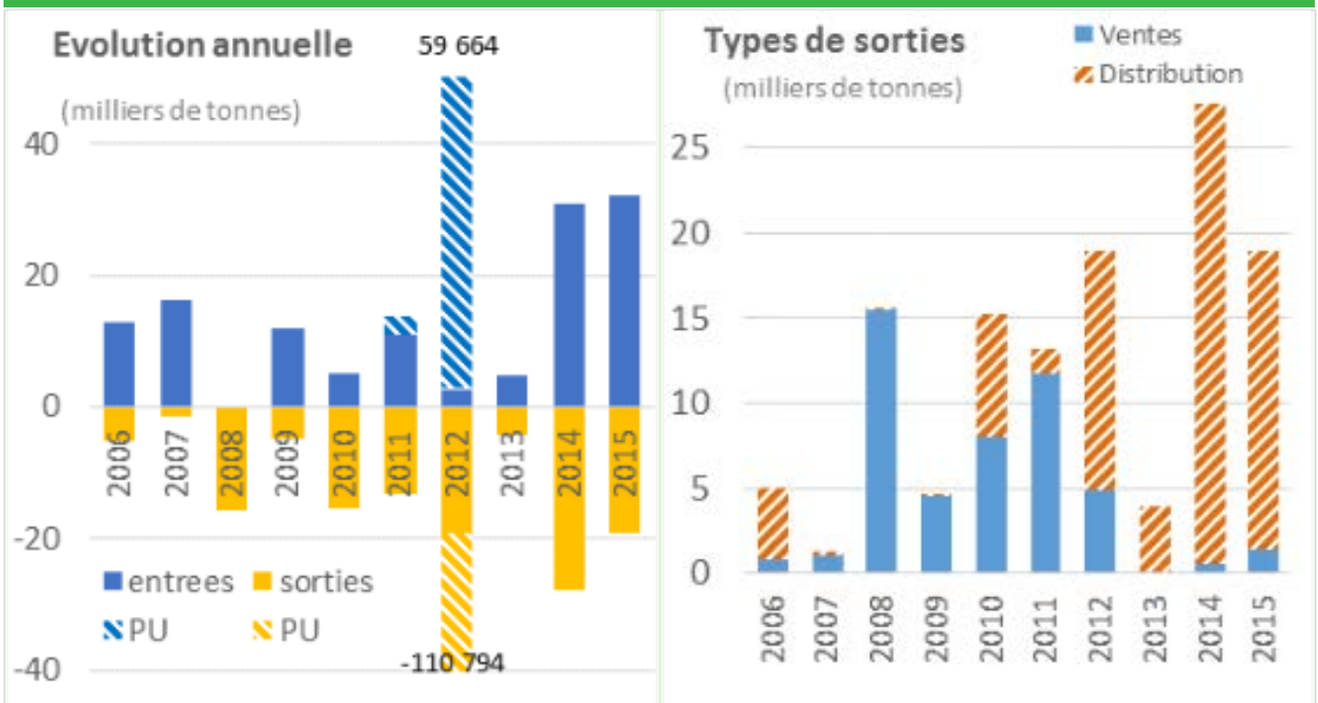
Source: U.N. OCHA financial tracking service (https://fts.unocha.org/)

The government of Mali uses a range of financing instruments to fund disaster responses:

1. **National disaster fund:** The National Agricultural Support Fund (FNAA) is a trust account created in 2010 in the state budget. A small portion of it is dedicated to disaster response. In 2015, the FNAA was granted a total budget of XOF 3 billion, out of which approximately 81, 1.5 and 17.5% was allocated to the 'Agricultural development,' 'Risks and calamities' and 'Guarantee Fund' windows (Coulibaly 2014).
2. **National food reserve:** The Stock National de Sécurité (SNS) is housed within the Office des Produits Agricoles du Mali/Malian Office for Agricultural Products (OPAM) and managed jointly with international partners. It is funded through yearly budget allocations from the state and its partners. The SNS offers a total storage capacity of 136,700 tonnes. The SNS's ideal capacity is set by its management code at 35,000 tonnes of cereals (mostly millet and sorghum). Figure 4.2 illustrates the annual overall evolution of the SNS stock and what proportions of the exiting stock were used for market sales and free distribution. On average, the SNS was used at 82% of the optimal

level from 2006 to 2015. Before 2012, annual purchases and distributions/sales averaged around 15,000 tonnes. In 2006 and 2010, free food distribution spikes can be observed in response to the respective droughts that occurred in 2005 and 2009 . At the beginning of the political and security crisis in 2012, increases in purchases and food distribution can be observed. In 2013, these dropped to a minimum as there were no resources for purchases and food stocks had been depleted the year before. In 2014 and 2015, purchases were used to restock the SNS and to provide free food distributions (FAO 2017a).

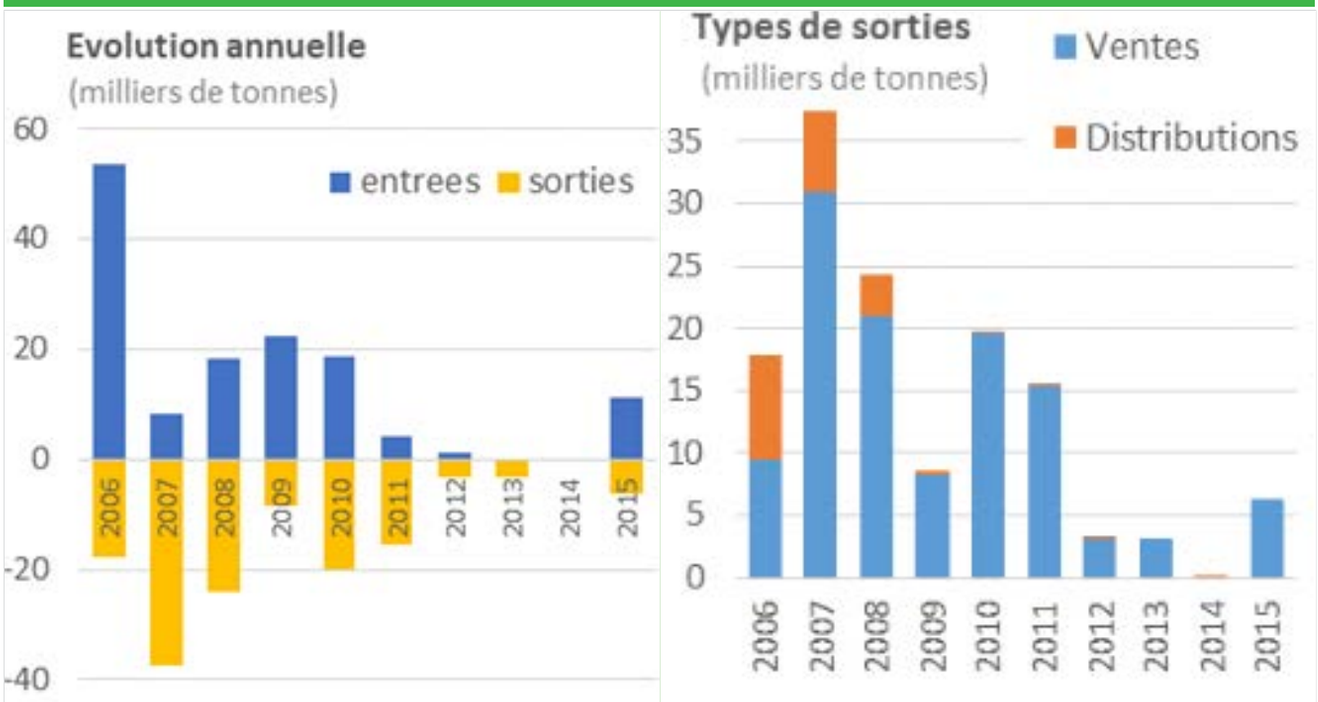
FIGURE 4.2 EVOLUTION OF FOOD STOCKS KEPT AT THE STOCK NATIONALE DE SÉCURITÉ IN MALI



Source: FAO 2017a

In addition to the SNS, the Malian government set up and financed the Stock d'Intervention (SI) in 2006, managed solely by OPAM. The government's goal was to mitigate the slow SNS mobilization procedures and reduce dependency on international partners. While the SNS mostly has millet and sorghum, the SI mostly stocks rice (although it did acquire millet and sorghum in 2006, 2010 and 2012) and has optimal stock of 25,500 tonnes. However, the storage capacity made available by OPAM is 30,000 tonnes to guarantee flexibility in operations. Figure 4.3 illustrates the annual overall evolution of the SI stock and what proportions of the exiting stock were used for market sales and free distribution. On average, the SI was used at 87% of the optimal level over the recorded period. The graph shows that unlike the SNS, SI stocks are mainly used for market sales and not for free distributions. This could be because the government has mainly tried to use stocks for market price stabilization rather than food security purposes (FAO 2017a).

FIGURE 4.3 EVOLUTION OF FOOD STOCKS KEPT AT THE STOCK D'INTERVENTION IN MALI



Source: (FAO 2017a)

4.2 Insurance market and regulations overview

Mali is a member of the CIMA, which is a confederation of 14 other countries in west Africa. The objectives of CIMA are (i) to strengthen, consolidate and ensure close cooperation of the insurance sector, (ii) to encourage the development of national insurance markets to increase retention at national and regional levels, (iii) to contribute to the creation of an enabling environment for investing in insurance and reinsurance services and (iv) the harmonization and convergence of legal and regulatory frameworks in all member countries. In addition, CIMA also carries out capacity development for the insurance industry through a standardized set of tools and module-based approaches in local languages in member countries (The World Bank 2015; AXCO 2020).

In 2019, the CIMA introduced a framework for Sharia-compliant insurance, outlining licensing requirements for insurers and general insurers wishing to introduce takaful products. This includes guidelines on administrative, accounting and investment rules and internal controls for those who wish to engage in takaful business (ibid).

At the national level, the insurance supervision and regulation are carried out by the Commission Régionale de Contrôle des Assurances in Mali's ministry of finance (The World Bank 2015)**.** The Fédération des Associations des Banques et Établissements Financiers de l'Union Économique et Monétaire Ouest-Africaine, in collaboration with the Cellule de Contrôle et de Surveillance des Systèmes Financiers Décentralisés-Mali,[19] is responsible for regulating all national associations of banks and financial institutions.

Mali has low non-life insurance penetration (0.34% of the national GDP), which is significantly lower than many other economies in the CIMA. This has been attributed to the lack of a culture of insurance purchase, little understanding of the benefits, high levels of poverty and the insecurity situation in the country (AXCO 2020).

There are five major insurance groups that dominate the insurance market in the country: The National Insurance and Reinsurance Fund, Allianz, Sunu, Nouvelle Societe Interafricaine d'Assurance (NSIA) and the Atlantic Business International Group. The National Insurance and Reinsurance Fund acts as both a local insurer and reinsurer. It was initially created as a public body, but was privatized in 1998.

19. Control and Monitoring Unit for Decentralized Financial Systems

The insurance sector has an industry organization called the Comite des Compagnies d'Assurances du Mali/Committee of Insurance Companies of Mali. The objective of this committee is to lobby the government on the behalf of the industry and to create insurance awareness through advertising campaigns to the general population. The insurance companies operating in the country are also members of the Federation des Societes d'Assurances de Droit National Africaines, established in 1976 and headquartered in Dakar, Senegal. Its objective is to promote insurance and reinsurance services in Africa and encourage cooperation among the its members (AXCO 2020).

Several innovative technological initiatives have been launched in the country by private insurers, including mobile phone-based payment systems. One such initiative is 'Sini Tonon', a life insurance product offered by NSIA Assurances au Mali in partnership with Orange, a telecommunication provider in Mali. Based on a mobile wallet, it allows a client to make small contributions towards his/her savings, thus extending the cover to life and disability insurance. The mobile wallet option by Orange allows for collection of some of the health mutual component (mutuelles de santé) premiums for the insurance policy (The World Bank 2015). The subscription fee is about USD 6. To date, Sini Tonon has underwritten 3,000 policies. The insurance company has various distribution channels, including banks, which sell the product to their clients, e.g. independent/individual agents, networks of commercial agents and social media use. All the four offices and five agencies are in Bamako and Kayes. In 2016, Orange Mali launched two life-based micro-insurance products (savings, life, disability and maternal health) specifically targeting women, who tend to be marginalized in the insurance market in Mali (AXCO 2020).

Most of the insurance products in Mali are sold through brokers and general agents. Estimates suggest that about 40-50% of the business is generated by brokers. Progressively, banks, mobile platforms and e-commerce are being developed as distribution channels for different insurance products, given the rise in internet penetration, which was about 63.4% in 2018 (AXCO 2020).

4.3 Agricultural insurance and services

Several international development organizations have invested in supporting the introduction of agricultural insurance schemes in Mali. Inclusive Guarantee (IG) is a critical player in the agricultural insurance market in the country. It has been instrumental in designing and launching micro-insurance products for low-income households and small holder farmers. In 2009, IG designed and implemented index-based weather products for maize farmers in partnership with the African Enterprise Challenge Fund and Allianz Mali, the local subsidiary of Allianz Africa.

In 2011, IG launched an insurance plan called Assurance Récolte Sahel (Sahel crop insurance), with the objective of establishing index-based insurance products that cover drought risks. This was done in collaboration with the Global Index Insurance Facility of the World Bank Group (GIIF 2017). In Mali, the Sahel crop insurance is being underwritten by the insurer Allianz Mali, in close collaboration with Mali Meteo and SUM Africa EARS,[20] along with development organizations and NGOs, such as OXFAM, farmer associations, cooperatives and micro-finance institutions (GIIF 2017). In addition, it was further supported by reinsurers, Swiss Re, CICA Re and Africa Re. Though crop-focused, this scheme is currently operational in four countries: Mali (cotton and corn), Senegal (peanuts and corn), Burkina Faso (cotton and corn) and Benin (corn) (Atlas Magazine 2017). In 2017, IG provided maize and sesame insurance cover to more than 40,000 clients in Mali. The product is based on a satellite drought indices built using relative evapotranspiration data from meteorological satellites (GIIF 2017; USAID 2018).

NISA Insurance has in the past partnered with IG to provide agricultural insurance products that cover livestock death and provide credit. The partnership ended because of logistical challenges and high client default rates. Nevertheless, NISA Insurance remains interested in agricultural insurance and has expressed interest in getting involved in a livestock insurance product, although they acknowledge that they have limited knowledge on the livestock sector. However, they believe that there are challenges around agriculture and livestock insurance information in the pastoral areas, thus awareness creation is essential.

Since 2014, the Développement International Desjardins (DID), in collaboration with the Agriculture and Rural Financing in Mali project (FARM) is working towards enhancing food security through increased access to financial services, including insurance. The FARM aims to develop financial products adapted to the agricultural sector through (i) capacity building of four MFIs to reach 18,000 farmers that include 4,500 women, (ii) the establishment of a guarantee fund and (iii) a line of credit (crop insurance and loan guarantee) and support for the restructuring of the micro-finance system in Mali. The target regions for this project, with exclusive focus on crops, are Ségou, Koulikoro, Bamako and Sikasso.

20. Environmental Analysis and Remote Sensing- satellite and data provider

Various insurance products have been introduced by DID and the capacities of participating agricultural producers to access and use these products have been built. The crop insurance component targets rice, corn and onions and currently covers about 1,500 farmers. The underwriter of the insurance scheme is OKO crop insurance. The DID is also partnering with several organizations and government institutions such as the Financière agricole du Québec - Développement International, ministries of economy and finance, investment promotion and private sector initiatives and rural development, financial institutions, such as the Nyèsigiso and Kafo Jiginew networks of financial cooperatives, the professional association of decentralized financial systems (APSFD-Mali) and insurance companies among others (DID 2016; WFP, UN Women and USAID 2017).

The OKO crop insurance provider has been working on piloting two insurance products, (i) rice-based index insurance in the Niono district and (ii) onion-based index insurance in Baguinéda. By December 2020, it had about 4,000 clients for both products. In addition, the company has developed a product to protect corn producers from drought in the district of Diola. To date, the product is not Sharia compliant. The OKO finance company also works in collaboration with Sunu Insurance and Orange Mali, with the former doing the product design, which is based on satellite and weather information. In 2020, because of the drought, OKO finance paid out USD 150,000 to 1,900 farmers in 504 villages in the Diola district.

I**n these two insurance products, Orange Mali is responsible for registering clients and making payments while Sunu insurance oversees the operational aspects of product implementation**. All the services offered are digital and accessible to all producers via both smart and feature phones. The product information is available via SMS and through a call center. The product is distributed through regional managers and field agents, who are also responsible for creating awareness and marketing of the product. The call center answers client questions. Partnerships are created with input sellers, through whom the product is distributed. Besides, OKO finance also partners with the agricultural ministry to leverage its extension services, farmer organizations and public treasury directorate. As part of its expansion plan, OKO finance is in negotiation with Baobab Micro-finance to bundle credit services with the insurance products. To date, OKO Finance has not considered offering an index-based livestock insurance product.

Mali has been a member of the ARC risk pool from 2015 to 2020. For the 2019-20 agricultural season, Mali had drought insurance cover limit of USD 15 million, with an additional USD 12.6 million covered through the ARC Replica (led by the World Food Programme). No payout has been received so far (PWC 2020). The Malian government has signalled its interest in joining the AfDB's Africa Disaster Risks Financing program.

Overall, the experience of Mali in implementing agricultural insurance is limited and the few examples available are limited to crops. To the authors' best knowledge, no traditional or index-based insurance programs targeting livestock systems have been implemented in the country. Table 4.1 provides a summary of the insurance players in Mali and their main products.

Photo credit: EAP Photo Collection/ World Bank

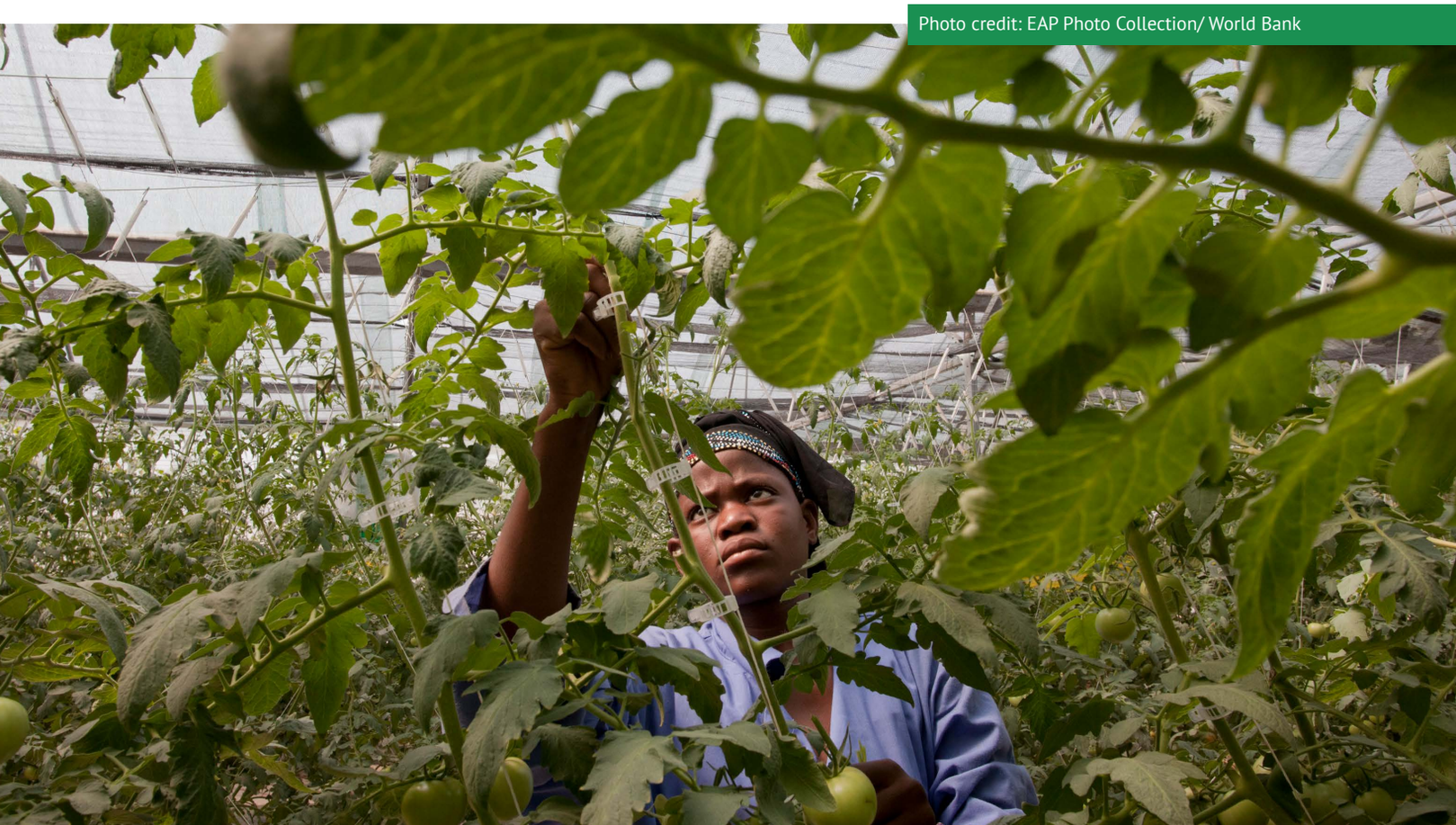


TABLE 4.1 INSURANCE PROVIDERS AND THEIR DISTRIBUTION CHANNELS IN MALI

Insurance provider	Type	Product	Partners	Distribution channels	Interest in IBDRF
NSIA Assurances	Private entity	◆ Life insurance ◆ Health mutual	◆ Orange Mali	◆ Banks ◆ Individual agents ◆ Social media ◆ Commercial agents	◆ Expressed interest although they have limited livestock sector knowledge
Inclusive Guarantee	Private entity	◆ Crop insurance	◆ Allianz Mali ◆ Meteo ◆ Sum Africa	◆ Farmers associations ◆ Cooperatives ◆ Micro-finance institutions	◆ A feasible link for IBDRF because of partnership with other insurance companies
Sonavie	Private entity	◆ Life Insurance ◆ Disability ◆ Accidents	◆ Micro-Cred	◆ Micro-finance Institutions	◆ No mention of interest and may not be feasible as they have no experience in agri-insurance
African Risk Capacity	International Public-private entity	◆ Sovereign level crop and livestock	◆ WFP	◆ Not mentioned	◆ A feasible link
DID	International development organization	◆ Crop Insurance	◆ FARM ◆ Ministry of Economy and Finance ◆ Insurance companies	◆ Farmers associations ◆ Cooperatives ◆ Local financial institutions	◆ A feasible link because of partnerships with the relevant ministries
OKO Finance	Private entity	◆ Crop insurance	◆ Orange Mali ◆ Ministry of Agriculture and Livestock	◆ Field agents ◆ Regional managers ◆ Input sellers	◆ Has not considered offering livestock insurance products

4.4 Agro-meteorological and extension services

At the sub-regional level, the Sahel Institute (INSAH) was created to assist member states of the Permanent Interstate Committee for Drought Control in the Sahel (CILSS) with the development and implementation of policies related to agricultural productivity and natural resources management, by promoting exchanges between national systems. The institute works through two programs, population and development and agro-socio-economic research. It is involved in the collection and analysis of a variety of data including in water control, adaptation and mitigation of climate change impacts and facilitation of access to markets.

The Institute of Rural Economy is the main national agricultural research institution in Mali whose mandate is to implement the national agricultural research policy to ensure sustainable agricultural productivity. The institute is involved in various activities including integrated and decentralized rural development, training, agricultural credit, gender and development, natural reSource management, rural business development, soil, water and plant analysis, food analysis and food technology.

The National Meteorological Service (NMS) is the main Source of information and expertise on weather and climate conditions as well as being the custodian of historical data in the Sahel region. The NMS of Mali produces 10-day agro-meteorological bulletins on crop condition, crop pest/diseases, pasture conditions, water Sources, animal movement and health, forestry, fishing and agricultural markets. The NMS is also part of the Multidisciplinary Working Group of Meteorological Assistance/Groupe de Travail Pluridisciplinaire d'assistance Météorologique (GTPA) of Mali. This group currently includes representatives from several government agricultural service agencies in west Africa. The GTPA acts as an intermediary institution between the NMS and the community by 'translating' complex climatic data into easy-to-understand advice for the farmers (World Meteorological Service undated).

The Direction Nationale de la Météorologie or the Meteo Mali, as it is commonly called, is responsible for the collection, archiving and analysis of basic agro-meteorological data. Meteo Mali has been conducting seasonal forecasts since 1998, however, from 2007, it has been providing daily and weekly forecasts. The forecasts are at temporal and spatial resolutions for the seasonal and daily/weekly forecasts, respectively. The spatial resolutions range from the sub-regional scale of the daily forecast, where a region is one of nine first-level administrative boundaries below the national category, to the five climatological zones for the seasonal forecasts (Carr et al. 2014).

Rainfall data is recorded by Local Meteorological Support Groups/Groupes Locaux d'Assistance Meteorologique and volunteer farmers and transmitted to Meteo Mali at the end of each 10-day period during the months of May to October through the radio or telephone. The involvement of volunteer farmers arose from different types of capacity building and awareness raising activities conducted by Meteo Mali and the GTPA. Some of the training included rainfall recording and raising awareness for the media and decision-makers at different levels (Carr et al. 2014; Carr et al. 2017). However, gaps in meteorological observation networks still persist, causing bottlenecks in providing actionable climate information services nationally. The lack of maintenance of existing weather stations, their concentration in towns and on highways, cost of processing and analysing weather station records and NMS capacity constraints, have made the prospects for scaling up these services challenging.

The Climate Change Agriculture and Food Security (CCAFS), , International Research Institute for Climate and Society (IRI) and other partners are working on the Enhancing National Climate Services (ENACTS) initiative. This initiative supports the NMS and AGRHYMET in west Africa to overcome data gaps and provide high quality climate information (CCAFS 2017). The ENACTS initiative partnered with the Joint Agro-meteorological Services Incubator (JAMSI) to build the capacity of Meteo Mali during the implementation of the Participatory Integrated Climate Services for Agriculture approach developed by the University of Reading. The climate data and other products generated through ENACTS can be accessed via Meteo Mali's 'datathèque' (CCAFS 2017).

In addition, the International Crops Research Institute for the Semi-arid Tropics (ICRISAT) Mali launched the JAMSI to build the capacity of Meteo Mali and other intermediaries to interpret, communicate and use climate services for agricultural decision-making(Hansen et al. 2019). Specifically, the objectives of the incubator are to (i) improve Meteo Mali's historical rainfall and temperature data through the development of gridded data sets created by combining quality-controlled station data with satellite retrievals and other proxies, (ii) improve seasonal prediction as well as understanding of current trends related to sub-seasonal rainfall distribution and (iii) build the capacity of Meteo Mali to provide high quality climate services and information to both the public and private sectors (ICRISAT 2016).

The AGHRYMET centre based in Niger but operating regionally, also has significant capacity in managing remote sensing datasets and hosts the National Aeronautics and Space Administration—Storm Event Imagery hub for west Africa. The AGRHYMET is part of the CILSS and is mandated to provide early warning information on a regular basis to support governments in managing droughts. It provides regular food security bulletins following the Integrated Food Security Phase Classification approach.

The NGO, Action Contre la Faim (ACF) has established a pastoral surveillance system in the region combining satellite data to monitor pasture biomass and surface water resources with ground surveys. The information is integrated to generate early warning and food security bulletins. This could be another interesting dataset and network to facilitate the design and basis risk assessment of insurance solutions. It is, however, unclear if ground data have been collected in Mali to calibrate and validate remote sensing-based models.

While there are several actors at national and regional levels with capacity to handle agro-meteorological and remote-sensing data, their experience in using these services for insurance purposes is very limited. A summary of agro-meteorological services provided by the different public, private and research institutions working in Mali is provided in Table 4.2.

TABLE 4.2 MAIN ACTORS IN AGRO-METEOROLOGICAL AND AGRICULTURAL EXTENSION SERVICES IN MALI

Agromet institution	Type of service	Activities	Partners
INSAH	◆ Water control ◆ Market data	◆ Population development and ◆ Socio-economic research	◆ Regional countries in the Sahel
NMS	◆ Crop conditions ◆ Pests and disease ◆ Pasture availability ◆ Water Sources	◆ Forecasts ◆ Extension services	◆ Groupe de Travail Pluridisciplinaire d'assistance Météorologique
Meteo Mali	◆ Rainfall ◆ Temperature ◆ Water Sources ◆ Pasture availability	◆ Forecasts	◆ Government ministries ◆ Financial institutions ◆ Farmers association
CCAFS	◆ Rainfall ◆ Soil moisture ◆ Temperature	◆ Capacity development of national institutions	◆ IRI ◆ NMS
ICRISAT	◆ Rainfall and ◆ Temperature	◆ Capacity development of national institutions	◆ Meteo Mali
ACF	◆ Pasture ◆ Biomass ◆ Surface water	◆ Pastoral surveillance system	◆ NMS ◆ Meteo Mali ◆ Private companies

4.5 Digital financial and telecommunication services

A joint USAID and World Bank study showed that 20% of Malians aged 15 and above had some sort of account with a financial institution (13%) or in the form of a mobile money account (12%) (USAID 2018). Despite this financial market penetration, access to credit remains a challenge for farmers as they are often vulnerable to market volatility and consequent fluctuations in the prices of agricultural inputs and outputs. Moreover, only one of Mali's main banks provides financial services related to agricultural development. This section provides an overview of the telecommunication and banking sector in Mali. It also includes some micro-finance initiatives, which may or may not be linked directly with the agriculture sector.

4.5.1. Telecommunication services

The mobile phone penetration in Mali in 2016 was over 60% (about 11 million people) but the use of mobile money is still mainly limited to urban areas, with a 30% penetration in the rural areas (GSMA 2017). The telecommunication sector in Mali is currently dominated by Orange and Malitel. Even though both operators have significant coverage in most of Mali, they have limited presence in the northern regions of Tombouctou, Gao and Kidal due to security issues.

Both operators offer money withdrawal, peer-to–peer and mobile money services, amongst others. Operational since 2003, Orange launched its mobile money service (Orange Money) in 2010, while Malitel launched MobiCash in 2014. In 2014, 58% of the Orange Money users were based in the capital city of Bamako, and yet 61% of the country's population lives in rural areas. Orange is working towards greater penetration in the rural areas (GSMA 2017).

As part of its services and agent network expansion strategy, Orange seeks to expand its mobile money services by including savings and credit products. Orange telecommunication is the dominant player in digital mobile money and has approximately 18 000 agents across the country in the urban, peri-urban and rural areas. Most of the agents have small kiosks, where they offer mobile money services and other general goods and services.

Since Mali has a significant proportion of its population living abroad, it is estimated that USD 806 million worth of remittances from around the world were received in Mali in 2016. Remittances have been made more efficient through a partnership between Ecobank, Orange Money and Banque Internationale pour le Mali. Orange Money is offering mobile money wallets for international remittance products regionally.

Malitel was established in 2000 as the first mobile phone service in the country and is a branch of Société des Telecommunications du Mali. The telecommunication company covers most of the country, with seven main branches in the rural and interior parts of the country and six branches in Bamako. Malitel has also partnered with a micro-finance institution (Nysigiso) to facilitate loan payments through MobiCash.

Malitel MobiCash's financial solution was launched in 2014, allowing a significant portion of the population to transact without bank accounts. Client registration is automatic once one becomes a Malitel client, after which he/she can subscribe to opt-in packages with limits of USD 400 - 20,000 a month. The MobiCash account allows customers to conduct their day-to-day transactions (money withdrawals and deposits, purchases of Malitel airtime, money transfers and national and international bill payments) from their mobile phones securely. As a result, the account is widely used in the rural areas. The clients include small traders, students, farmers (including pastoralists and agro-pastoralists) and craftsmen, most of whom are in rural areas.

Since the escalation of insecurity from 2012, Malitel has played an important role by collaborating with NGOs and humanitarian agencies in the central and northern rural areas to provide cash transfers to those affected. Some of these organizations are SNV, OXFAM, ECHO and DECA. However, some of the branches have experienced operational difficulties in the recent past because of terrorist attacks and conflict. It is possible that insecurity may prevent other private companies from investing in these areas.

Should a livestock insurance product be implemented, Malitel is interested in being a partner since it has distributors in the agro-pastoral and pastoral regions, who could be used as insurance agents. Malitel has branches with agents and uses individual contractors (shops) that provide all types of services, including MobiCash in the rural areas. Shops and kiosks also act as agents, where customers can subscribe to MobiCash services, purchase subscriber identity module cards and deposit and withdraw cash.

LemonWay, a French payment service provider operating in Mali since 2013, offers a personal identification number-based peer-to-peer payment platform delivered via any mobile carrier, thus enabling money transfers between Mali and European Union countries. It offers customers the ability to make domestic and international payments/transfers via SMS or smartphone applications, regardless of telephone service provider. LemonWay had approximately 1 million accounts in March 2016. The agent network includes BIM branches, shop owners and LemonWay kiosks, which only sell mobile money related products (CGAP 2017).

The digital financial services, especially mobile money services are dynamic and growing in Mali, recording the highest value of transactions and subscribers, second only to Côte d'Ivoire in the region (BCEAO 2015c). However, only 7% of the total population utilizing DFS use electronic money services to purchase agricultural insurance/products (WFP; UN Women and USAID 2017).

4.5.2 Banking and micro-finance services

The Banque Nationale de Développement Agricole (BNDA), a public-private entity was established for lending to agribusiness ventures and 55% of its loan portfolio is agriculture-related businesses. The BNDA was established in 1983 to financially support the livestock, fisheries and forestry agricultural sub-sectors. The main objective of the bank is to offer financial solutions that cover farmers' short, medium and long-term financing needs. The bank finances farmers' associations, cooperatives and small and medium enterprises through investment financing in equipment, infrastructure and working capital. It has a total of 46 branches spread across Mali.

In collaboration with partners such as the United Nations Capital Development Fund (UNCDF), BNDA finances cotton, rice, dry cereals and potato value chains. There is limited financing in the agriculture sector as it is considered a weak sector in terms of returns on investment.[21] However, the BNDA provides loans to farmers for the purchase of bulls, animal feed and to undertake animal fattening.

21. The bank official interviewed stated insecurity as one of the reasons for low investment in this sector.

There is no loan cap/ceiling for loans that BNDA can provide to individuals and groups. For example, loans up to USD 90,000 can be provided to a group of agro-pastoralists who can then elect to distribute it among themselves. During the Eid season, the bank extends loans to traders to meet the sheep demand within the country and the region. The BNDA provides micro-finance services including for crops. This service was set up in partnership with FARM. Collateral is in the form of joint surety of the members along with a private sector guarantee fund for clients wishing to start a business. As such there is no standard repayment policy, except that repayment is guided by the activities undertaken, e.g. for animal fattening, the client usually has about six months to repay the full amount after the loan drawdown.

The BNDA is seeking opportunities to develop products targeted at the livestock keepers and producers. However, the main challenge remains lack of collateral/guarantees, business plans and financial education among the producers. Nevertheless, BNDA is working to create an agricultural insurance product with the support of the Canadian government.

Micro-finance institutions play a significant role at the smallholder level. There were about 30 active MFIs in 2017, serving a client base of 1.1 million people, many of whom reside in remote rural areas. A World Bank study found that 53% of the loans extended by the MFIs were to smallholders farmers, who constitute a relatively small share of the credit market. The proportion of MFIs that finance smallholder farmers was quite significant (USAID 2018). There are a few dominant MFIs such as Kafo Jiginew, Nyesigiso and MicroCred that also offer DFS services such as mobile banking because most mobile network operators (MNO) seek to work as agents for the MFIs (USAID 2018).

Baobab Micro-finance, which was established in Bamako in 2011 by MicroCred SA, has 19 branches in Mali, 11 in Bamako and 8 in Sikasso, Koutiala, San, Bougouni, Kota, Mopti, Kayes and Ségou regions. Baobab works with several banks and other MFIs, including collaborations with service providers, development organizations (e.g. USAID, Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ)), OKO insurance and technical and financial partners in Mali.

Baobab focuses on financing agricultural activities in rural areas, especially the very small, small and medium size enterprises, which are poorly served by the banks. They extend credit to traders and finance actors in maize, potato, rice and onion value chains and livestock fattening activities. The products such as (i) taka, a credit facility ranging from USD 9 - 450 for very small enterprises and (ii) ALIP, a credit facility of up to USD 50,000 for small and medium enterprises, are digitally accessible.

Baobab collaborates with Orange Mali, leveraging its mobile banking services. Apart from mobile banking, other services offered include call centers and mobile banking through local branches, shops and local communities. It provides seasonal funding of USD 200-400 to farmers for crops such as maize, rice and onions.

Most of the agents of Baobab Micro-finance reside in the southern part of the country where it has eleven branches in the district of Bamako and large cities including Sikasso, Koutiala, San, Bougouni, Kita, Mopti, Kayes and Ségou. Even though Baobab Micro-finance does not cover the whole country, it does have some representatives in remote agropastoral zones. The institution has shown interest in being part of a livestock index-based insurance program in the marketing and distribution domain because of its existing platforms that can be used for marketing and awareness creation. However, they do acknowledge that given their limited knowledge of the livestock sector, they would have to build the necessary capacity.

Besides the dominant MFIs, there are organizations such as myAgro that have loan products that allow smallholder farmers to make a series of small flexible payments that are linked to a package of inputs. The myAgro MFI uses a system of scratch cards that can be purchased from local myAgro vendors and credited to the smallholder's airtime through a code via SMS. The myAgro approach is particularly useful for consumers that can operate simple phones and can top-up their airtime using scratch cards (Mattern and Ramirez 2017).

Organizations such as Mercy Corps have worked in a consortium that included PlaNet Finance, IG and Soro Yiriwaso (MFI) in agropastoral areas to increase access to financial services. The Linking Financial and Social Capital to Enhance Resilience of Agropastoral Communities program launched in 2016 was designed to provide appropriate and affordable financial products that build resilience against climate change and related shocks (USAID 2018).

At the same time, Soro Yiriwaso partnered with Save the Children in Mali to offer a loan product designed specifically for farmers, called Prêt de Campagne or 'countryside loan'. This product was targeted at women who were members of local community associations. The loans were dispersed at the beginning of the agricultural cycle with the condition that the repayment would be lumpsums immediately post-harvest (Beaman et al. 2013). A summary list of the DFS in Mali is provided in Table 4.3.

TABLE 4.3 DIGITAL AND FINANCIAL SERVICES OFFERED BY PROVIDERS IN MALI

Institution	Service provider	Service	Activities	Partners	Interest in IBDRF
Orange Mali	Telecommunications	◆ Mobile money	◆ Orange Money for cash deposits and withdrawals ◆ Payouts ◆ Premiums	◆ OKO Finance ◆ NSIA ◆ Development organizations	◆ No mention of interest but could be considered given its partners and range of services offered
Malitel	Telecommunications	◆ Mobile money ◆ Cash transfers	◆ MobiCash for cash transfers ◆ Deposits ◆ Withdrawals ◆ Loan payments ◆ Humanitarian assistance	◆ SNV ◆ OXFAM ◆ WFP ◆ Micro-finance institutions	◆ Expressed interest due to its presence in pastoral and agropastoral areas
LemonWay	Financial	◆ Remittances	◆ Domestic and international money transfers	◆ Orange Mali ◆ Malitel ◆ Community groups	◆ May not be a feasible link for IBDRFI
BNDA	Agri Bank	◆ Agribusiness financing ◆ Loans for livestock	◆ Business loans for SMEs ◆ Livestock purchases ◆ Animal feeds and fattening	◆ UNCD	◆ Is a feasible link since it is the only bank providing agriculture-related services ◆ Could be considered for bundling of services
Baobab	MFI	◆ Agribusiness loans	◆ Credit for traders ◆ Value chain development ◆ Business loans	◆ Orange Mali ◆ USAID ◆ GIZ ◆ OKO Finance	◆ Expressed interest in marketing and distribution ◆ Feasible link due to its platforms and partnerships with telecommunication companies
myAgro	MFI	◆ Agribusiness loans	◆ Loans for inputs	◆ Orange Mali ◆ Malitel	◆ May be a feasible link
Mercy Corps	Development organization	◆ Savings and ◆ Credit	◆ Financial services in agropastoral areas	◆ PlaNet Finance ◆ Inclusive Guarantee ◆ Soro Yiriwaso	◆ A feasible link due to its partnering organizations and geographical presence
Soro Yiriwaso	MFI	◆ Savings and ◆ Credit	◆ Crop loans for women	◆ Save the Children	◆ A feasible link due to its focus on women

4.6 Non-governmental organizations and pastoral association networks

In Mali, extension and advisory services are provided by both public (see Section 4.2) and private entities. The extension services are mainly supported by international development organizations at the sub-regional level, with initiatives launched to build local institutional and community capacities. Services include best practice hubs, reSource centres, demonstration plots, value chain approach in the provision of market information, agricultural entrepreneurship through reinforcement of the producer cooperatives' capacities, amongst others. One of these initiatives is the World Bank's West Africa Agricultural Productivity Program, which has the main objective of providing and disseminating improved technologies. Another is the USAID's Feed the Future program, which provides institutional assistance in the dissemination and management of improved technologies (USAID 2018).

In the pastoral areas, several challenges remain, such as the availability of quality fodder crops, production capacity of animal feeds, limited water points, animal health services, limited access to livestock markets and transportation, few extension agents and incidents of conflict and terrorist attacks. To address some of these challenges in the pastoral areas, international development organizations have implemented some initiatives such as:

- **The Sustainable Technology Adaptation for Mali's Pastoralists (STAMP) initiative, which was started by SNV in 2015 to improve the resilience of pastoralists against extreme climatic events by developing a dedicated information service to support the use and access to geosatellite-derived data.** Also known as the Garbal information service, this digital platform was launched in 2017 to provide pastoralists with information that allows them to make informed decisions regarding herd migration. Information related to (i) biomass availability and quality, (ii) surface water availability, (iii) herd concentration and (iv) market prices for livestock and staple grains along the different transhumance routes is sent to the user through a specific number provided or in response to an unstructured supplementary service data (USSD) request. At the end of the first STAMP phase (2015-18), the Garbal service had recorded 1,307 calls and 84,816 USSD requests from more than 50,000 users, mainly pastoralists, input dealers and traders. As part of the ongoing second phase, the GARBAL services are being extended to Kidal, Mopti, Timbuktu, Gao and Menaka to provide information on animal health and financial products to facilitate pastoralists' access to inputs (SNV 2019).
- **The implementation process for STAMP is a multi-institution partnership involving several stakeholders,** e.g. Orange Mali, which manages and commercially operates the call center and the USSD requests. Specifically, the call center provides information on (i) livestock prices and numbers on the markets, (ii) availability and quality of biomass and use of areas during the lean season, (iii) land occupation, (iv) availability of surface water and (v) price of cereals and animal feed, among others. To date 13 major livestock markets have been covered under the first phase, with 60 additional markets proposed to be part of the second phase. Satellite data is processed and stored by Hoefsloot Spatial Solutions, while the local NGO Tassaght, supervises the collection and distribution of the field data. This is done in collaboration with pastoralists themselves, particularly for information related to biomass quality, herd concentration and market prices. The Ministry of Livestock and Fisheries supports the field extension while validating the disseminated information. In addition, the project is supported by the Ministry of Digital Economy and Communication, which is responsible for the governance of the service.
- **IRAM has been working in Mali focusing on access to resources, health, education and markets, land rights, multi-actor consultations, adaptation to climate change, resilience and improving public policies to address water and pasture availability for the pastoralists.** However, IRAM is currently focusing on (i) studying the practices that herders and social organizations use to manage agropastoral systems, negotiate rights and build social agreements, (ii) strengthening the capacity of herder representatives to negotiate with local authorities and supporting consultative bodies, (iii) securing pastoral lands and facilitating social management of water structures to limit conflicts, (iv) constructing and rehabilitating water points and pools, facilitating negotiations and demarcating selected transhumance corridors and rest areas, (v) improving public policies on pastoral development through facilitating public dialogue at the national and sub-regional levels and (vi) designing and implementing programs, formulating strategies and regulatory texts, among others.

Regarding livestock index insurance, SNV sees itself playing a significant role in awareness creation among the agro-pastoralists and pastoralists and creating linkages with financial institutions and insurance companies. The SNV is responsible for the overall coordination of the STAMP project. In 2018, there was 15% reduction in livestock mortality, 10% improvement in livestock productivity and 10% increase in income generation for 60,000 pastoralists in the Gao and Menaka regions.

There are several projects that have been supporting the pastoral communities in Mali. Some of them are the Regional Support Project for Pastoralism in the Sahel (PRAPS Mali), Project for the Development of Animal Husbandry in Mali (PADEL-M), Project for Sustainable Development of Pastoral Farms in the Sahel (PDDEPS) and Program for the Integrated Development of Animal and Aquaculture resources in Mali (PDIRAAM). Most of these initiatives are coordinated by the Ministry of Livestock and Fisheries. The PRAPS and PADEL-M projects work more closely with the regional governments. The PRAPS project was implemented in six Sahel countries and although it is coming to an end there will be some continuity through the PADEL-M project, which is considered a sister project to PRAPS.

- **The PADEL-M, a 6-year project (2018-24) financed by the World Bank. By focusing on sedentary livestock sectors, it complements the PRAPS-Mali project, which focuses on pastoral communities.** The two projects are complementary and work synergistically on animal health and crisis prevention and management. The PADEL-M focusses on three components, including (i) strengthening of livestock services with the objective of supporting the Ministry of Livestock and Fisheries in its modernization drive to better supervise the livestock sector and provide quality services, (ii) promoting the economic organization of livestock sectors and supporting private sector investment and (iii) prevention and management of crises in livestock farming.
- **As part of improving animal health initiatives, the PRAPS-Mali and PADEL-M projects support state agents and pastoralists by organizing vaccination campaigns.** Vaccination data are collected by the National Directorate of Veterinary Services through its local branches. The PADEL-M comprises nominated government officials and executives from the private sector. Central staff coordinate project activities. At the decentralized level, state agents in the livestock sub-sector oversee the implementation.
- **The PADEL-M works with the Permanent Assembly of Chambers of Agriculture of Mali and the Agency for the Promotion of Investments under the ministry of investment to establish and formalize agricultural enterprises.** The PADEL-M also works with the Ministry of Security and Civil Protection, the CSA and SAP to provide emergency or humanitarian responses. The PADEL-M has also been promoting micro-finance to livestock breeders (including women and youth) at a 12% interest rate, where formal banking channels are not available. The project intends to set up 1,200 micro-projects targeted at women and youth using the PADEL-M financing.
- **The PDIRAAM has three priority areas: red meat and milk, poultry and aquaculture. The main project objectives are: (i) to contribute towards sustainable improvement of animal feed production and quality, (ii) creation of modern infrastructure to be made available to communities, (iii) financing livestock fattening and milk production initiatives through the Islamic Micro-finance and (iv) capacity building of actors.** In addition, the project facilitates the training of producers in animal and fodder production techniques through field schools and distribution of fodder seeds.
- **The PDDEPS Mali is part of a program financed by the Islamic Development Bank and the Malian government over 5 years.** The overall objective of the project is to contribute to the improvement of animal production to ultimately increase the incomes of target populations and reduce food insecurity in the project area, through better management of natural resources and improved access to markets.
- **The International Fund for Agricultural Development (IFAD) is currently working on a Livestock Mobility Project aimed at strengthening the resilience of pastoralists and agro-pastoralists to shocks and extreme events**. Being a multi- country project, the areas of operation are Mali, Senegal, Niger, Mauritania and Burkina Faso. The project focuses on securing and equipping livestock corridors for the trans-border movement of livestock, to enable the pastoralists in the Sahel to manage risks of climate variability, reach refuge areas during severe drought events and ensure access to markets and market-related services. To date, the project has managed to secure 2,668 km of livestock corridors, construct 52 water points, rehabilitate 53 fodder banks and provide more than 3,000 tonnes of fodder supplements along the transhumance routes (IFAD 2017).
- **As part of the USAID Feed the Future project, an initiative called Livestock for Growth (L4G) is being implemented by a local NGO called AECOM, using a value-chain approach to commercialize the livestock sector in Mali.** Working in the Mopti and Tombouctou regions, the objectives of L4G are to (i) improve animal production, (ii) make veterinary services available and production of feeds and (iii) commercialize livestock marketing, including entrepreneurship development. In addition to this initiative, the USAID is also supporting[22] PRAPS project (USAID 2018).

Besides the international development organizations, there is a considerable number of local associations, federations and organizations working in the pastoral areas. The National Federation of Inter-professional Groups of the Livestock Meat Sector in Mali (FEBEVIM), is made up of groups of livestock associations that pay a monthly fee for services provided. There are presently 272 groups, with presence in the northern regions of Kidal and Tombouctou, as well as

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in the south and east. These groups primarily include livestock producers and traders. Each region has its own office, through which operators get assistance to access animal feeds and medicines, and in dealing with the government agencies as necessary (ibid).

The RBM, is a network of pastoralist organizations in west Africa, responsible for early warning monitoring systems to prepare pastoralists, NGOs, government bodies, technical and financial bodies for emergency responses. The focus is on the state of pasture and water Sources, animal movements and diseases, trends in livestock markets, other events such as conflicts and pest attacks, etc. The Mali chapter of RBM has been involved in an advocacy campaign, supported by SNV post the 2015 lean season, to prevent feed and fodder shortage crises in the pastoral areas. The output from this campaign was the creation of a 'livestock feed commission' linked to the National Response Plan of the government of Mali (Cisse 2016).

The Syngenta Foundation for Sustainable Agriculture (SFSA) focuses on improving the livelihoods of smallholder farmers. This is done by facilitating greater access to inputs, credit, training and secure market linkages through various farming organizations, agricultural equipment operating centers and financial institutions (Syngenta Foundation Mali undated).

The WFP leads the Agriculture Women and Sustainable Development Framework (AgriFed), a flagship program implemented in collaboration with the FAO and United Nations Development Program. The program operates in six regions of Mali, including in the pastoral regions of Mopti and Gao. The five-year project, which was started in 2017, is responsible for economic capacity-building of the 40,000 women farmers and youth in the targeted regions.

The WFP has been involved in the development of rangelands, fodder production, building wells in the pastoral areas, development of water ponds, construction of vaccination parks and animal fattening activities. The objective of this program is to support the livestock production activities of women and young people in the rural areas thereby improving their resilience to climate change. The WFP accomplishes this through facilitating their access to land, quality information, and markets and land security. In addition, the program also provides food assistance and asset realization in exchange for labour. All activities under the program are carried out in a participatory manner, especially when it comes to targeting the most vulnerable among the women and youth (WFP; UN Women and USAID 2017).

The COVID-19 pandemic led the WFP to strengthen the social safety net activities through individual cash transfers to additional households, which were identified in collaboration with the communities through a participatory approach. Profiling criteria for the recipients were designed to distinguish the most vulnerable and this was done through the involvement of state and local communities' technical services. The profiling process is carried out at two levels, with the first one at the relevant municipality and second level is the most vulnerable populations within those municipalities. The profiling process are decided in consultation with the communities/beneficiaries, usually on a case-to-case basis, e.g. fodder production.

Within the Harmonized Framework for the Identification of Areas of Risk and Vulnerable Populations, the WFP conducts two surveys per year on crops and livestock, food, nutrition and health status to identify areas at risk and vulnerable populations requiring immediate assistance. One such survey conducted in 2020 led to the identification of 50 000 vulnerable households in the regions of Kayes and Timbuktu, due to biomass deterioration and conflict.

In addition, the WFP is working with the ARC to provide insurance cover against droughts with the intention of using the payouts to support feeding programs for undernourished children. There is interest in livestock insurance, as the general feeling is that it would be useful against the recurrent droughts faced by the pastoralists.

A short summary of the different interventions is provided in Table 4.4

TABLE 4.4 SELECTED INTERVENTIONS IN THE PASTORAL REGIONS OF MALI

Organization	Type	Initiative	Partners	Activity
SNV	International development	STAMP	◆ Orange Mali ◆ Ministry of Livestock and Fisheries ◆ Ministry of Digital Economy and Communication ◆ RBM	◆ Collection and dissemination of information on market prices, biomass, water availability and land occupation
IRAM	International development	Climate change adaptation and resilience	◆ Local community ◆ Livestock associations	◆ Strengthening capacities of local herders ◆ Conflict mitigation ◆ Rehabilitation of water points
World Bank	International development	PADEL-M PDIRAAM PDDEPS	◆ Ministry of Livestock and Fisheries	◆ Strengthening livestock services ◆ Support for private investment ◆ Crisis management in livestock farming ◆ Improvement quality and production of animal feed ◆ Financing ◆ Fattening and milk production ◆ Increased incomes through improvements in animal production methods ◆ Management of natural resources ◆ Access to markets
IFAD	International development	Livestock mobility	◆ RBM	◆ Securing and equipping livestock corridors for the trans-border movement of livestock
USAID	International development	Livestock for growth	◆ AECOM	◆ Improve animal production ◆ Access to veterinary services ◆ Commercialization of livestock marketing
Syngenta Foundation	International development	Improving livelihoods	◆ Farmer organizations	◆ Provision of agricultural equipment, inputs, credit and securing market linkages
WFP	International development	AgriFed food assistance	◆ UN Women ◆ USAID ◆ Local associations	◆ Access to land, information and markets for women and youth ◆ Food for labour ◆ Rangeland development ◆ Fodder production ◆ Development of water ponds
FEBEVIM	Local federation	NA	◆ Livestock associations ◆ Traders	◆ Access to animal feed and medicines ◆ Advocacy on pastoral issues with government
RBM	Local network	No particular named initiative	◆ International development organizations ◆ Local NGOs ◆ SNV	◆ Pasture and water Source monitoring ◆ Disease surveillance ◆ Livestock markets ◆ Conflict management

Key takeaways from Chapter 4: Operational assessment	
Drought risk management and financing	Given the severe impact of drought on food security, there are several standard instruments for drought risk management operating in pastoral regions of Mali. These including food aid distribution, shock-responsive social protection programs initiated by the governemnts and donor shock-responsive social protection. However, there are no national IBDRFI initiatives, except for ARC. In 2020, the 2021-2025 Mali National Plan for Drought was published, providing a clear programmatic framework for drought risk management in the next few years.
Insurance sector	Mali has a growing insurance sector. Most of the insurance companies offer general insurance but a few of them, like Inclusive Guarantee and OKO Insurance, offer crop insurance services, including index-based products. There are several development organizations which have partnered with insurance companies to provide crop insurance products against droughts and climate-related losses. However, no initiatives have been conducted in the pastoral regions.
Agro-meteorological services	There are a few institutions supporting agro-meteorological and extension services, but national institutional capacity in handling the data component of index-insurance initiative appears limited. Regional institutions such as AGHRYMET, ACF or ARC could support data management tasks, while supporting capacity building nationally.
Government and regulatory bodies	Mali is a member of CIMA, which already has regulations in place for IBDRFI. The CIMA recently introduced regulations for Sharia- compliant products, although there is currently no reported demand.
Digital financial and telecommunication services	The prominent telecommunication companies are Orange and Malitel. Both companies have developed services for insurance product delivery and premium collection. Due to the escalating conflict situation in Mali, Malitel has been used by many development organizations to facilitate cash transfers and to provide humanitarian aid. Malitel has a wide network in the rural areas and this presence offers IBDRFI opportunities. As far as banks are concerned, there is a single bank that offer agricultural loans. Micro-finance institutions, therefore, play an important role in providing access to finance to unbanked (without bank accounts) populations. Most of the MFIs have partnered with telecommunication companies, such as Orange, for mobile money services.
The NGOs and pastoral organizations	Mali has a strong network of pastoral and livestock associations and most of the development organizations are already collaborating with them for service provision. One of the dominant development organizations is SNV, which has noTable presence in the pastoral areas implementing its STAMP program. The COVID-19 pandemic also led organizations such as the WFP to strengthen their social safety net programs, which could offer advantages for livestock insurance product launches, depending on the type of product that would be most ideal for this context.
Women and youth	The existing crop insurance products do not explicitly target women and youth groups. However, Orange Mali has two life micro-insurance products that specifically target women. Organizations such as the WFP are working with women and the youth by assisting them in livestock production and resilience building against climate change in two pastoral areas. However, the rest of WFP initiatives are mainly in the non-pastoral areas. Finally, several DFS initiatives have a gender component, which suggests that there is growing inclusivity and awareness around gender issues.
Conflict and terrorism	Several private sector companies have found it challenging in the recent years to access some pastoral regions, especially the ones bordering Niger and Burkina Faso due to heightened conflict and insecurity related to terrorism/jihadist movements. This could present a challenge in the implementation of IBDRFI in some of these areas, especially regarding awareness creation and product distribution. In addition, inter-community clashes between farmers and pastoralists over land resources have been on the rise, indicating the need to link IBDRFI schemes with conflict mitigation mechanisms.

5. Scenario analysis

5.1 Background and objectives

This scenario analysis provides a broad overview of how a product might work and an illustration of indicative costings for two alternative IBDRFI programmatic options: (i) a micro-level retail insurance scheme and (ii) a fully funded macro-level social livelihoods protection program. This is not a product or program design study, thus the analysis is simplified and based only on previous implementation experiences in east Africa. It should be noted that the proposed scenarios neither provide specific recommendations, nor do they pretend to cover an exhaustive range of IBDRFI solutions. Thus, a detailed analysis of alternative programmatic options and product design customizations needs to be planned with local stakeholders during the early implementation stages of future initiatives.

The two programmatic alternatives, built upon experiences from existing programs, should be seen as two illustrative options that represent extremes of a broader range of potential IBDRFI programs that could be designed based on Mali's priorities. Indeed, they could be seen as complementary (not alternative) approaches in a harmonized IBDRFI framework at country level. Both options rely on the private sector for product distribution and management, provide payouts directly to pastoralists and are based on the same index-based model. The two options fundamentally differ in their main goals, targeting approach and the level of participation of public sector actors, regarding subsidies and direct support to complementary activities. Table 5.1 summarizes key similarities and differences.

The micro-level retail insurance scheme aims, not only to protect pastoral households from sliding into poverty during drought periods due to livestock losses, but to also improve access to inputs and credits and stimulate investments in the value chain to ultimately improve livestock production and marketing. Clients of the scheme are expected to pay premiums. The level of public sector participation, mainly through partial subsidies, needs to be modulated to ensure financial viability and uptake and to create incentives for additional private sector investments.

The macro-level social livelihoods protection program aims to provide social safety nets to the most vulnerable pastoral households and complement humanitarian responses that protect pastoralists' key assets and livelihoods during the early stages of drought crises. The program targets beneficiaries that own a small number of livestock assets but are unable to pay premiums. Therefore, targeting and registration become critical steps. The level of public sector support required for subsidies and awareness creation is high. In addition to social protection, subsidies could be linked to good agricultural practices to improve the resilience of pastoral households (e.g. rangeland management) to climatic shocks.

TABLE 5.1 SUMMARY OF THE SIMILARITIES AND DIFFERENCES BETWEEN THE TWO PROGRAMMATIC SCENARIOS

Item	Micro-level commercial retail insurance	Macro-level social livelihood protection
Main goal	◆ Improve access to inputs and credit to pastoral households ◆ Protect households from sliding into the poverty trap	◆ Provide social safety nets to the most vulnerable pastoral households ◆ Complement humanitarian responses
Insurable interest	◆ Herders' interests to protect their livestock asset during extended periods of forage reSource deficits	◆ Public interest in anticipatory responses to drought ◆ Reduction in humanitarian support needs
Satellite data Source	◆ Same, e.g. NDVI	◆ Same, e.g. NDVI
Index design	◆ Same ◆ Proxy for forage availability	◆ Same ◆ Proxy for forage availability
Sum insured	◆ Same (but could increase for larger commercial herders) ◆ It is based on estimated additional costs of livestock maintenance during seasons with forage deficits	◆ Same ◆ It is based on estimated additional costs of livestock maintenance during seasons with forage deficits

Item	Micro-level commercial retail insurance	Macro-level social livelihood protection
Commercial premium rates	◆ Same underlying pure loss costs but commercial premium rates may need to be considerably higher to reflect higher operational costs associated with voluntary sales to individual pastoralists (insured policyholders)	◆ Same underlying pure loss costs but with potential to minimize operational loadings as there is automatic cover for large numbers of beneficiaries
Payouts	◆ Same, assuming same sum insured and triggers are adopted (direct to policyholder/insured)	◆ Same, assuming same sum insured and triggers are adopted (direct to beneficiary)
Target audience	◆ More affluent small/medium-sized and large pastoralists, who can afford to pay either the full commercial premium or a partly subsidized premium rate	◆ Vulnerable pastoralists who depend largely on livestock herding for their livelihoods, but cannot afford to pay commercial premium rates ◆ These pastoralists should have a minimum herd size
Distribution approach	◆ Voluntary purchase by the individual pastoralist or group	◆ Automatic enrolment of selected pastoralists by government entity/agency
Policyholder (Insured)	◆ The individual pastoralist is the policyholder and insured as named on the policy certificate	◆ The insured policyholder is the government entity/agency on behalf of the preselected pastoralists (beneficiaries) listed on the policy issued to the government entity/agency
Insurance awareness creation and sensitization	◆ Not essential if marketing, promotion and sales functions are correctly performed by the insurer or their appointed agents/distribution channels	◆ Essential as pastoral communities and their members must be made aware of the scheme rules and why some pastoralists are identified as beneficiaries and will be automatically enrolled, while others will not be selected
Targeting, sales and selection	◆ Insurers will be responsible for their own marketing, promotion and sales programs including: ◆ Own sales agents ◆ Other distributors	◆ The government entity/agency will need to work closely with country-level authorities, community and pastoral leaders to identify the selection criteria and the beneficiaries of the program in each insured unit (IU)
Registration	◆ All insured pastoralists must be electronically registered	◆ All beneficiaries must be electronically registered
Premium subsidies	◆ Variable ◆ It could also change over time depending on the product uptake	◆ 100% or close to ◆ It is, however, recommended that pastoralists contribute with a token or some other modalities

Source: Authors

The scenario analysis takes into consideration an IBLI type product, which has been designed, customized and widely tested in both Kenya and Ethiopia (Appendix 2). As already described in Section 1.2, the IBLI product design adopted in the existing programs relies on (i) an index calculated from time series of NDVI imagery acquired from satellite sensors and (ii) a payout function to convert the index values into payouts for policyholders/beneficiaries. The analysis was limited to the areas that were considered suitable or partially suitable (i.e. requiring forage review) for the IBLI product implementation (Chapter 3, Figure 3.5).

It should be noted that the index calculation and the payout function of the IBLI product must be customized during the early implementation stages of any initiative aimed at launching IBDRFI solutions, in close collaboration with local stakeholders. The cost of any IBDRFI product is largely determined by calculating historical payouts (i.e. pure loss rates) according to the chosen set of parameters and customization options of the IBLI product. This allows tailoring the IBDRFI solution to the local context and specific goal of the IBDRFI initiative.

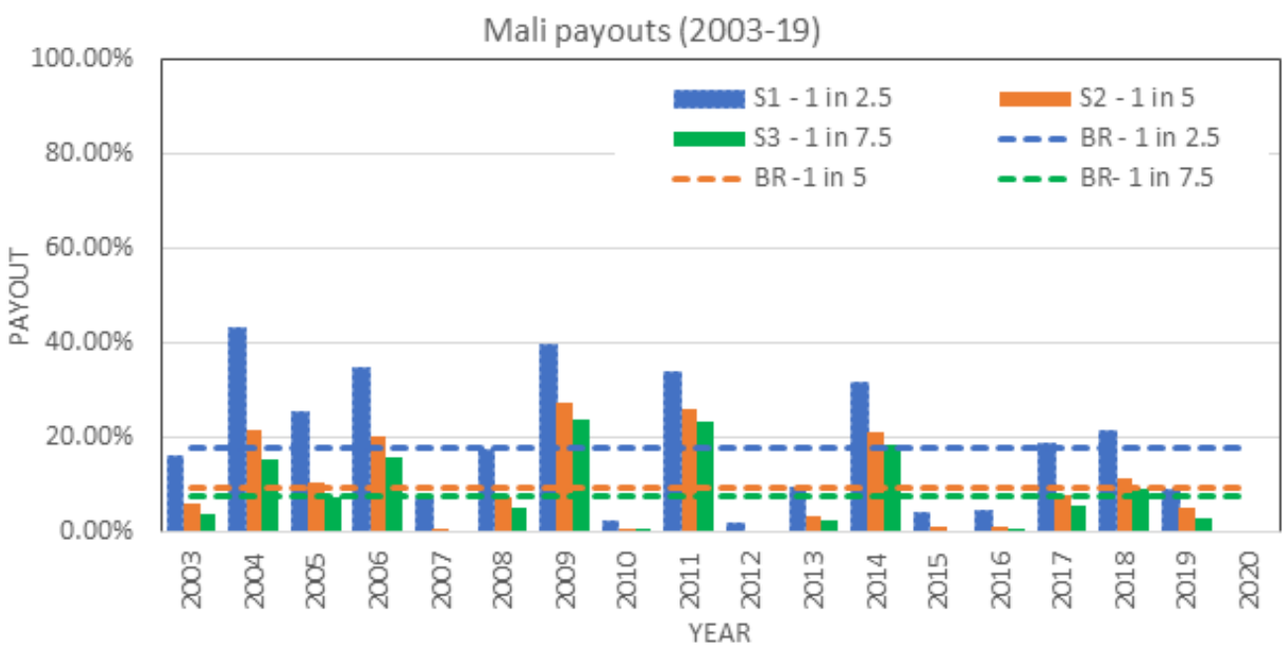
The scenario analysis is divided in two steps: firstly, a simulation analysis on historical data was conducted to illustrate the product performance in the country (i.e. independently by the implementation modality) and secondly, a financial analysis was conducted to illustrate the hypothetical costings of implementing an IBDRFI program in the country. The costings were generated for the two programmatic options illustrated above; a micro-level, purely retail insurance program and a macro-level, fully subsidized social protection initiative.

5.2 Simulation of historical payouts in Mali

Three historical payout scenarios are presented to illustrate how an IBLI product would have worked in Mali's pastoral areas over the last two decades. The reference scenario is an IBLI product with a trigger attachment threshold[23] set to one payout in 5 years (S2). The two alternative scenarios were included to illustrate the implications of changing the attachment threshold by increasing (i.e. 1 in 2.5 years) (S1) or decreasing the frequency of payouts (i.e. 1 in 7.5 years) (S3). All the other parameters are constant across the scenarios.

In each of these scenarios, five main payouts would have been triggered in Mali in response to major droughts in the years 2004, 2006, 2009, 2011 and 2014 (Figure 5.1). However, moderate and minor payouts were quite frequent and in 12 out of the 18 years, payouts were triggered for all scenarios. This reflects the impact of more localized drought events that affect specific regions of Mali in different years. Of note, no large payouts were triggered. The main payouts triggered were consistent with the main reported events in the literature (see Section 2.5).

FIGURE 5.1 HISTORICAL ANNUAL PAYOUTS AS A PERCENTAGE OF TOTAL LIABILITY IN SUITABLE MALI ADMINISTRATIVE UNITS (2003-19),ASSUMING A JULY TO NOVEMBER INSURANCE COVER PERIOD



The average payout (pure loss cost rate) would be 17.7, 9.4 and 7.4% for payout scenarios S1, S2 and S3, respectively, illustrating how more frequent payouts would result in significantly higher costs for the IBDRFI product. This demonstrates how decisions made during the product customization stages with local stakeholders on desired frequency of payouts have important implications on the costs (premiums), of which the pure loss rate is a key component. It also shows that the product can be tailored to suit the objectives of the IBDRFI program and the capacity of pastoralists to pay the premiums.

5.3 Costing scenarios for future initiatives in Mali

Indicative costings for the two programmatic scenario (PS) options described in Section 5.2 are presented to illustrate the financial implications for the government or donors of implementing an IBDRFI solution in Mali. The two PS costings were modelled on the existing implementation experiences in Kenya and Ethiopia and include a micro-level commercial insurance implementation scenario (PS1) and a macro-level social livelihoods protection coverage implementation scenario (PS2). Both scenarios were developed using an IBLI product and a trigger attachment threshold of 1 in 5 years (S2 in Section 5.2). The scenarios were designed for a 5-year program.

23. The index threshold below which a payout is made.

The two programmatic scenarios differ fundamentally in expected contributions from the government or development partners, as PS1 assumes 50% subsidies while PS2, 100% subsidies. Another important difference to note is the public sector contribution to complementary investments, such as registration infrastructure, awareness creation and monitoring and evaluation. Finally, the two scenarios differ in the expected uptake levels, as it is assumed from previous experiences that commercial insurance uptake rates are generally rather slow. A detailed summary of assumptions is provided in Appendix 5. It should be noted that the assumptions made for this analysis are an over-simplification of the reality and should be seen as purely illustrative.

Indicative costs of complementary activities, including registration, awareness creation and monitoring and evaluation are provided to illustrate the importance of including these components during the design stage of any IBDRFI initiative. However, the costs are estimated based on a per-person flat rate, which is an over-simplification. In a more realistic scenario, these components would often require an initial larger investment for setting up the infrastructure. The costs would then increase proportionally in line with the program expansion until a certain critical level, when greater cost-efficiencies should in principle reduce costs.

PS1. Micro-level commercial implementation with partial subsidies

The micro-level commercial insurance implementation scenario indicates the costing of supporting a relatively large implementation program in the pastoral areas of Mali for an IBDRFI micro-insurance product with partial subsidies (i.e. 50% of the premium) (Table 5.2). Under commercial implementation, the uptake is expected to be gradual and in five years, the program could reach 25,000 pastoral households and approximately 125,000 TLUs.

TABLE 5.2 COSTS OF IBDRFI MICRO-INSURANCE PRODUCT IMPLEMENTATION WITH PARTIAL SUBSIDIES OVER FIVE YEARS

Item	Total (Cumulative, over 5 years)
Policyholders	75,000
TLUs covered	375,000
Total sum insured (USD)	56,250,000
Indicative premium (total) (USD)	8,982,795
Subsidy (50%) (USD)	4,491,397
1. Electronic registration of livestock producers (USD/Livestock unit)	0
2. Herder awareness, education and training (USD)	375,000
3. Monitoring and evaluation (USD)	375,000
Total cost (USD)	5,241,397

Yearly costs are presented in Appendix 5 (Table A5.2).

The global fiscal cost of supporting a micro-level insurance program with 50% subsidies is estimated to be USD 5.2 million over five years of implementation. This includes the cost of subsidies (USD 4.5 million) and program support activities (USD 0.75 million). After five years, full-scale implementation may be in the order of 125,000 TLUs (physical uptake) and USD 1.7 million government fiscal support costs per year.

The insurance premium to be paid by a pastoral household would be approximately USD 12/TLU per year with a maximum payout of USD 150/TLU. There are no data in Mali to evaluate if pastoralists would be able/willing to cover this cost. However, based on the willingness to pay study recently conducted in Senegal, this amount might be too high for most pastoralists in the Sahel region (Syll et al. 2019). It is worth mentioning that the commercial loadings on pure loss premiums might be underestimated, especially if the insurer needs to undertake significant investments in marketing and distribution channel development.

In this scenario, there is significant uncertainty about the uptake Figures and actual private sector investment levels on complementary activities. The uptake of agricultural micro-insurance solutions has often been below expectations for a variety of reasons, including poor product design, weak investments in marketing and awareness creation, high implementation transaction costs leading to unsTable private sector commitments. Partial subsidies are deemed important to support the initial market uptake, therefore, smart use of subsidies needs to be planned to incentivize the private sector to invest in critical financial and knowledge infrastructure. In this scenario, a fixed 50% premium subsidy was used, but a gradual subsidy reduction could also be planned over the medium term.

PS2. Macro-level social livelihoods protection coverage implementation

The macro-level social livelihoods protection coverage scenario illustrates the costing of supporting a relatively large implementation program in Mali for an IBDRFI social protection coverage targeting the most vulnerable pastoralists, who cannot afford to pay insurance premiums (100% of the premium is covered) (Table 5.3). Under the social protection implementation, the program expansion is expected to be faster such that in five years it could reach 50,000 pastoral households and approximately 250,000 TLUs.

TABLE 5.3 COSTS OF MACRO-LEVEL IBDRFI SOCIAL LIVELIHOODS PROTECTION COVERAGE OVER FIVE YEARS

Item	Total (Cumulative, over 5 years)
Beneficiaries	150,000
TLUs covered	750,000
Total sum insured	1,12,500,000
Indicative premium (total) (USD)	15,851,991
Subsidy (100%) (USD)	15,851,991
1. Electronic registration of livestock producers (USD/Livestock Unit) (USD)	250,000
2. Herder awareness, education and training (USD)	750,000
3. Monitoring and evaluation (USD)	750,000
Total cost (USD)	17,601,991

Yearly costs are presented in Appendix 5 (Table A5.3)

The global fiscal cost of fully supporting the program implementation is estimated to be USD 17.6 million over five years, including premium subsidies (USD 15.8 million) and program support activities (USD 1.75 million). At the end of the five-year program, 250,000 TLUs would be protected from drought at an annual cost of USD 5.8 million.

T**he premium cost per TLU to be covered through subsidies would be USD 21.1/TLU. No premium is expected to be paid by pastoral households.** However, a token contribution is recommended to support product awareness. This is an important lesson learnt from ongoing initiatives in both Kenya and Ethiopia.

In this scenario, the main Source of uncertainty is associated with the long-term fiscal sustainability of the initiative, as medium-term budget allocation commitments need to be guaranteed. Depending on the social protection goals of the IBDRFI program, a gradual exit strategy should be planned from the beginning. For example, a system incentivizing graduation of pastoral households to partially subsidized commercial coverage could be implemented, allowing for gradual reduction in fiscal costs over the medium to long term.

Hybrid approach: combining commercial micro-insurance with a social protection program

Experience from operational programs in Kenya and Ethiopia suggest that a hybrid approach could be adopted to address sustainability issues in the two programmatic options illustrated. A macro-level social livelihoods protection program could target the most vulnerable pastoralists (e.g. those with up to five TLUs) with a highly subsidized product. At the same time, partially subsidized commercial insurance could be sold to those that are not beneficiaries of the social protection program and/or to top-up the coverage of additional TLUs. Subsidies could then be modulated over time between the two programs and used as incentives to the private sectors and clients to promote uptake and financial sustainability.

This could bring multiple potential benefits including:

- Cost sharing for financial service infrastructure development and complementary activities, as the public sector/ donors could support the initial investments under the social livelihoods protection scheme, while the private sector guarantees maintenance and invests heavily in market expansion.
- The macro-level protection program could be planned to rapidly scale up coverage in the medium term and create confidence in the private sector regarding the short-term profitability of the scheme.
- Meanwhile, subsidies can be used as an incentive to drive private sector participants to invest in the commercial scheme and expand the retail market.

6. Summary of findings and recommendations

Based on socio-economic, technical and operational conditions, Mali presents a moderate level of readiness for the implementation of an IBDRFI initiative targeting livestock keepers in extensive pastoral systems. Table 6.1 illustrates the key findings with respect to the feasibility criteria considered in this study.

The socio-economic assessment (Table 6.1, green) emphasizes the paramount role of the livestock sector in Mali's economy and the high vulnerability of pastoralists to drought shocks. Droughts are the major climate risk faced by the livestock sector and have severe impacts on food security, which is currently exacerbated by conflict and insecurity. No information was available on demand for insurance by pastoral communities. However, considering the poverty levels and inequality among pastoralists, social protection initiatives to protect the most vulnerable are a priority. Mali's participation in the ARC risk pool demonstrates that IBDRFI is already part of the government's strategic planning and could provide the foundation for broader complementary initiatives, including micro or meso levels.

The technical assessment (Table 6.1, yellow) indicates that the geographic areas that were classified as feasible (green), or feasible but needing review (orange) for the implementation of an insurance product tailored to extensive pastoral systems, cover a vast portion of the country and host the majority(63%) of the national livestock herd. For the areas needing review, it would be important to engage with local stakeholders to confirm the suitability of these areas for extensive herding. Specifically, in the central western regions that are characterized by mixed-land use, it would be important to confirm the presence of pastoral communities that largely depend on livestock and local rangeland resources, while in the northern regions, it would be important to confirm the suitability of the vegetated areas for livestock herding.

The operational assessment (Table 6.1, grey) shows contrasting results. While the overall country conditions show promising elements, the implementation in pastoral regions might present significant challenges because of the lack of infrastructure and the prevailing security situation. The regulatory environment, private sector experience in agricultural index-insurance (targeting crops), good telecommunication and DFS networks and strong presence of NGOs, international organizations and pastoral associations supporting livestock value-chain and resilience interventions (e.g. PRAPS II), are all positive factors for IBDRFI operational implementation. However, the overall institutional capacity seems to be relatively weak to support large IBDRFI initiatives and the pastoral regions appear to have had marginal investments in financial resilience. Thus, financial literacy is expected to be low and should be considered as a major investment requirement to stimulate the demand for insurance and its effective use in resilience building by individual pastoralists or communities. In addition, while telecommunication companies indicated their capacity to operate in insecure regions, in recent years other actors have found it challenging to access some pastoral regions, especially the ones bordering Niger and Burkina Faso, due to heightened conflict and insecurity. This could be a another challenge in implementing IBDRFI in some of these areas, especially regarding awareness creation and product distribution.

Table 6.1. summarizes the main critical areas that would require targeted investments for IBDRFI implementation (red dots). These include:

- Awareness creation on financial protection mechanisms and insurance among pastoral communities. This is a prerequisite to stimulate informed demand and to support the creation of local markets. This goal can be achieved through sensitization campaigns and capacity building of insurance and extension agents operating in pastoral regions.
- Technical capacity development of local institutions on index insurance design and calculation. Though there are multiple national institutions providing agricultural extension services, they have limited experience with index-based instruments. Capacity development could, therefore, be supported by regional institutions such as AGHRYMET and ACF. The ARC is already involved in IBDRFI programs.
- Development of an electronic registration system. This is fundamental in targeting beneficiaries and the effective management of the initiatives. In the framework of the national shock-responsive social protection program, there are plans to set up a household registration system and potential synergies should be explored.

It should be noted that there are some gaps in the assessment as the team had limited opportunities to conduct field work to obtain more insights from local institutions, especially at the sub-national level (i.e. pastoral regions) due to the COVID-19 pandemic restrictions. This particularly limited the assessment of potential demand from pastoral communities and drought costs and their associated impacts on pastoralists and the livestock sector in general. In addition, while the current insecurity situation in the pastoral region could be another operational constraint, this study was unable to assess the extent and specifics of this limitation as it is highly context specific.

TABLE 6.1 FEASIBILITY ASSESSMENT OF THE COUNTRY'S READINESS FOR IMPLEMENTATION OF IBDRFI PRODUCTS TARGETING PASTORALISTS

			Justification
Socio-economic Feasibility	Importance of pastoral livestock to the local economy		The livestock sector is particularly important to the Malian economy. It contributes around 19% to the national GDP and is the main Source of livelihood for more than 30% of the population. While agropastoralism is practiced by the majority of the population, the national livestock herd is almost equally split between pastoralists (45%) and agro-pastoralists (55%).
	Impact of drought on the livestock sector		Droughts lead to recurrent food security crises in Mali and the pastoral regions are particularly affected. There is limited data on the costs of droughts especially in the livestock sub-sector. However, anecdotal evidence shows that costs can be extremely high. For example, during the severe drought in the 1970s, more than 40% of the national herd are estimated to have died due to lack water and forage resources. In addition, a recent WBG study revealed these pastoral areas may expect annual losses as high as 3.7% of the rangeland production and up to 20.6% in 100 years.
	Vulnerability of pastoralists to drought		The northern pastoral regions are not only the most arid parts of the country, but also the most exposed to recurrent droughts. Pastoralists depend largely on livestock (over 80% of their income) and inequality among pastoralists in these parts is very high. The poorer half of the population has on average only 2.5 TLUs per capita or less at their disposal. As a result, the vulnerability to droughts is highest among those poorer pastoralists.
	Pastoralist demand for livestock insurance		This study did not have sufficient elements to make this assessment.
	Pastoralist financial literacy		Pastoralist communities have been exposed to insurance and, therefore, have some understanding of the concept. However, agricultural and index insurance is largely unknown in the pastoral areas and its introduction would require investments in awareness creation.
Technical Feasibility	Rangeland dominance		Extensive rangelands dominate a large portion of the central and northern parts of Mali. However, in the northern part of the country extending into the Sahara desert, vegetation growth is limited by rainfall. Conversely, the more productive southern and south-western parts of the country are dominated by croplands and human settlements.
	Seasonality and signal intensity		Vegetation in the rangeland dominated regions of Mali shows a well-defined single growing season, allowing for the definition of one distinct drought risk period. The pasture and rangeland vegetation growing season runs from June/ July to October/November, showing geographically consistent patterns
	Overall feasibility of product design		The final suitability classification of Mali's administrative units indicates that 15, 10, 55 and 21% of the country is suitable (green), suitable but needs rangeland review (orange), suitable but needs forage review (yellow) and unsuitable for IBLI product design, respectively. Pastoral regions where IBLI is suitable or feasible but needing review host about 62.6% of the Mali's total livestock population

			Justification
Operational Feasibility	Technical capacity on index calculation and quality assessment	🔴	National-level institutional capacity in handling data components of index-insurance initiative seems limited, although there are a few institutions supporting agro-meteorological and extension services. Regional institutions such as AGHRYMET, ACF and the ARC could support data management tasks, while supporting national capacity building.
	Legal and regulatory insurance environment	🟢	Mali is a member of CIMA, which already has regulations in place for IBDRFI. The CIMA recently introduced regulations for Sharia-compliant products, although there is currently no demand for them.
	Insurance market development	🟠	Mali has a growing insurance sector. There are several development organizations, which have partnered with insurance companies to provide traditional crop and weather indexed insurance products against droughts and climate-related losses. However, no initiatives have been conducted in the pastoral regions to date.
	Interest from insurers in IBDRFI	🟠	Companies such as Inclusive Guarantee and OKO Insurance offer crop insurance services, including index-based products and have expressed interest in solutions targeting pastoral areas
	Effective distribution channels	🟠	The insurers' presence in pastoral areas is limited. However, the good DFS networks that are also used for cash transfer programs, might offer opportunities to support effective distribution channels, if targeted investments are made.
	Existing pastoralist beneficiary registries	🔴	A unified social registry has been established to facilitate national shock-responsive social protection programs. However, the coverage of this registry seems is still limited and its expansion in pastoral areas requires targeted investments
	Finance available for premiums	⚪	This study did not have sufficient elements to make this assessment.
	Interest from government	🟠	The government has shown interest in IBDRFI initiatives targeting pastoral systems and has a proactive approach toward drought risk management as shown by the National Plan for Drought and its consistent participation in the ARC drought risk pool. More engagements are necessary to understand specific objectives and levels of commitment towards implementation in the pastoral areas.
	Conflicts and insecurity	🟠	While telecommunication companies indicated their capacity to operate in regions affected by terrorism/conflicts, other actors have found it challenging in the recent years to access some pastoral regions, especially the ones bordering Niger and Burkina Faso, due to heightened insecurity . This could be a hurdle in implementing IBDRFI in some of these areas, especially awareness creation and product distribution. However, a detailed review of potential constraints arising from the country's security situation was not conducted in this study. Therefore, a comprehensive assessment of potential operational constraints was not possible, as this is highly context specific.

🔴 **= low;** 🟠 **= medium;** 🟢 **= high.** This study did not have sufficient elements to make this assessment

The following paragraphs provide a set of recommendations to be considered by the government of Mali and other public and private stakeholders, should they consider the implementation of an IBDRFI initiative targeting pastoralists.

Recommendations

Considering the limited scope of a feasibility study, the next steps toward implementing an IBDRFI initiative require in-depth engagements with stakeholders in Mali and analytical studies to address the knowledge gaps identified in this assessment.

Next steps

Stakeholders' engagement and policy support

R1: Given the consensus expressed by public and private sector stakeholders on the need and value of IBDRFI initiatives targeting pastoralists and the importance of the livestock sector to the country, it is recommended that a more structured national dialogue or policy round Table discussions on the scope of alternative IBDRFI implementation options be initiated. While there are contrasting indications about Mali's level of readiness to support IBDRFI initiatives for pastoralists, consensus of the need and value of such initiatives has been expressed by all stakeholders. The primary objective of this dialogue should be to define the policy priorities and objectives of IBDRFI (R2). As such, the dialogue should be anchored to the 2021-25 National Plan for Drought and could involve multiple ministries (ministries of livestock and fisheries, information and digital economy and economy and trade), insurance companies, regulators, pastoral associations, international organizations and development banks/institutions with interest and experience in implementing IBDRFI. As part of this effort, a Technical Working Group (TWG) could be also established to address technical aspects of the initiative that inform the decision-making process and commissioning of technical studies to cover the gaps identified in this study (R3-R9).

R2: The policy dialogue should primarily define the policy objectives and evaluate alternative IBDRFI programmatic options. The options to be considered might include tailored micro- and macro-level approaches targeting individual pastoralists, similar to those implemented in east Africa and innovative schemes involving meso-level distribution channels requiring the promotion of risk aggregators, such as pastoralist groups or pastoral associations. However, Mali's feasibility results suggest that macro- or meso-level IBDRFI initiatives with the goal of protecting the most vulnerable pastoralists might have to be prioritized. These should, in any case, be built upon and well harmonized with existing initiatives, such as shock-responsive social protection safety nets. The initiatives might be integrated with a scaling component or the ARC sovereign-level drought coverage scheme, which now offers a new tailored product for rangelands. Given the instrumental role of development organizations, such as the WFP, in humanitarian support provision during drought shocks, coordinated actions to design an IBDRFI mechanism should be evaluated.

Follow up actions on some of the priority areas identified:

R3: Cost-benefit analysis

- **A review of the government expenditures on emergency responses that would inform cost-benefit analyses of alternative IBDRFI options.** This study was unable to identify the most recent data on the response costs for droughts and other climatic crises in Mali, particularly for the pastoral areas. This is an important gap that should be filled. This step informs the decision-making process that is needed to select a set of potential IBDRFI options for a detailed review, which includes a cost-benefit analysis. The analysis should assess the government's role in subsidy provision or complementary investments in micro-, meso- and macro-level schemes and their harmonization with existing drought risk management efforts (e.g. ARC insurance and the safety net program). The review should weigh alternative subsidy options and evaluate the trade-offs from a cost-benefit perspective, including long-term financial sustainability and governance aspects.

R4: Distribution channels

- **A study on the distribution models in pastoral areas, considering existing country DFS initiatives from public, private and international development actors should be undertaken.** It is recommended that organized structures such as RBM, local pastoral associations and local NGOs be considered as entry points for any IBDRFI product distribution. Besides direct distribution to pastoral households, meso-level approaches should also be evaluated as potential alternatives, with pastoral groups or associations acting as risk aggregators.
- **The targeting approach is important, not only to guarantee coverage of the most vulnerable communities, but to also ensure social inclusivity and cohesion.** Given the challenges around insecurity, conflict and coverage, interviewed stakeholders concurred that both Orange Mali and Malitel could be involved in the delivery infrastructure development. This is due to the extensive coverage that Malitel and Orange Mali enjoy in the northern and southern central parts of the country, respectively. Moreover, both telecommunication companies have systems that enable subscribers to make different kinds of payments, while also partnering with micro-finance institutions for their product delivery. Malitel has been working with development organizations in conflict areas facilitating cash transfers, thus presenting a learning opportunity for systems development.

Next steps

R5: Product design

- **A product design review and customization study.** A large portion of Mali has been assessed as suitable but requiring product design reviews with local stakeholders. Therefore, it is recommended that a product review/customization exercise during the early stages of implementation be conducted, in consultation with pastoral associations, national institutions involved in extension service provisions and development organizations operating in pastoral areas (e.g. WFP and the SNV). One key objective of the review should be the definition of spatial aggregation units that better reflect the wet season mobility of pastoralists. This is critical to understand if alternative products should be considered for the northern regions, where medium to long range transhumance is still the common herding practice and for the central pastoral regions, where a significant fraction of livestock keepers are agro-pastoralists. Secondly, it would be important to evaluate the trigger approach and payout schedule to maximize the utility of the payouts for asset protection. Thirdly, given the observed land use changes and pasture degradation, trend analysis is recommended to evaluate possible impacts on the risk modelling and product pricing. Finally, considering the emerging EO technologies available, alternative EO-derived indicators (e.g. rainfall estimates, evapotranspiration and soil moisture) or drought indices can be evaluated.
- **A systematic review of ongoing pastoral development interventions to identify priority geographic clusters for initial intervention.** Lessons learnt from existing programs indicate the importance of linking financial protection efforts with complementary livestock value chain (feed and fodder, markets, animal health and water management) and resilience interventions (e.g. PRAPS II) from the beginning to maximize co-benefits. This is especially true for areas with limited livestock value chain development, where IBDRFI payouts for asset protection might not effectively be used because of limited options. This review could also identify priority clusters that can implement IBDRFI interventions, starting with regions where livestock services are more developed, including some DFS infrastructure for financial inclusion, existing interventions to stimulate feed/fodder markets and presence of development organizations and private sector actors.

R6: Conflict mitigation

- **An in-depth analysis of the conflict/security situation in the pastoral/agro-pastoral regions and the potential operational implications for IBDRFI initiatives.** Even though IBDRFI schemes for pastoralist have been implemented in regions with high levels of insecurity in east Africa, the next stages of implementation should carefully consider security-related constraints in the demand, supply and scaling up of the product. Several pastoral areas of Mali are currently affected by acute insecurity conditions due to terrorism/jihadist movements that could limit operations, investments in infrastructure and awareness creation efforts from public/private sector and development organizations. Clashes between the Fulani and farming communities over land resources are becoming increasingly common, especially during drought periods.
- **Terrorism and inter-community clashes tend to geographically overlap in some cases and are inter-related but have profoundly different implications for IBDRFI implementation.** The former can be a constraint for operational implementation that cannot be addressed directly during the IBDRFI initiative. The latter, however, can instead limit the effective use/positive impact of payouts and might be mitigated with appropriate strategies while implementing the IBDRFI initiative. The security status review should, therefore, inform a cluster approach toward implementation. Since some private sector actors indicated their capacity/ability to operate throughout the whole country, it is recommended that areas with relatively low incidences of terrorism and well-organized regional governance structures for the rollout and consolidation of the scheme be prioritized. Furthermore, the study should carefully assess the impact of conflict on the pastoralists, including displacement of pastoral systems from their ecological niche, to evaluate complementary strategies for conflict-mitigation between farming and pastoral communities that could be implemented (e.g. sensitization campaigns about mutual mechanisms for both communities, use of payouts to regulate the timing of migration and support of feed/fodder distribution along transhumance corridors, etc.).

Next steps

R7: Capacity development and learning

- **An awareness creation campaign for pastoral communities and a capacity building strategy targeting institutional and private sector actors.** Stakeholders engaged in this study have strongly emphasized the need for awareness creation and capacity building of local institutions. It was suggested that information campaigns to build trust between livestock owners and the insurance companies be organized, supporting the notion that pastoralists would be culturally reluctant to accept IBDRFI products. This is mainly because of the extremely low levels of financial literacy among pastoralists, hence the need for targeted investments in financial literacy, digital financial services and awareness creation.
- **Widespread sensitization efforts would be important at the initial stages of implementation, including targeted efforts to better understand whether any communal or cultural barriers may affect the uptake of an IBDRFI product.** BNDA was interested in being part of the awareness creation process. Most of the insurance companies and financial institutions acknowledged that they have little awareness about IBDRFI products for livestock and pastoralists, therefore, institutional capacity building would also be necessary.
- **A monitoring and evaluation strategy as part of a broader learning framework to ensure that appropriate mechanisms for quality assurance and impact evaluation are in place.** Considering the lack of experience in IBDRFI and the limited financial literacy, it would be essential to set up effective monitoring mechanisms. These would ensure, not only the verification of the project implementation, but also the actual engagement with the communities to make them active participants in the product review by providing feedback and recommendations on what works and what does not work.
- **Rigorous evaluation and impact assessment studies (multi-annual surveys) are recommended to rigorously demonstrate the benefits of the proposed initiative** on pastoralists' resilience and welfare and ensuring that unwanted secondary impacts will not be stimulated by the intervention (e.g. pasture degradation and conflicts). The need for data improvements emerged clearly in this study. Therefore, it is highly recommended that a comprehensive strategy for data collection is established, leveraging off digital technologies and encompassing multiple impact dimensions such as rangeland condition, livestock production, markets and human welfare and food security.

Photo credit: EAP Photo Collection/ World Bank

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Appendices

Appendix 1. Key differences between micro-level retail and modified macro-level social livelihoods protection programs

TABLE A1.1 DIFFERENCES BETWEEN MICRO AND MACRO-LEVEL PROGRAMS USED IN KENYA AND ETHIOPIA

Item	IBLI micro-level commercial retail insurance	KLIP social livelihoods protection program
Product design and rating:		
Index: Satellite NDVI (MODIS)	◆ Same	◆ Same
Contract design (triggers) and payouts (loss cost rates)	◆ Same	◆ Same
Sum insured	◆ Same (but could increase for larger commercial herders according to the feed requirements of their herds)	◆ Same (but as livelihoods protection, based on minimum nutritional requirements of livestock)
Commercial premium rates	◆ Same underlying pure loss costs, but commercial premium rates may need to be considerably higher to reflect higher operational costs associated with sales to individual pastoralists (insured policyholders)	◆ Same underlying pure loss costs, but with potential to minimize operational loadings as there is automatic cover for large numbers of beneficiaries, hence the potential to achieve economies of scale in operational costs
Payouts	◆ Same, assuming same sum insured and triggers are adopted (direct to policyholder/ insured)	◆ Same, assuming same sum insured and triggers are adopted (direct to beneficiary)
Target audience	◆ More affluent small/medium and large pastoralists who can afford to pay either the full commercial premium rate or a partly subsidized premium rate	◆ Vulnerable pastoralists who depend largely on livestock herding for their livelihoods, but cannot afford to pay commercial premium rates. ◆ These pastoralists should have a minimum herd size of 5 TLUs
Compulsion of insurance	◆ Purely voluntary decision by the individual pastoralist or group	◆ Automatic enrolment of selected pastoralists by project management/government entity
Policyholder (insured)	◆ The individual pastoralist is the policyholder and insured as named on the policy certificate	◆ The insured policyholder is the government entity/ agency on behalf of the preselected pastoralists listed in the schedule (or annexure) attached to the policy issued to the government entity/agency
Preconditions of insurability	◆ Insured pastoralist households must: ◆ Be able to pay their share of premiums ◆ Have a smartphone to receive SMS messages ◆ Have a bank account (fixed or mobile money) into which payouts can be directly made	◆ Beneficiary pastoralist households must: ◆ Own a minimum of 5 TLUs and be livestock herders ◆ Have a SMART phone to receive SMS messages ◆ Have a bank account (fixed or mobile money) into which payouts can be directly made
Insurance awareness creation and sensitization	◆ Not essential if marketing, promotion and sales functions are correctly performed by the insurer or its appointed agents/ distribution channels	◆ Essential as pastoral communities and their members must be made aware of the government livelihoods protection program and why some pastoralists are being identified as beneficiaries and will be automatically enrolled, while others will not be selected

Item	IBLI micro-level commercial retail insurance	KLIP social livelihoods protection program
Targeting, sales and selection	◆ Insurers will be responsible for their own marketing, promotion and sales programs using: ◆ Own sales agents ◆ Other distributors	◆ The government agency will need to work closely with country-level authorities, community and pastoral leaders to identify the selection criteria and the beneficiaries of the program in each insured unit (IU).
Registration	◆ All insured pastoralists must be electronically registered along with their livestock holdings and details of their address, phone number and bank/mobile money account and name of the insured unit where their livestock are normally grazed and which they have selected to be their trigger IU. ◆ IBLI details must also be recorded including non- insured TLUs, sum insured, premium rates for that IU and premiums paid by the pastoralist	◆ All beneficiaries must be electronically registered along with their livestock holding and details of their address, phone number and bank/mobile money account and name of the insured unit where their livestock are normally grazed and which they have selected to be their trigger IU ◆ Policy details must also be recorded including non-insured TLUs, sum insured, premium rates for that IU and premium paid by government
Premium payment and policy issuance	◆ On the payment of their share of premiums, each insured policyholder should receive a uniquely numbered certificate of insurance (local language), policy wording and schedule of cover (as necessary)	◆ Beneficiaries do not pay any premiums (at least in initial year(s). ◆ A single master policy document will be issued to the government entity that purchases cover ◆ Each beneficiary must receive a certificate detailing the protection they are receiving (non-insured TLUs, sum insured and maximum payouts per season and IU)
End of season notification (and settlement of payouts)	◆ Ideally, SMS will be used to advise each insured during the coverage period if drought conditions are developing in their IU and at end of the cover period whether a drought payout has been triggered or not and the amount of payout due ◆ Electronic money transfers should be carefully tracked to each insured's bank or mobile money account	◆ Ideally, SMS will be used to advise each beneficiary during the coverage period if drought conditions are developing in their IU and at end of the cover period whether a drought payout has been triggered or not and the amount of payout due ◆ Electronic money transfers should be carefully tracked to each beneficiary's bank or mobile money account
Government support: premium subsidies	◆ Currently none under IBLI micro-level programs in Kenya and Ethiopia	◆ Kenya: 100% subsidized and financed by GoK (out of SDL-MALF budget) ◆ Ethiopia: the WFP finances 100%, but pastoralists are expected to contribute towards premium costs through insurance for assets, in-kind labour on PSNP public works programs
Costs of implementing program to insurers	◆ The administration, operating requirements and expenses for insurers to market micro-level IBLI policies to individual pastoralists in the ASAL regions are extremely high. The costs include awareness creation and policy promotion/sales, policy issuance, premium collection and claims payouts (See Table 4.7 for further details)	◆ The administration, operating requirements and expenses for insurers to underwrite a single modified macro-level policy with government are much lower than for a micro-level IBLI program ◆ Main costs include registering pastoralists (beneficiaries) and insurance awareness creation
IGAD country experience to date	◆ IBLI ASAL counties of Kenya since 2010-11 ◆ IBLI Borena, Oromia region, Ethiopia since 2012-13	◆ KLIP, ASAL counties of Kenya since 2015-16 ◆ SIIPE, Somali region, Ethiopia since 2017-18

Source: ILRI (2021)

Appendix 2. IBLI product design and overview of customization options

This section describes the standard IBLI product used for the scenario analysis in this study while providing a brief, non-exhaustive overview of alternative options that can be considered during product design customization during the early stages of implementation.

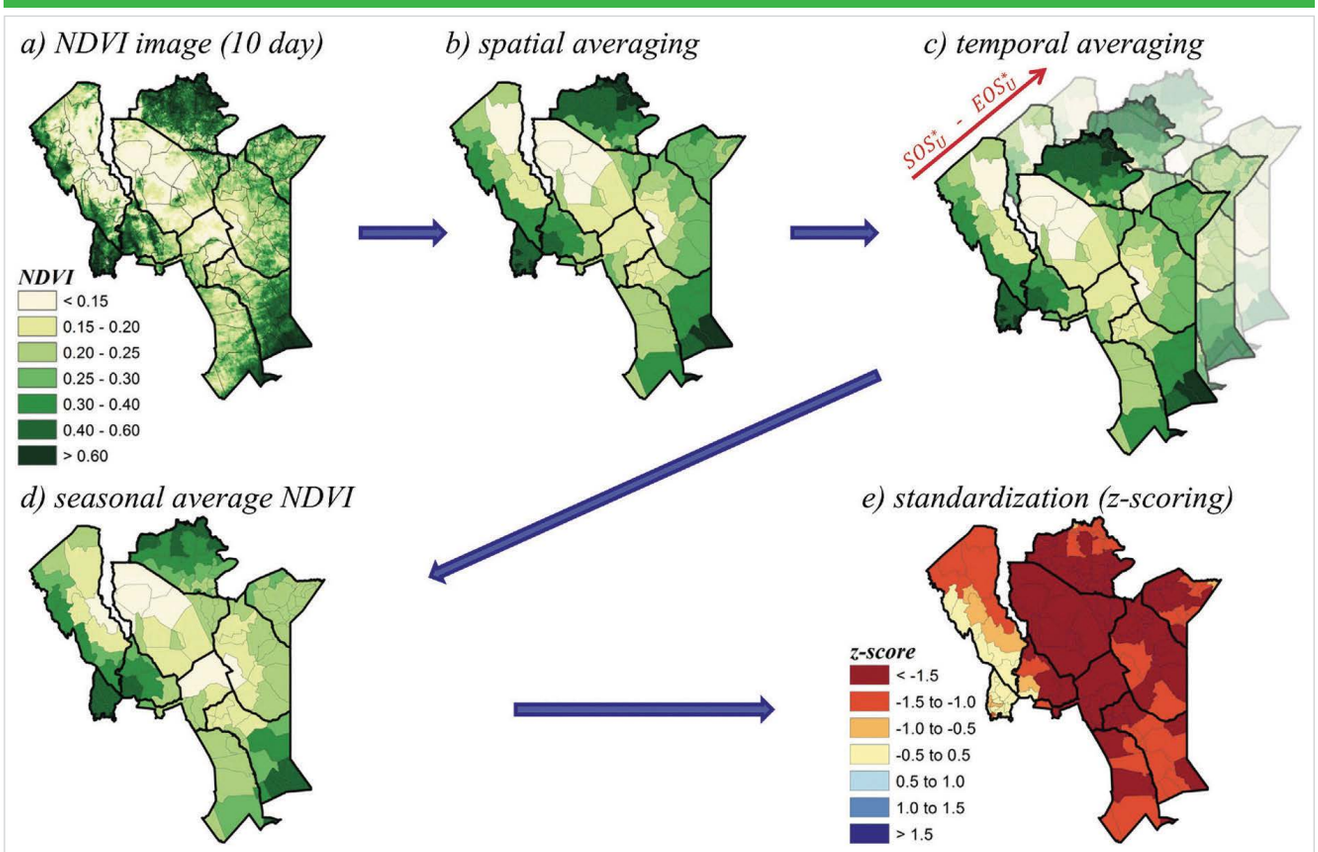
Index design

The IBLI product relies on NDVI time series acquired from the MODIS satellite sensors (eMODIS product). The use of alternative satellite indicators, such as rainfall estimates or soil moisture, was not considered in this study as currently there are no products designed for African pastoral regions based on these alternative indicators (Fava and Vrieling 2021). While in principle they could offer a valuable alternative, rigorous research and quality assessments would need to be performed prior to their use.

To transform the NDVI into a useful index for pastoral IBDRFI schemes, three steps are required (Figure A2.1):

1. Spatial aggregation: Geographic units are normally larger than grid cells, both for operational reasons and to reflect that herds move. Aggregation within units generally incorporates a mask of where rangelands occur.
2. Temporal aggregation: Most schemes assess seasonal forage scarcity, which requires expert or EO-derived [32] knowledge on rainfall/vegetation seasonality.
3. Normalization to compare the current index values against historic index realizations in previous years.

FIGURE A2.1 IBLI PRODUCT DESIGN



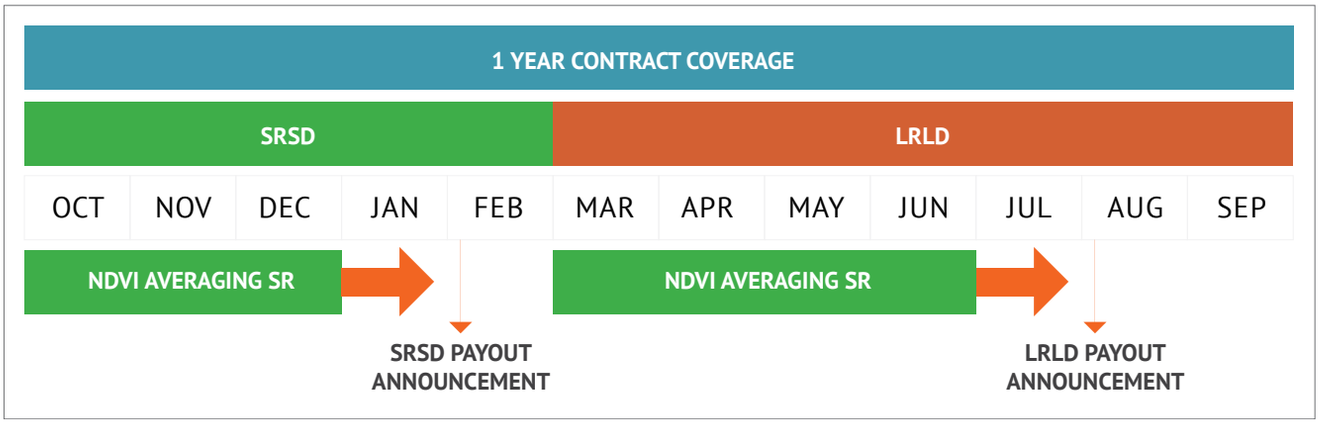
Source: Vrieling et al. 2016

Spatial aggregation units are level 2 administrative units. Insurance units are generally defined in collaboration with local stakeholders according to set criteria (Chelanga et al. 2017), but this would be out of scope for a feasibility study. However, it should be noted that this is a very important step that requires planning in the early implementation steps.

Temporal aggregation is set to seasonally aggregated data. To define the pasture growing season temporal boundaries, unit-level start of season (SOS) and end of season (EOS) dates are estimated using the Joint Research Centre phenology maps.[24] When the spatial variability of SOS and EOS is limited, fixed dates can be used. For Mali, the SOS was fixed to June and the EOS to November. Figure A2.2 shows an example of the temporal aggregation in the KLIP program.

Depending on the type of IBDRFI instrument used, the temporal aggregation can be customized. For example, running averages (e.g. monthly and quarterly) have been proposed and utilized as alternatives (e.g. in the Hunger Safety Net Program in Kenya).

FIGURE A2.2 IBLI KLIP CONTRACT COVERAGE AND INDEX CALCULATION PERIODS AND TIMING OF PAYOUTS (KENYA)



Source: (Fava et al. **2021)**

The normalization approach is based on the use of standard scores. However, multiple options exist, such as linear scaling between minimum and maximum historic values (i.e. the vegetation condition index), percentile calculation or per cent deviation from average. However, it is not expected that there will be major implications on the payouts related to the normalization metric used.

Payout function

The formulation of the payout function is a linear function of the index value between an index attachment and an index exit threshold. Payouts range from 0 (below the attachment value), to a predefined maximum value (below the exit). In the standard model, the attachment threshold is calculated at unit level in terms of expected payout frequency (i.e. 1 out of 5 seasons) on the historical data set. The exit threshold is set to the minimum historical index value. The maximum payout is calculated as the cost of maintaining the livestock alive during a severe drought shock.[25] These parameters are not constant across IBDRFI programs and need to be individually customized.

The standard payout function is applied to the end of season index values (in agreement with the temporal aggregation step described above (Appendix 2). However, options for multiple seasonal payouts (e.g. one early and one end of season) have also been proposed and utilized. The early payout is not a fully independent payout, but an anticipation of the main payout.

Alternative formulations of the payout function have also been proposed, but not yet applied in operational programs in Africa. For example, an alternative formulation of the payout function is based on the persistency of forage deficit conditions rather than the seasonally aggregated values. In this case, when index values fall below a predefined attachment threshold for a given number of consecutive time periods (e.g. 2 or 3 decads), payouts are triggered. The payouts increase proportionally to the length of the forage-deficit period till a maximum payout is reached.

24. Available at https://mars.jrc.ec.europa.eu/asap/

25. In Kenya, the monthly sum insured is currently 1,167 Kenyan Shilling (KES) per TLU per month (KES amount = USD 1.00 at date) to cover the costs of purchased fodder and feed supplements. The Kenyan IBLI programs provide payouts to enable pastoralists to purchase supplementary feeds for their animals over the 5-month short rains dry season (October to February) and for the 7-month long rains dry season (March to September). Therefore, the sum insured to feed 1 TLU over 12 months is KES 14,000 (KES amount = USD 1.00 at date) per TLU.

Appendix 3. Technical feasibility assessment methods

The technical feasibility analysis was based on the standard IBLI product. This product has been specifically designed and tested for extensive pastoral systems of east Africa. Therefore, a few conditions need to be met for its use in different geographic contexts as discussed below. In addition to these requirements, the product can be refined, customized and improved upon to reflect conditions within a specific country.

To be technically suitable, three major factors are considered:

1. **Dominance of extensive rangelands to provide clear linkages between satellite NDVI values and ground forage conditions.** The estimation of forage indices is built on spatial aggregation of predefined units, IUs. Thus, heterogeneous landscapes, such as agro-pastoral systems, mixed crops, agroforest areas, non-forage production areas etc. are challenging to drought index design and are not suitable for IBLI.
2. **Sufficient forage production that can be detected by satellite NDVI.** Since NDVI is used as an indicator of forage availability for determining insurance index and payouts, rangelands that have little or no forage resources, such as barren lands, must be identified and masked out from the index calculation. Similarly, areas with no inter-annual variability (e.g. evergreen vegetation, water and artificial surfaces) must be identified and excluded.
3. Clear seasonal patterns for both wet and dry seasons to allow the identification of the risk period and related insurance parameters (i.e. coverage period, sales windows and time of payouts).

To determine rangeland dominance, forage availability and seasonality, the analysis was based on various satellite products (Table A3.1), including 10-day eMODIS[26] NDVI time series at 250 meters spatial resolution, decadal rainfall estimates from CHIRPS data (CHIRPS; Funk et al. 2015) available at a spatial resolution of 0.05° for the period 2002-20, land cover characteristics defining cropland/rangeland extent derived by the Copernicus Global Land Cover product and phenological metrics for the number of growing seasons (NGS), SOS and EOS obtained from the Joint Research Centre. The metrics NGS, SOS, and EOS are derived from the long-term average of eMODIS NDVI data at 1 km resolution for the period 2003--16 (Klisch et al. 2016).

26. Earth resources Observation and Science Moderate Resolution Imaging Spectroradiometer.

Photo credit: EAP Photo Collection/ World Bank

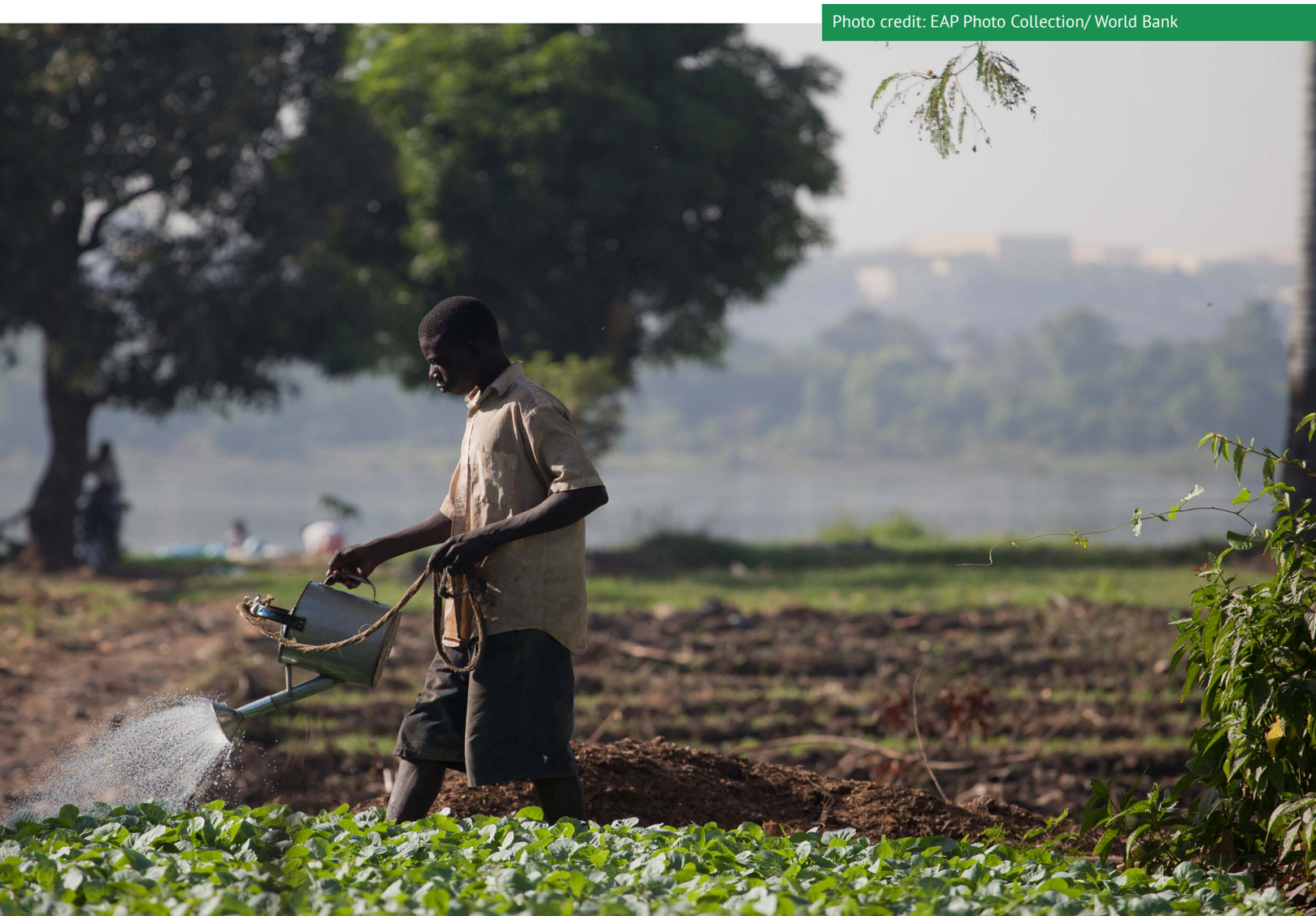


TABLE A3.1 SATELLITE DATA PRODUCTS USED IN THE STUDY

Data	Product	Description and Source
NDVI	◆ Normalized difference vegetation index	◆ A 10-day temporal smoothed NDVI product at 250 m spatial resolution covering the period July 2002 to July 2020 ◆ From eMODIS, United States Geological Survey
Land cover	◆ Copernicus Global Land Service: Land Cover 100 m: ◆ Collection 3: 2019 epoch (Globe) ◆ Copernicus Global Land Service ◆ Fractional covers for: grass, shrubs, trees, bare and built-up areas and croplands	◆ A global near real time annual product for the 2019 epoch collection 3 land cover maps at 100 m spatial resolution. ◆ These are produced by the global component of the Copernicus Land Service, derived from the Project for Onboard Autonomy-V satellite observations and ancillary datasets ◆ The global map includes a discrete classification with 23 classes aligned with the UN-FAO's land cover classification system (Meroni 2018) ◆ Global land cover fractions, i.e. percentage of ground cover for the four main classes used in the analysis for 2019
Phenology	Phenological timings ◆ Number of growing seasons ◆ Start of season ◆ End of season	Three products were used: ◆ Number of growing seasons per year ◆ Start of season and ◆ End of season ◆ The IGAD region has both unimodal and bimodal precipitation regimes, thus each season has a start and end ◆ These metrics were derived from long-term averages of the 10-day MODIS NDVI data produced by BOKU university at 1 km resolution for the era 2013-16 (Klisch et al. 2016) and the European Joint Research Centre
Precipitation	◆ Climate Hazards Group Infra-red Precipitation with Station data	◆ Computed decadal averages using the 10-day product for Kenya for the years 2002 to 2018, available at 0.05° (Funk et al. 2015)

The classification approach used for each criterion is described below. All unit-level analyses were conducted at administration level 2 spatial aggregation.

1. **Dominance of extensive rangelands.** To determine rangeland extent and dominance, the Copernicus fractional cover products for 2019 available at 100 m spatial resolution (Table A3.1) were used in a decision tree classification format. In the decision tree classification, firstly, a savanna layer was produced by summing the shrubs, herbaceous and herbaceous wetland fractional covers. The savanna layer created coupled with the continuous field layers of built-up and croplands (both referred to as human landscapes), trees and bare land fractions, were used in the classification approach to create ad-hoc rangeland masks within the insurance units.

To assess the rangeland dominance at unit level, the following conditions for the fractional covers were considered to determine their suitability class:

- Rangelands where human landscapes and tree cover are both ⩽ 25% and bare lands cover ⩽ 20%, were **classified as suitable.**
- Rangelands with human landscapes > 25 but ⩽ 40% and tree and bare lands cover as stated above were classified **as suitable but needing rangeland review** before implementation to ascertain their use as pastoral or agro-pastoral areas.
- All the remaining areas were classified as non-suitable.

2. **Sufficient forage production.** The unit-level forage availability was evaluated to eliminate areas with NDVIs that were too low (e.g. bare lands) or with no inter-annual variability as these are unsuitable for IBLI implementation. To this end, a valid pixel mask was generated first by computing the NDVI amplitude as the difference between the 95th and 5th percentiles of NDVI values in the full time series and masking out pixels with amplitude values < 0.1 (Vrieling et al. 2016). To eliminate non-land areas, pixels where the NDVI time series comprised < 60% of positive NDVI values were masked out.

The generated mask for 'valid' and 'non-valid' pixels was finally used at unit level to assess the overall feasibility classes, considering the following conditions:

- If a unit comprised of ⩾ 50% valid pixels, then then it was classified as **suitable.**
- If the non-valid pixels in the unit were > 50%, then the unit was classified as **suitable but needing forage review,** to allow further considerations by users on the extent of forage availability for pastoral use.

3. **Clear seasonal patterns.** The seasonality conditions were assessed by extracting the phenological metrics NGS, SOS and EOS per insurance unit, with further refinement using average precipitation and NDVI profiles. Two seasonality classes were derived:
   - clear if the season had well-defined wet and dry seasons and
   - **undefined** if seasons were not clearly defined.

IBLI feasibility classification

Using scoring criteria, the three conditions of rangeland dominance, sufficient forage production and seasonality were merged to produce four feasibility classes (summarized in Table A3.2):

- Suitable
- Rangeland review
- Forage review and
- Unsuitable.

TABLE A3.2 INDEX-BASED LIVESTOCK INSURANCE FEASIBILITY CLASSIFICATION CRITERIA

Rangeland Condition	Forage Condition	Seasonality Condition	Feasibility Class
100% satisfied	100% satisfied	100% satisfied	Suitable
Partially satisfied	100% satisfied	100% satisfied	Rangeland Review
Fully/Partially satisfied	Partially satisfied	100% satisfied	Forage Review
Not met	Not met	100% satisfied	Unsuitable

Appendix 4. Stakeholder engagement

Based on the scoping mission literature review, key stakeholders were identified for further information and fact-finding, to assess the socio-economic and operational feasibility of a drought risk financing product. The stakeholders were representatives from the insurance markets (private and public sector, regulators, members of government bodies, financial organizations, international development organizations and local pastoral groups). A list of key stakeholders is provided in Table A4.1.

TABLE A4.1 LIST OF STAKEHOLDERS

No.	Type	Stakeholder
1.	Insurance providers	NSIA Assurance OKO Mali
2.	Financial organizations	National Bank of Agriculture Development Baobab Micro-finance
3.	Telecommunication companies	Malitel
4.	Government bodies	Financial Sector Development Strategy and Monitoring Support Unit (Ministry of Economy and Finance) Direction Nationale des Services Vétérinaires(ministry of livestock) National Directorate of Animal Productions and Industries(ministry of livestock)
5.	International development organizations	PADEL-M SNV WFP
6.	Pastoral organizations	RBM

Appendix 5. Scenario analysis

The assumptions made for scenario PS1 (commercial micro-insurance) and PS2 (social livelihoods protection) are presented in Table A5.1. These assumptions are based on very general and simplified considerations, therefore, the presented costs should be seen as purely illustrative.

TABLE A5.1 SUMMARY OF THE ASSUMPTIONS MADE IN THE COSTING ANALYSIS

Item	Micro-level commercial insurance (PS1)	Macro-level social protection coverage (PS2)	Authors' assumptions
Uptake in five years	◆ 2,5% of total herd ◆ 0.5% per year increase rate	◆ 5% of total herd ◆ 1% per year increase rate	◆ Uptake levels are generally lower in PS1, while they can be predefined in PS2
TLU per policyholder/ beneficiary	5	5	◆ Aligned with existing programs[27]
Total sum insured/TLU	USD 150	USD 150	◆ Indicative average value provided by stakeholder during interviews
Trigger frequency	1 in 5	1 in 5	◆ Realistic frequency in the country
Premium rate	Pure loss rate * 1.5	Pure loss rate * 1.3	◆ Higher commercial loadings are expected for PS1 ◆ These loadings are at the lower end of the typical loadings applied internationally by the insurance sector and should be carefully reviewed for the local markets
Subsidies (government or donors)	50%	100%	◆ PS1 is partially subsidized ◆ PS2 needs to be fully subsidized ◆ However, any intermediate subsidy option is also possible

27. Five TLUs have been selected on the KLIP and SIIPE macro-level social safety-net protection insurance programs, as this is the minimum number of 'breeding' stock/ TLUs required to maintain a viable herd through times of severe drought. However, this value is country specific.

Item	Micro-level commercial insurance (PS1)	Macro-level social protection coverage (PS2)	Authors' assumptions
Registration costs (government or donors)	-	USD 5 /beneficiary	◆ For PS1 the cost is covered by the private sector ◆ The amount is purely illustrative
Awareness creation	USD 5 / policyholder	USD 5/beneficiary	◆ This is an important component to support markets and inform demand
Monitoring and evaluation	USD 5/beneficiary	USD 5/beneficiary	◆ This is an important component to demonstrate the value of the initiative ◆ The amount is purely illustrative

The yearly and total indicative costs for the two scenarios are presented in Tables A5.2 and A5.3. The premium paid by each policyholder for each TLU in the S1 scenario can be obtained from the formula: (premium-subsidy)/TLUs.

TABLE A5.2 ANNUAL AND TOTAL COSTS FOR FIVE YEARS OF THE MICRO-LEVEL COMMERCIAL INSURANCE IMPLEMENTATION

	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Beneficiaries	5,000	10,000	15,000	20,000	25,000	75,000
TLUs	25,000	50,000	75,000	100,000	125,000	375,000
TSI (USD)	3,750,000	7,500,000	11,250,000	15,000,000	18,750,000	56,250,000
Premium (USD)	598,853	1,197,706	1,796,559	2,395,412	2,994,265	8,982,795
Subsidy (USD)	299,426	598,853	898,279	1,197,706	1,497,132	4,491,397
1. Electronic registration of livestock producers	0	0	0	0	0	0
2. Farmer awareness, education and training (USD)	25,000	50,000	75,000	100,000	125,000	375,000
3. Monitoring and evaluation (USD)	25,000	50,000	75,000	100,000	125,000	375,000
Total (USD)	349,426	698,853	1,048,279	1,397,706	1,747,132	5,241,397

TSI = Total sum insured

TABLE A5.3 ANNUAL AND TOTAL COSTS FOR FIVE YEARS OF MACRO-LEVEL SOCIAL PROTECTION COVERAGE IMPLEMENTATION

	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Beneficiaries	10,000	20,000	30,000	40,000	50,000	150,000
TLUs (USD)	50,000	100,000	150,000	200,000	250,000	750,000
TSI (USD)	7,500,000	15,000,000	22,500,000	30,000,000	37,500,000	1,12,500,000
Premium (USD)	1,056,799	2,113,599	3,170,398	4,227,198	5,283,997	15,851,991
Subsidy (USD)	1,056,799	2,113,599	3,170,398	4,227,198	5,283,997	15,851,991
1. Electronic registration of livestock producers (USD)	50,000	50,000	50,000	50,000	50,000	250,000
2. Farmer awareness, education and training (USD)	50,000	100,000	150,000	200,000	250,000	750,000
3. Monitoring and evaluation (USD)	50,000	100,000	150,000	200,000	250,000	750,000
Total (USD)	1,206,799	2,363,599	3,520,398	4,677,198	5,833,997	17,601,991

TSI = Total sum insured

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