



InsuResilience
Solutions Fund



Prefeasibility Study on Large-Scale Smallholder Farm Drought Insurance in South Africa

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Contents

- 1. Executive Summary 3
- 2. Introduction 4
- 3. Demand survey 6
 - 3.1 Smallholder farmer Strategic challenge 6
 - 3.1.1 Role and structure of agriculture in South Africa7
 - 3.1.2 Smallholder producers7
 - 3.2 Definition of Target Group 9
 - 3.3 Smallholder Farmers Survey 11
 - 3.4 Engagement with co-operatives and other stakeholders 12
 - 3.5 Scalability based on demand assessment 13
 - 3.6 Potential distribution channels 14
- 4 Data Consideration 14
 - 4.1 Data availability 14
- 5. Business model concept 18
- 6. Product Design Considerations 21
 - 6.1 Crop Insurance 21
 - 6.2 Pasture Drought Index Insurance (PDII) 22
 - 6.3 Spatial Considerations 22
 - 6.4 Area Yield Index Insurance (AYII) Crop Insurance 23
 - 6.5 Pasture Drouth Index Insurance (PDII) 25
 - a. General Product Considerations 29
- 7. Project management timeline 30
- 8. Annexure A – Smallholder Survey Questionnaire 33
- 9. Annexure B – Drought Insurance Survey 36

1. Executive Summary

Land Bank Insurance (SOC) Limited of South Africa and CelsiusPro join forces to develop and introduce an index drought insurance scheme (area-yield for crops and NDVI for livestock) consisting of both crop and livestock insurance for smallholder farmers in South Africa. South Africa is vulnerable to climate change and El Niño, that can further exacerbate the drought.

We target farmers that produce food for home consumption and selling surplus to the market. They live with less than USD 15 per day and person. There are roughly 250,000 smallholder farmers in South Africa, falling into the target group. These farmers are vulnerable and without any level of preparedness for mitigating drought risk. Farmers and their families are at risk of going hungry, losing their income, and being forced to leave their land and move to urban slums.

For both crop and livestock farmers, we propose to use index insurance, namely area-yield index insurance for crop and for livestock we propose pasture drought index insurance. Based on a first analysis, it seems that area-yield index insurance based on yield data from Department of Agriculture, Forestry and Fisheries can be suitable. If in a thorough data analysis, it is found that yield data is not suitable for area-yield index, then an adequate weather-index insurance will be structured. Index insurance is very cost-efficient and offer insurance to target groups which otherwise could not be financially included. Index products trigger pay-outs based on breach of an objective and pre-agreed index. The index insurance will be bundled with loans from co-operatives and Land Bank on a mandatory basis.

Land Bank Insurance Company (LBIC), together with its mother company Land Bank (LB), is specialised in agriculture and mandated by the government to facilitate access of poor and vulnerable population to financial services.

For insurance for smallholder farmers, distribution is key. Distribution in our case will be executed through an extensive network with existing members. The network consists of LBIC, LB with its satellite offices and branches and farming co-operatives such as TWK, Unigro, VKB, GWK and Suidwes Operatives. This adds up to over 21,500 active clients (15,000 Land Bank + 6,500 co-operatives) that can be offered insurance cover and a whole pool of new clients, who were previously declined, due to lack of collateral.

LBIC will set-up an insurance platform, that allows for automated pricing, booking and administration of insurance policies. LBIC's partnership with CelsiusPro aims at best-in the class IT solution, as CelsiusPro has developed a proprietary platform designed to be plugged in to the existing IT environment and introduce index insurance products into the company's product offering.

LBIC together with CelsiusPro is well placed to introduce large scale smallholder farm drought insurance in South Africa. The demand and need for such insurance are clearly there. LBIC wishes to serve and protect the previously excluded and marginalized smallholder farmers population and ensure they will be able to build up appropriate coping mechanisms against extreme weather events.

2. Introduction

Land Bank Insurance (SOC) Limited of South Africa and CelsiusPro, plan to develop and introduce an index drought insurance scheme (area-yield for crops and NDVI for livestock) consisting of both crop and livestock insurance for smallholder farmers in South Africa. Drought is the predominant peril affecting the low-income and vulnerable farming population in South Africa, a semi-arid country. As such an insurance product of this nature is critically important for the sustainability of agriculture in South Africa.

It is estimated, there are approximately 250,000 smallholder farmers in the country, mainly uninsured against weather related risks. The Department of Agriculture, Forestry and Fisheries (DAFF) defines smallholder farmers as those who “produce food for home consumption, as well as sell surplus produce to the market”, meaning that earning an income is a conscious objective distinct from “subsistence/resource-poor producers” who produce mainly or entirely for own consumption. The smallholder farmers as defined as such in South Africa typically produce on a land size of up to maximum 20 hectares. Large acreage per head in the definition is explained by the vast size of available land in South Africa. However, most of these smallholder farms in the former homelands on less than one hectare. Moreover, size of the land available for farming doesn't necessary translate to the ease of living, with 25.2% (or 13.8 million) of population living below the food poverty line. Statistics South Africa defines the poverty line as the amount of money that a person needs every month to purchase enough food to consume around 2,100 calories per day. In 2015, the Eastern Cape had the highest share of poor residents at 72.9%. and at the same time the highest percentage of smallholder farmers and the highest engaged in livestock, grain and oilseed farming¹.

The National Treasury (NT) and the DAFF have identified smallholder producers in the grain, oilseed, and livestock value chains as the priority population group for a potential intervention in the insurance market that would support the policy goal of improving economic transformation in South Africa. Based on discussions with government, this includes the assessment of the feasibility and indicative fiscal cost of three potential government interventions in agricultural insurance:

- a) for commercial farmers, risk-sharing to help rebuild the existing Multi-Peril Crop Insurance (MPCI) market;
- b) for smallholder crop producers, developing an Area Yield Index Insurance (AYII) program; and
- c) for smallholder livestock producers, developing a Pasture Drought Index Insurance (PDII) program.

The South African agricultural insurance market has experienced significant contraction in the past several years due to poor results. Only three² out of 81 general insurers in South Africa offer crop and livestock insurance products with limited reinsurance capacity available. This insurance offering is largely for commercial farmers and there are no specific products designed for the smallholder farming community.

The South African crop and livestock insurance market has traditionally targeted the risk transfer needs of commercial farmers only. Currently, only one agricultural insurer (Old Mutual Insure) offers a product aimed at smallholder farmers providing livestock mortality cover. As a result, market penetration of agricultural insurance for smallholder farmers is less than 1%. Index-based insurance is a form of insurance in which claim payments are based on values obtained from an index that serves as a proxy for losses rather than upon the assessed losses of each individual policyholder. Although index-based insurance can be used to mitigate or reduce the impact of a

¹ <https://africacheck.org/factsheets/factsheet-south-africas-official-poverty-numbers/>

² Land Bank, Old Mutual, Santam.

wide range of risks, its most prominent use in the developing world is to manage weather risk, in particular in the agricultural sector.

The consolidated MPCI insurance market results for the period 2001/05 to 2014/15 have indicated that MPCI insurers have incurred negative underwriting results in six of the past 11 years. This led to the MPCI premium increase and a supply contraction at the same time, as a result of insurers trying to blow up their margins on MPCI to make up for the losses in the past and pull out from money losing MPCI business. The restricted supply of MPCI has severely affected insurance penetration among commercial grain producers, approximately 80 percent of whom do not purchase cover, as it is not financially sustainable given their net revenues from grain production. Indemnity MPCI insurance product being too expensive, there is a clear need for a cheaper alternative. Index insurance has low operational costs, as there is no need to pay for claims adjustments and the pay-out is automatically triggered upon the breach of pre-agreed index. This is the main reason why an introduction of an index-based insurance solution is critical for the South African Insurance Market to enable insurers to develop and offer affordable insurance to the smallholder farming community.

Index-based insurance has had a relatively short history and was first introduced during the 1920s by an Indian scholar who proposed the use of area-yield insurance rather than individual farmer yield insurance. Due to its relatively short history, very few countries have developed the legal and regulatory frameworks necessary for index-based insurance products.

As individual loss assessments are not conducted, index-based insurance can significantly reduce the cost and administrative delay from the traditional use of insurance claims assessors and may therefore allow for faster claims processing and lower costs. Additionally, index-based insurance can help to reduce moral hazard and anti-selection and address correlated weather risks. This will allow for the development of affordable products that could support the smallholder farming industry and provide a means for smallholder farmers to obtain more affordable agriculture production loans.

The Land Bank Insurance (LBIC) is registered insurance company, whose main objective is to provide insurance to farmers and the overall agricultural sector. LBIC is subsidiary of the Land Bank. Land Bank is a wholly government owned Development Finance Institution, with National Treasury as bank's key shareholder. Land Bank provides financial services to the farming sector. The bank has a mandate to make available new, appropriately designed financial products for clients from historically disadvantaged backgrounds. Therefore, the Bank's core mandate includes the following objectives:

- Provide finance for emerging farmers in pursuit of the equitable ownership of land, agrarian reform and land distribution.
- Remove the legacy of past racial and gender discrimination.
- Promote food security and support commercial agriculture.

Land Bank is currently providing loans and financial services to commercial and mid-sized farmers but has a clear mandate from the government to access the smallholder community. Land Bank Insurance has taken on the mandate of its mother company and aims to contribute with its own means. As a consequence, LBIC wishes to launch an agricultural insurance for smallholder farmers – group of clients who are currently untapped not only by LBIC, but also by the whole insurance market in South Africa. Providing agricultural insurance to small holder farmers will enable them to build up financial security and have the collateral needed to acquire an agricultural loan. At later stage, it might be possible to create a blended product of loan and insurance tailor-

made for smallholder farmers. LBIC is therefore working towards launching a drought insurance scheme, targeted at smallholder farmers in South Africa.

The consortium implementing above mentioned index drought insurance scheme will be a newly formed public-private partnership with the state-owned Land Bank Insurance Company (LBIC) and private-sector company CelsiusPro, supported by an international reinsurer. Furthermore, the collaboration includes Land Bank and farming co-operatives such as TWK, Unigro, VKB, GWK and Suidwes Operatives. These farming co-operatives already have existing intermediary agreements with LBIC on the provision of crop insurance for commercial farmers.

It is against this background that a study is necessary in order to among others, assess demand for the drought insurance for crop and livestock; obtain a better understanding of market dynamics and development of a business model concept for the drought-insurance scheme. Furthermore, the South African Government in principle agreed to collaborate with the private sector to explore possibilities of a government premium subsidy for agricultural insurance schemes in general. LBIC with its link to the National Treasury is in a good position to not only eventually benefit from the governmental premium subsidy, but also from the political support needed to be aligned with the nationwide insurance scheme, should there be one. This initiative by LBIC in partnership with CelsiusPro will provide the necessary blueprint and piloted data necessary to plug into the bigger government initiative.

3. Demand survey

3.1 Smallholder farmer Strategic challenge

Part of the Land Bank Insurance's mandate involves bringing farmers from previously marginalized groups into the mainstream of South Africa's agricultural sector. The reason is that these groups are typically smallholders without access to risk mitigation mechanisms available to larger commercial farmers, such as insurance that covers for losses in case of extreme weather. With no risk mitigation, there is a full exposure especially to the risks of drought and subsequent loss of output of farming. This creates an uncertain environment for smallholders, with unfavourable economic and social consequences. The money they invested in their farming production is lost. As a result, reinvestment into production is minimal, assets are put in jeopardy and smallholder farmers are viewed as unattractive clients to financial institutions. As an example, Land Bank has currently set a minimum lending amount of ZAR 250k³, which is too high for smallholder community, living of maximum USD 15 per day⁴. Smallholders are therefore limited in their capacity to invest in improved and innovative agriculture methods. It becomes impossible or very difficult for smallholders to escape poverty. Overall, the agricultural sector tends to produce less than its potential, with a negative impact on society in terms of growth, rural employment, and food security⁵.

Traditional approaches to agricultural insurance (where each policyholder is indemnified against their own crop loss) aimed at smallholders have been unsuitable. This is as the costs of upfront, on-going and claims underwriting become prohibitively expensive, relative to the low sums insured and hence low premiums typically charged to smallholders. Average MPCl premium charged by LBIC on their commercial business equate to 8% of sum insured with application of

³ Land Bank application documents

⁴ <https://m.fin24.com/Economy/more-than-50-of-sas-population-is-living-in-poverty-20170822>

⁵ <http://www.arc.agric.za/arc-iscw/News%20Articles%20Library/Challenges%20and%20constraints%20for%20small-scale%20farmers.pdf>

high deductibles (30%) and risk sharing to reduce the impact of the company's loss from MPCl. In addition, insurance coverage is limited to a maximum of 65%. These deductibles, risk sharing structures and limited guaranteed yield would not be affordable for poor and vulnerable farmers who live on a maximum of 15 US dollars per day and would not comprehensively protect poor farmers as they do not have capacity to retain any risk. In response to this, attempts to reduce or remove underwriting have resulted in insurance programs fraught with moral hazard, adverse selection and fraud.

3.1.1 Role and structure of agriculture in South Africa

Agriculture contributes minimally to South African Gross Domestic Product (2.5%) but nonetheless plays a significant indirect role in the economy through its linkages to other sectors, in particular manufacturing (World Bank, 2016). Approximately 70% of agricultural output is used as intermediate products in the manufacturing sector (DAFF, 2015b). An estimated 869,000 South Africans (2%) are employed in agriculture, a figure that has been declining since the late 1980s as farm sizes increased (DAFF, 2015c; DAFF, 2015b).

Agriculture in South Africa is characterized by a dualistic production system where approximately 40,000 large commercial farmers produce 95% of agricultural output and approximately 250,000 smallholder farmers produce the remainder (DAFF, 2015a; de Klerk et al., 2013; Pringle et al., 2014). A further 1.5 million subsistence farmers produce only for consumption, mostly through back yard farming (DAFF, 2015c; de Klerk et al., 2013). The initial focus for the drought insurance scheme is on the 250'000 smallholders who produce food for home consumption, as well as sell surplus produce to the market. The average household size is 6 people (2 spouses, 2 children, 1 elderly family member, 1 additional family member)⁶. This segment has higher likelihood of obtaining credit because of their business approach to farming. Therefore, the market is well suited for supporting the strategic distribution approach of linking credit with insurance through cooperatives. Once distribution channels are fine-tuned, the drought insurance scheme has potential to be expanded to the broader subsistence farmer segment.

Within the target segment of 250'000 smallholder farmers we further differentiate between crop and livestock producers. Crop farming includes vegetable, fruit, industrial crops, and grain and other food crops. Approximately 52'500 farmers fall into this category nationwide, by either farming grains only, or both livestock and crop⁷. Livestock is considered to be cattle, sheep, goats, pigs, poultry and animal combination, all of which are in scope. Livestock only farming represents 43% of all smallholder farming in South Africa. There are 107'500 smallholder livestock farmers and 25'000 mixed farmers farming both crops and livestock⁸. The overall demand for livestock insurance is 130'000 farmers at nation level.

3.1.2 Smallholder producers

Reliable information on smallholder producers in South Africa, including number, location, and farming practices, is not currently available, a situation that creates a significant challenge for the

⁶ Final research report, October 2018 (Accenture, SAIA, sasria, World Bank Group), page 16

⁷ Final research report, October 2018 (Accenture, SAIA, sasria, World Bank Group), page 9

⁸ Final research report, October 2018 (Accenture, SAIA, sasria, World Bank Group), page 9

design of an agricultural insurance program that targets this population. However, Land Bank and Land Bank Insurance has a clear mandate from the government to access this population and will find means of doing it. Distribution of insurance to smallholder farmers is key. Distribution is executed through an extensive network with existing members. The network consists of LBIC, LB with its satellite offices and branches and farming co-operatives such as TWK, Suidwes, AFGRI and OVK and Suidwes Operatives.

The index insurance will be bundles with loans from co-operatives and Land Bank on a mandatory basis. In case of a drought event, insurance payout will be made to the financier, i.e. the co-operative or Land Bank. This payout will go towards the farmer’s loan instalment, meaning that the farmer does not need to make any payment from their pocket for that season, this will result in more disposable income for the farmer to cover parts of the income so that the family can survive and stay on the rural lands. By paying the financier directly, the index insurance product will ensure that the farmer will not default on their loans, increase creditworthiness in future, ensure that interest is not escalated due to default on loans, and overall improve access to credit. This will in turn improve the resilience of smallholder farmers and allow more poor and vulnerable farmers to have access to credit. Previously, these farmers have been marginalized from main economic activities because of a lack of security. The proposed drought insurance product with the backing of cooperatives and the Land Bank has the capability of serving as security for financiers allowing for more lending to smallholders.

Insurance premiums will be added to the loan amount, this has the benefit of making the product more affordable as premiums will not have to be paid upfront, but rather combined with loan repayments, making it more appealing and manageable for poor and vulnerable farmers who have other competing priorities, such as provision of basic needs for their families.

Smallholders are categorized into three producer types based on level of both dependence on agricultural production for income and integration with the commercial market, with Type 3 being the most integrated (DAFF, 2013). Table 1 compares the DAFF agricultural population framework:

Table 1

Subsistence farmers	Smallholder farmers	Semi-commercial farmers
<p>SP1 – Smallholder producer type 1</p> <p>Smallholders for whom smallholder production is a part-time activity that forms a relatively small part of a multiple livelihood strategy. Some of these producers may aspire to grow their agricultural enterprise, but possibly at the expense of pursuing off-farm activities, therefore it is a risky prospect. It is worth bearing in mind that more than 50 percent of smallholder households live in poverty, and most of these appear to fall</p>	<p>SP2 – Smallholder producer type 2</p> <p>Smallholders who are more or less in the middle of the spectrum, meaning that they rely largely on their agricultural enterprises to support themselves and are not living in extreme poverty, but need further assistance both to expand production, join in the value addition and find markets.</p>	<p>SP3 - Smallholder producer type 3</p> <p>Smallholders who operate according to commercial norms but who have not reached the threshold at which they are obliged to register for VAT or personal income taxes. These smallholders tend to be capable all-round entrepreneurs; they often command large amounts of support from government by virtue of the fact that they tend to be mobile and vocal, but in reality, often have the capacity to sustain themselves and even grow on their own, not least by means of loan finance.</p>

into this category. This category of smallholders is worthy of focused support, not least to raise their households above the poverty line.		
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Sources: DAFF, 2013

Given the fact that LBIC has a mandate to access poor and vulnerable farmers, operating in the commercial market environment, **smallholder producer type 2** is the ideal target group for the drought insurance scheme. Smallholder producer type 2 lives in poverty but is able to maintain agricultural activity to produce food for home consumption and sell surplus to the market. This category is composed of 250'000 smallholder farmers, based on the "Final research report, October 2018 (Accenture, SAIA, Sasria, World Bank Group)"⁹.

The **smallholder producer type 2** category falls within the target of the InsuResilience initiative, that is aims to close the insurance coverage gap in the ODA¹⁰ countries, particularly the ones exposed to the extreme weather events. If we look at the official InsuResilience definition of the target group, it overlays the data on poverty and vulnerability in South Africa.

The target group for InsuResilience has been defined as follows:

- Extreme poverty: people with an income of less than 1.9US dollars per day (dollars based on purchasing power parity (PPP) calculations)
- Moderate poverty: people with an income of 1.9 to 3.1US dollars per day (dollars based on PPP calculations)
- Vulnerability: people with an income of 3.1 to 15US dollars per day (dollars based on PPP calculations)

More than half of South Africans were poor in 2015, with the poverty headcount increasing to 56% from a series low of 53% in 2011. The figures are calculated using the upper-bound poverty line of ZAR 992 per person per month in 2015 prices, or USD 2 per day¹¹. This translates into over 30,4 million South Africans living in poverty in 2015.

The drought insurance scheme will for now target the Type II category, Smallholder farmers, who are defined to produce food for home consumption and sell surplus to the market and who fulfil the international criteria of poor and vulnerable as defined in the InsuResilience initiative.

3.2 Definition of Target Group

The Eastern Cape, KwaZulu-Natal, Limpopo and North West Province have the highest concentration (67%) of smallholder farmers farming livestock, grain and oilseed. Most of these smallholder farms in the former homelands on less than one hectare where 42 percent raise livestock (mostly poultry, cattle, or a combination of animals), 31 percent produce only crops (including vegetables) and 22 percent practice mixed farming. Smallholders depend on rain fed-crop production, with 40% farming on dryland, 26% using irrigation and 34% using a combination of both.

⁹ South African Insurance Association

¹⁰ Official Development Aid

¹¹ OANDA currency converter, as at May 7th 2019 and R992/30 days

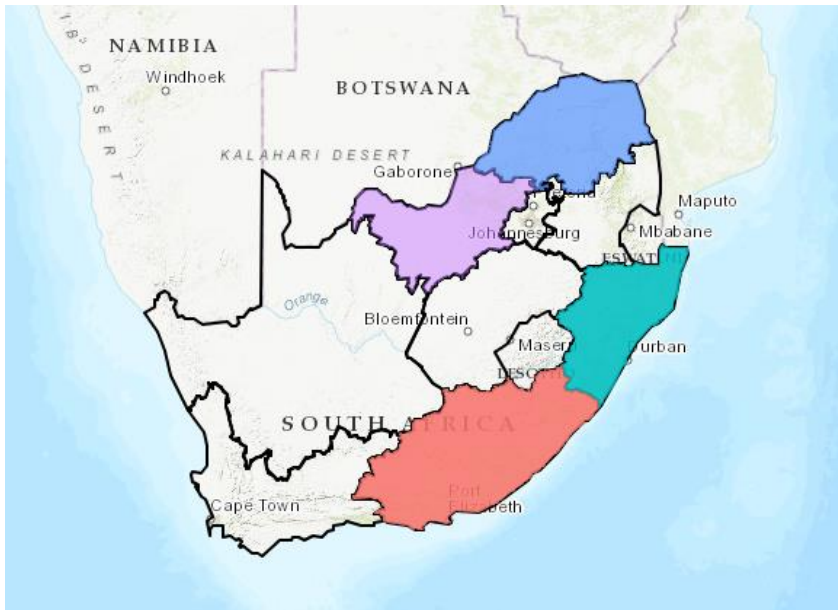


Figure 1: Majority of smallholder farmers live in Eastern Cape (orange), KwaZulu Natal (green), Limpopo (blue) and North West Province (violet).

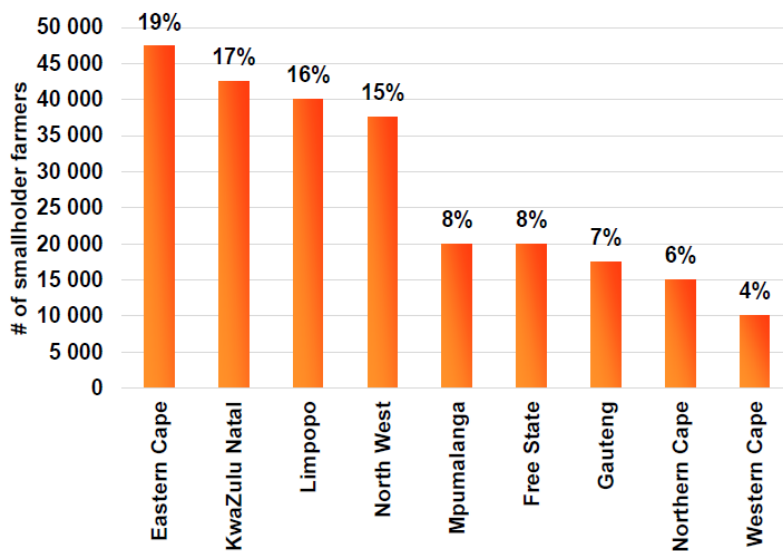


Figure 2: Smallholder farmer location by province

The most common traits of smallholder farmers within the targeted Provinces are as follows: Eastern Cape has the highest percentage of smallholder farmers and the highest engaged in livestock, grain and oilseed farming. The province is one of three, along with KwaZulu-Natal and Limpopo with mainly female smallholders. Smallholders in South Africa are predominantly black, and over 65, characterized by low levels of education and financial literacy, as well as low access to water and electricity, communal land.

Smallholder farmers have access to basic financial services but lack access to formal means of credit and insurance. Primarily, they have access to funeral and life cover which demonstrates capacity for financial product subscription, if adequately priced. Most smallholder farmers input costs go towards farm feed, maintenance and repairs as well as electricity and fuel costs. The overall rising input costs negatively affect affordability for insurance products. In a preliminary

study on smallholder farmers in South Africa, the potential demand for index based agricultural insurance is approximately ZAR 113,000 for livestock insurance contracts and ZAR 45,000 for crop insurance contracts (Accenture, 2018). In a survey study by the University of North West investigating farmers willingness to pay for livestock index insurance, 85% of smallholder farmers indicated that they may be willing to purchase index insurance and there is a strong willingness among this grouping to consider the insurance if premiums were subsidized.

3.3 Smallholder Farmers Survey

A survey of 61 smallholder farmers that are Land Bank clients was conducted in order to assess farmers awareness of agricultural insurance, understand the frequency of crop loss due to drought, obtain initial market insight of the demand for the drought insurance scheme, and to understand how drought affects livelihood (Annexure A). Farmers were sampled via a simple random selection from the Land Bank smallholder farmer loan book database. This loan book is geographically representative of the various provinces (figure 2). Per the loan book 59% of smallholders farm in the target group of Eastern Cape, KwaZulu-Natal, Limpopo and North West Province. The sampling includes a majority element of farmers within the target group. The interviews were conducted telephonically by LBIC operations personnel who have experience in administering the organization’s crop insurance portfolio. This ensured that all queries and matter of clarification could be adequately resolved. Results of the questionnaire indicate the following:

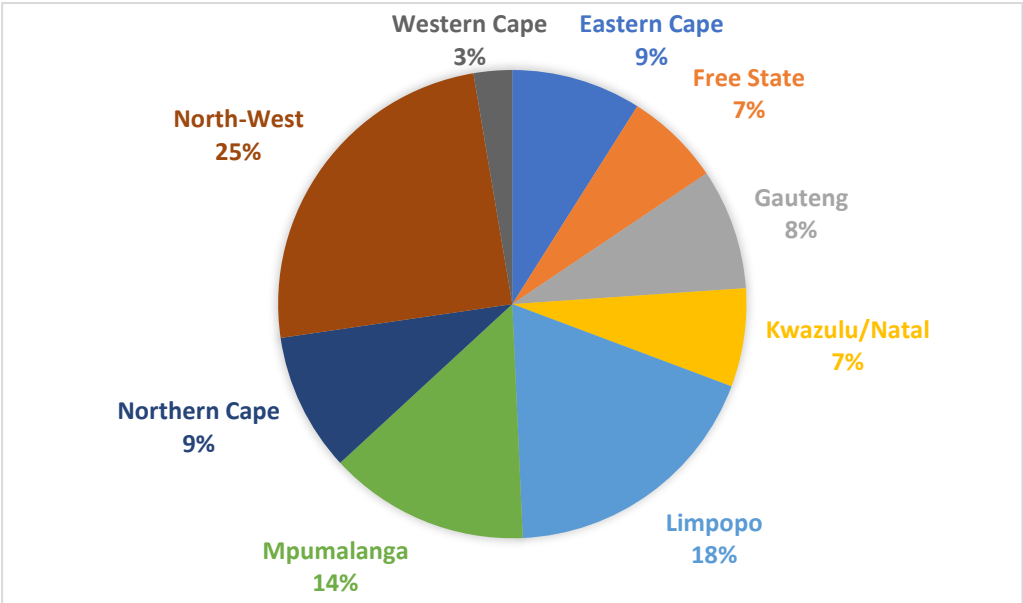


Figure 2: Land Bank smallholder farmer loan book

Demographics

73.8% of respondents were male and 26.2% female. Most of the sampled population (36.1%) were between the ages of 40-49 followed by 21.3% between the ages of 30-39. Only 10% of the sampled farmers were 70 years and older. Farming experience is evenly distributed, with a majority of farmers with 5 – 10 years’ experience. It is important to note; smallholder farmers have access to vast lands although not necessarily arable land. Farmers for this survey farm on diverse farmlands and farmers farm on bigger farm sizes. However we still find their input to the survey useful for understanding insurance needs. The farm sizes are diverse showing 31% farming on lands of more than 100 hectares (Crop and livestock farming), 23% on land between 11 and 30 hectares and 23% on less than 10 hectares, this includes smallholders farming on less than 1

hectare. Only 12% of South Africa's land can be used for agricultural production¹². The large tracts of land are based in the former homelands with a large portion of the land unutilized. The predominantly planted crops are maize (34.4%) followed by sunflower (21.3%).

Drought Risk Questions

54.1% of smallholders indicated that drought affects them every year, with 27.9% indicating that they are affected every 5 years. 47.5% of farmers lose half their crops when drought occurs, 26.2% lose more than a quarter and 26.2% lose less than a quarter. A significant 68.9% of farmers are of the view that the level of dryness has increased over the last 5 years, furthermore a substantial 60.7% of farmers indicated that they are not prepared for drought, with 19.7% indicating that they are somewhat prepared and an equal 19.7% indicating that they are very prepared.

Insurance Related Questions

93.4% of farmers have heard of insurance, mostly crop insurance, the level of knowledge around index-based insurance is very low since no index products are available in the South African market. When farmers were asked whether they would be interested in alternative coping mechanisms and the concept of index insurance was explained a substantial 95.1% indicated that would be interested in purchasing the product. Regarding existing agricultural insurance solutions, 50.8% of farmers indicated that they do not have crop or livestock insurance because premiums are too expensive and a further 32.8% indicated that they were not aware of such insurance. Most farmers indicated commercial banks to be their preferred channel for enrolment of crop/livestock insurance, with 60.7% of farmers indicated that they would be willing to pay a premium of 5% of their income to protect their crops or livestock.

Detailed results of the survey are presented on Annexure B. Overall farmers are affected by drought almost every year and the level of preparedness in managing drought risk is very low. A majority of farmers are aware of agricultural insurance, however they do not have insurance indicating that premiums are expensive. In conclusion, there appears to be significant demand for alternative insurance solutions with farmers willing to pay around 5% of their total income¹³ towards insurance. Specific questions on farmer income level was not included as an initial pilot sample, indicated general reluctance in responding to this question, particularly given the context that farmers have existing loans with the Land Bank and may have perceived this information as confidential.

3.4 Engagement with co-operatives and other stakeholders

Partnerships with Land Bank and established co-operatives, namely Transvaal Wattle Growers Co-operative Limited (TWK), Unigro Financial Services, NWK Limited, GWK, Obaro Holdings and Suidwes Beleggings provide a low-cost distribution model.

To date, Land Bank together with its service level partners (including the mentioned co-operatives) has disbursed ZAR 44 billion in loans to the farming sector, of which ZAR 4 billion has been disbursed to the smallholder target market group. Therefore, insurance is a key risk mitigating tool to reducing default risk as a result of drought. TWK and Unigro through its holding company Afrgi have specific smallholder development programmes in place and a vested interest in protecting their investment within this agricultural subsector¹⁴. Through these development programmes, the cooperatives have access to the target group and have the capacity and

¹² <https://www.brandsouthafrica.com/investments-immigration/business/economy/sectors/south-africa-agriculture>

¹³ Question on the level of income was specifically excluded. In the process of designing the question-naire and initially engaging a small pilot test for the questionnaire, farmers were reluctant to answer this question.

¹⁴ <https://twkagri.com/about-us/bbbeee-status> and <https://www.afrgi.co.za/harvest-time/>

capability to distribute the product. For livestock and crop production loans, LBIC will actively engage the Land Bank Board of Directors to consider the bundling of the drought insurance product with loan disbursements. It is envisaged that insurance premium will be added to the loan upon voluntary acceptance by the farmer. Should the index be triggered, a pay-out will be made to the financier towards reducing the farmers' loan balance.

Alternative distribution channels to be considered are Mobile Network Operators (MNOs) and Agribusiness which includes businesses within the agricultural value chain such as input suppliers' distributors, traders and processors. MNOs are commonly used for the distribution of mandatory and voluntary insurance products due to the increasing penetration of mobile phones. From an agriculture perspective, insurance is often bundled with farm inputs, or agriculture credit repayable post-harvest.

It is expected that a lot of the data and research conducted through the South African Insurance Association (SAIA) will be used to inform the final approach that this consortium will be focusing on. LBIC is a member of SAIA and the association has prepared a submission to the insurance regulator to have parametric insurance products approved within the legal framework of the country. This submission has been delivered to the insurance regulator and feedback is expected by July 2019. It is on the back of this collaborative approach that LBIC has taken the position to lead in developing suitable products for the smallholder farmer market. This is due to the fact that LBIC is a state-owned entity with a mandate to develop the agricultural sector particularly smallholder farming. In addition, the insurance regulator has indicated that submissions can be made for innovative insurance solutions for consideration. LBIC intends to submit a request in this regard to pilot the proposed drought Insurance scheme once the operational model hereto has been finalized.

3.5 Scalability based on demand assessment

South Africa has 250'000 smallholder farmers and a further 1,5 million subsistence farmers. There exists a great opportunity to penetrate the smallholder and subsistence sector in particular considering that there are currently no tailored agricultural insurance solutions for this market segment. Further, government support in the form of various programs supporting smallholders through loans and grants is on the increase along with calls for alternative and innovative financial mechanisms to be designed for smallholder farmers as there is an increasing awareness of the risk transfer role insurance plays. For example, in September 2018 government introduced a 4 year blended finance scheme¹⁵ consisting of 50% loan and 50% grant funding administered by the Land Bank where ZAR 300 million (USD 20,5mio¹⁶) has been designated to assist smallholder farmers for production (crop and livestock), asset acquisition and farm expansion purposes, from this blended finance initiative 6% of the fund has been ring-fenced for insurance purposes. This means that for all loans/grants provided to farmers, insurance is a prerequisite and a farmer will need to demonstrate that insurance is in place before funding can be disbursed. Therefore, the availability of drought crop and livestock insurance solutions is vital to service the expected increase in insurance demand among the smallholder market. Furthermore, to the blended finance, the Land Bank, Jobs Fund and Deciduous Fruits Producers Trust have collaborated in setting up a ZAR 600 million (USD 41mio¹⁷) fund to develop and support emerging farmers in the deciduous fruit industry. The composition of the fund is as follows:

- ZAR 200m (USD 13mio) in grant funding from the Jobs Fund
- ZAR 300m (USD 20mio) in debt funding from the Land Bank

¹⁵ https://pmg.org.za/files/181121Blended_Funding_Model.ppt

¹⁶ OANDA conversion rate as at 07/05/2019, 1USD = 14 ZAR. Throughout the document.

¹⁷ OANDA conversion rate as at 07/05/2019, 1USD = 14 ZAR. Throughout the document.

- ZAR 100m (USD 7mio) in subordinated interest free loan from the deciduous fruit industry (DFPT).

The fund is being set up to drive transformation, inclusivity, agricultural growth and job creation across the deciduous fruit value chain. The fund will provide debt funding to majority Black owned entities in the sector, through partnering with the deciduous fruit industry. A key element of the funding is comprehensive technical, marketing and business support to emerging borrowers, paid for by the Fund SPV, in order to reduce lending risk and enhancing commercial success of emerging entrepreneurs in the sector. This fund, the same as the Blended Finance, has 6% being ring-fenced for insurance purposes.

3.6 Potential distribution channels

Smallholder farmers have access to basic financial services such as transactional and savings accounts. High access to such transactional accounts could potentially be leveraged as an insurance distribution channel. However, at pilot stage the ideal distribution method to encourage insurance uptake is to bundle insurance with credit through leveraging the Land Bank (holding company) and existing relationships with farming co-operatives. The existing co-operatives that have been highlighted above, already have several target market groups that they are financing in collaboration with the Land Bank and through their respective smallholder development programmes aimed at assisting smallholder farmers reach commercial scale. The interest of these co-operatives is in protecting their lending to smallholders, ensuring that smallholders have adequate insurance to cope with climate risk. Further allowing the co-operatives to sustain their enterprise development initiatives and extent borrowings to a wider network of smallholders. Most of these groups are already spread across the country particularly in the various provinces highlighted above, which will provide enough spread for the purposes of conducting the pilot and they are funded by the same financial institutions. It therefore makes sense for LBIC to couple the insurance premium with the funding as a form of security to the funders.

4 Data Consideration

4.1 Data availability

In order to structure and design crop and livestock insurance schemes in South Africa we have identified the following key data: yield data, rainfall, vegetation, and land use. While we consider rainfall data from a number of providers, we only consider vegetation and land used data from MODIS (NASA) as it is the most widely used. For yield we only consider data from DAFF the Department of Agriculture, Forestry and Fisheries of RSA. Below outlined a list of datasets.

Crop Yield	Basis for index insurance	Insurance type
White and yellow maize Non-Commercial sector Department of Agriculture, Forestry and Fisheries (DAFF)	Not suitable for non-commercial farmers area-yield index insurance due to availability on province level only	Area-yield index insurance

<p>Spatial resolution: Province Period: 1996/97 - now Temporal resolution: yearly Update frequency: TBD</p>		
<p>White Maize based on samples of Co-workers from DAFF</p> <p>Department of Agriculture, Forestry and Fisheries (DAFF)</p> <p>Spatial resolution: Municipality Period: 1980/81 - now Temporal resolution: yearly Update frequency: TBD</p>	<p>We suggest using this data set as basis for the area yield index insurance. See chapter 6.4 Area Yield Index Insurance (AYII) Crop Insurance.</p>	<p>Area-yield index insurance</p>
<p>Vegetation</p>		
<p>Global MODIS vegetation indices are designed to provide consistent spatial and temporal comparisons of vegetation conditions NDVI.</p> <p>Spatial resolution: 5*5km Period: 2000 – now Temporal resolution: 16 days Update frequency: 16 days</p>	<p>We suggest using this data set as basis for the pasture drought index insurance. See chapter 6.2 Pasture Drought Index Insurance (PDII).</p>	<p>Pasture Drought Index Insurance</p>
<p>The eMODIS collection 6 is based on the Moderate Resolution Imaging Spectroradiometer (MODIS) data acquired by NASA</p> <p>Spatial resolution: 250*250m Period: 2002 – now Temporal resolution: 10 days Update frequency: 1mth</p>	<p>Not used, as we use the data set above.</p>	<p>Pasture Drought Index Insurance</p>
<p>The MODIS Land Cover product incorporates five different land cover classification schemes.</p> <p>Spatial resolution: 500*500m Period: 2001 – 2014 Temporal resolution: annually Update frequency: yearly</p>	<p>Used to select relevant areas to aggregate NDVI values, and thus omit rocks, deserts, lakes and other areas where vegetation is not dominant</p>	<p>Pasture Drought Index Insurance</p>
<p>Rainfall</p>		
<p>ARC2 Africa Rainfall Climatology Version 2.0</p> <p>Spatial resolution: 10*10km Period: 1960 – now Temporal resolution: daily Update frequency: daily</p>	<p>Used only for understanding rainfall data. Not used for index data, as we use area yield data or NDVI.</p>	<p>Weather-index insurance</p>

<p>RFE2 PC/Famine Early Warning System Daily Estimates</p> <p>Spatial resolution: 10*10km Period: 1960 – now Temporal resolution: daily Update frequency: daily</p>	<p>Not used for index data, as we use area yield data or NDVI.</p>	<p>Weather-index insurance</p>
<p>TAMSAT Tropical Applications of Meteorology using Satellite data and ground-bases observations</p> <p>Spatial resolution: 4*4km Period: 1983 – now Temporal resolution: daily Update frequency: 3 times a month</p>	<p>Not used for index data, as we use area yield data or NDVI.</p>	<p>Weather-index insurance</p>
<p>CHIRPS2 Climate Hazards Group InfraRed Precipitation with Station data</p> <p>Spatial resolution: 5*5km Period: 1981 – now Temporal resolution: daily Update frequency: monthly</p>	<p>Not used for index data, as we use area yield data or NDVI.</p>	<p>Weather-index insurance</p>

In addition to rainfall data from the above listed data sources, there are two data providers for weather station data: a) the South African Weather Service (SAWS)¹⁸ and b) the Agricultural Research Council (ARC)¹⁹ available in RSA. Given the limited number of stations, data quality and consistency issues and availability of historical data, we perceive the ground station datasets as not suitable for a country wide scheme.

The quality of the crop yield data for white and yellow maize for non-commercial farmers from DAFF is not suitable for an AYII product as it is only on province level and the yield data does not show the expected year-on-year variability. The data for the Western Cape for example is from 2001/05 to 2012/13 constant at 3.1t/ha. This cannot be representative yield data for non-commercial farmers in this province over nine years.

The white maize yields data based on co-workers from DAFF offers long historical data, small regional granularity and the expected variability. It needs to be understood however that the yield levels reported by co-workers from DAFF do not represent the yield levels experienced by the average small holder farmer in the regions. The reported yields are expected to be higher than the yields experienced by smallholders as co-workers from DAFF represent yields of well-trained farmers. The key yield anomalies in year and magnitude (percentage or standard deviation from average) are expected to be comparable. It will be key in the communication to small hold farmers what the 'benchmark' yield is and how their individual yield will differ, but still the product will make sense.

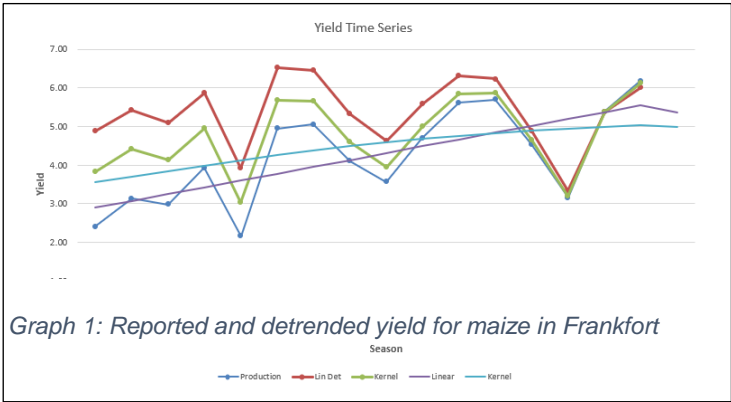
¹⁸ www.environment.gov.za

¹⁹ <http://www.arc.agric.za>

With yield data however, long data series in emerging economies exhibit strong trends that need to be adjusted for. Overall the co-workers from DAFF yield dataset looks promising for piloting an AYII scheme.

The graph shows the reported yield for Frankfort, Mafube in Free State and the detrended values with a linear and kernel method.

A strong trend typically relates to a significant increase in production which needs to be incorporated in structuring and pricing of AYII schemes.



The yield dataset based on samples of co-workers from DAFF reports data for the last ten years for:

Province	# Regions
Northern Cape	6
Free State	30
Eastern Cape	1
Kwazulu-Natal	10

Province	# Regions
Mpumalanga	12
Limpopo	3
Gauteng	5
North West	11

Not all yield datasets for these regions seem suitable for index insurance, however most of the datasets look suitable as basis for an Area Yield Index Insurance (AYII) scheme.

We have been informed that DAFF does not have information and reports on livestock mortality. We have however inquired with the Red Meat Producers Organization (RPO) in RSA and awaiting feedback. Although this information from commercial farmers only, it would provide some proxy for the smallholder farmers.

5. Business model concept

Sales and distribution

The sales and distribution channel should have a high rate of penetration into rural areas, given that the target clientele is in remote areas and is dispersed, therefore a decentralized channel is required. Land Bank and co-operative structures are suitable distribution channels precisely because of their reach in remote areas. Land Bank has 9 satellite offices and 26 decentralised branches across the country. These channels have the capacity to reach customers in a variety of native languages and have specific agricultural knowledge with a firm grasp on socio-economic dynamics in the country.

Since premiums are expected to be small, supporting and remunerating a dedicated insurance sales channel will not be commercially viable. Instead it is recommended that insurance products are sold through an existing sales channel, supported by other products and/or services. Examples include cooperatives, where the products could be bundled with small agricultural loans; and retailers of agricultural inputs who could also sell the product as an add-on. It is recommended that LBIC pilots these products with existing cooperatives as they possess most of the above characteristics. LBIC through its sister company Land Bank Life Insurance Company (LBLIC) provides credit life insurance to co-operatives (Suidwes, OVK and ongoing discussions with TWK) and agricultural input provider (Omnia) in the form of group schemes to protect outstanding loan balance in the event of death or disability of the farmer. Therefore, existing relationships are in place and insurance products have previously been and are currently offered to co-operatives and agricultural input providers.

Marketing and education

As is the case with sales, marketing campaigns need to have a high rate of penetration into rural areas. Marketing materials should be simplistic and made available in a variety of local languages. The mediums used to market the product should be accessible to the target clientele. Mobile Network Operators (MNO's) are the most common for insurance distribution in Africa as they lower the cost of distribution by leveraging existing infrastructure in remote areas. They also have existing relationships with clients. From an agriculture perspective, MNO's can also support weather monitoring and information dissemination as well as location services. At the outset, the products would not be well understood or well perceived by the target clientele. Potential clients will need to be made aware of the direct and indirect benefits (such as improved access to credit) associated with insurance and a series of outreach educational campaigns would be required. It is again recommended that LBIC pilots these products with existing cooperatives as they can be utilized to champion the marketing and education of these products. Furthermore, they are better placed to do this since they would have vested interest in these smallholder farmers as they will form part of their funding.

Pricing

Pricing is done on the index data for crop and livestock i.e. yield and NDVI data. Therefore, no individual farmer loss history is needed. In case historical yield data series need to be extended, it can be correlated with neighbouring regions or alternative proxies such as rainfall and NDVI. Regional drought experience needs to be correlated with the index to assure the fit. This is done on a seasonal and regional level only and not on an individual farmers level.

Structuring and pricing needs to be done to achieve a target premium cost that is affordable by the clients. This is a challenge as the clients are looking for a low cost covers but will have expectations of large pay-outs in drought years. Assuming that we are looking for a product with a 10-15-year return period i.e. full pay-out in a one-in-ten- or fifteen-year drought event, the cost will be around 10% of the sum insured. Most farmers assess premium in comparison to income, which is roughly 5% of income. This fits with small holder farmers willingness to pay. For example, the expected income of a farmer is ZAR 10'000 per ha. Sum insured is only part of this income, with ZAR 6000 per ha. The premium is roughly ZAR 300-600 and thus 3-6% of income and 10% of sum insured. Please see also chapter 6.5 Area-yield index insurance.

To achieve the best prices for the farmers, a few international reinsurers should be invited to provide their pricing. Insurance product for small-scale farmers will not offer attractive margin to the reinsurers but can offer positioning their social responsibility activities and for acquiring new business relationships in the market. Moreover, LBCI already has a longstanding reinsurance partners with A-rated capital, as they currently provide reinsurance capacity on LBIC portfolio. To be operationally efficient, distributors need to have access to prices across all relevant regions electronically. This can be best achieved with LBCI creating or purchasing an integrated platform, specifically designed to cater for index products and work on back-to-back interface connecting LBCI with the distributors.

Underwriting

The customer underwriting process will have to be automated, simple and efficient in order to ensure fast pay-outs and the best client experience. During the upfront underwriting process, clients would provide the necessary underwriting details such as crop type (in the case of crop insurance), location, and land size etc. and receive a valid price. CelsiusPro as part of the consortium is able to provide a turn-key solution for LBIC. CelsiusPro has developed a platform for underwriting and management of index insurance. The platform covers the lifecycle from A-Z and can be simply plugged-in to the LBCI existing IT environment. Initial time is needed to set it up and align it with LBCI ecosystem and train the trainers at LBCI to be able to use it autonomously. Since index insurance is a completely new product for LBCI, there is no legacy business and hence no hurdles in integrating the platform.

Premium collection and frequency

Electronic premium collection will have to be bundled with the cooperatives' finance offering, be it separately or through premium finance, taking into account clients' ability to access this. The insurance purchase decision and the subsequent premium payment needs to be done in advance or with an irrevocable payment order to LBIC to assure clients honour their insurance commitment and not refrain from paying the premium when the season looks good.

Reinsurance or risk transfer

As part of a risk management strategy, an appropriate level of reinsurance is required to mitigate against risks of large losses. This would potentially require a separate and specific structure designed to leverage off the reinsurance market expertise insofar as risk management of these types of risks. It is preferable that LBIC enters into an agreement with an international Reinsurer that has social responsibility to provide capacity to a segment like the smallholder farmer segment.

Government could also provide excess of loss reinsurance cover (at potentially subsidized rates) as it is preferred that premium income is retained with the fiscal budget (as opposed to transferring this income to the private sector). Reinsurance for major disasters could however be sourced

from international markets as this might expose Government to concentration risk from disasters at a time when the budget would be strained from dealing with other consequences of the disaster.

Claims underwriting and payment

No claims underwriting and reporting is required. As is the case with upfront underwriting, this significantly reduces the costs of the process. Payments are made automatically and timely, when a claim event is identified, so that farmers' operations are not disrupted. The reasons for claim payments and a clear explanation on how compensation is determined should be communicated, so that clients start to understand the value of the product and are able to understand how it works.

Policy administration and management

Policy conditions should be easily accessible, through the mediums preferred, by all relevant parties who require access (this includes clients and cooperatives). Policy wording should use simple language, an increasingly common requirement for all customer facing documentation. An automated renewal process, where clients have the option to "opt -out" at the policy anniversary date may be preferred for reasons of simplicity and cost effectiveness, as long as this is done in a way that treats customers fairly and is consistent with the Consumer Protection Act.

Evaluation and Consideration of key regulatory/legal constraints

The Financial Sector Regulation (FSR) Act was signed into law in August 2017 and became effective from 1 April 2018. The legislation brought about a major transformation of the South African financial services regulatory and risk management framework, including the move to a Twin Peaks approach to regulation. The FSR Act together with the Insurance Act, 2017 brought changes to a number of Acts including the LTIA, STIA and PPRs.

Under the Twin Peaks approach the regulation of prudential and conduct risks are separated out under the supervision of two distinct regulatory bodies, the Prudential Authority (PA) – contained within the South African Reserve Bank (SARB) – and the Financial Sector Conduct Authority (FSCA).

The amendments to the insurance legislation aim to give more South Africans access to insurance and allows for the provision of greater protection for policyholders. LBIC, together with South African Insurance Association (SAIA) have drawn up a submission to the Prudential Authority to achieve the following objectives:

To request and propose to the regulator, by providing and laying the groundwork for a new class of insurance (index-based insurance), that this type of insurance be considered as part of insurance classes recognized by the regulator. The paper goes on to provide market conduct risks as well as guidance in respect of prudential risks such as underwriting risks, regulatory capital, corporate governance and reporting and disclosures. Other objectives of the framework include:

- Obtain industry consensus on implementing and regulating index-based insurance;
- Find balance between market development and customer protection;
- Allow regulators to draft regulations or give regulatory exemption;
- Enable the creation of an insurance product that will support farming in South Africa; and
- Lay the groundwork for a new class of insurance.

These endeavours form the basis for regulatory approval of index insurance solutions. A pilot scheme of this nature would assist in providing on the ground data and experience to support the current discourse.

6. Product Design Considerations

6.1 Crop Insurance

Farmers are ultimately interested in an insurance that compensates them in case of losses of income. Therefore, the most ideal cover is a revenue cover incorporating a commodity price and own yield. As this is only possible under ideal circumstances such as good granular yield data in addition to representative price data, the second-best alternative would be a Multi-Peril Crop Insurance (MPCI) which is based on the farmers individual yield. As MPCI requires farm data level and loss adjusters inspecting harvest and yield post season on each farm, this model is not viable for a large-scale crop insurance for small scale farmers.

Given that there is no consistent and representative yield data available in many countries, the best proxy for yield is rainfall as rainfall variability explains the majority for vegetation and therefore yield variability in non-irrigated agriculture production.

Fortunately, the DAFF of RSA provides long time series of regional yield data that appear suitable for an insurance product. Therefore, we focus on the design of a yield index insurance for crop and don't need to approximate yields with rainfall and other parameters.

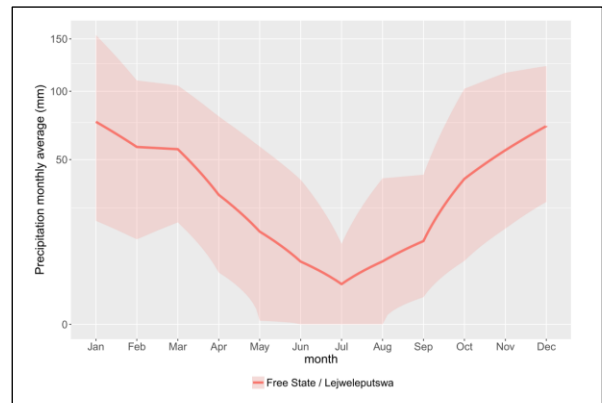
However, rainfall and vegetation indices are typically related to agricultural yields and are used to complete and confirm the information gathered from yield data in the product design phase.

Free State is a major maize production area with a very typical seasonal cycle for precipitation. (Graph 1)

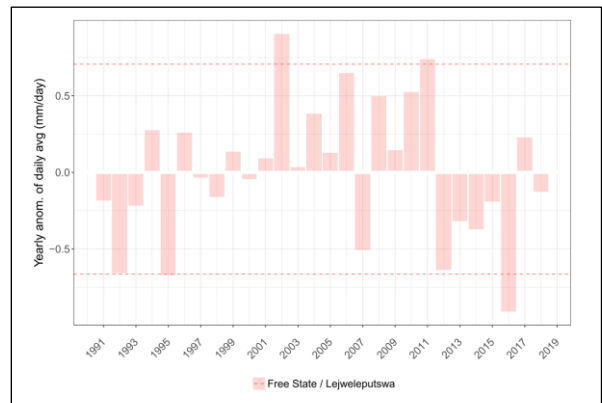
The yearly anomalies in the critical rainfall season (September to March) give indication about years with sufficient rainfall and those 'bad' years with little rainfall leading to low yields. (Graph 2)

In recent history the season Sep-Mar 15/16 was a year with a significant rainfall deficit. Clearly visible the deviation of actual rainfall to the long-term climatology causing a significant rainfall deficit. (Graph 3)

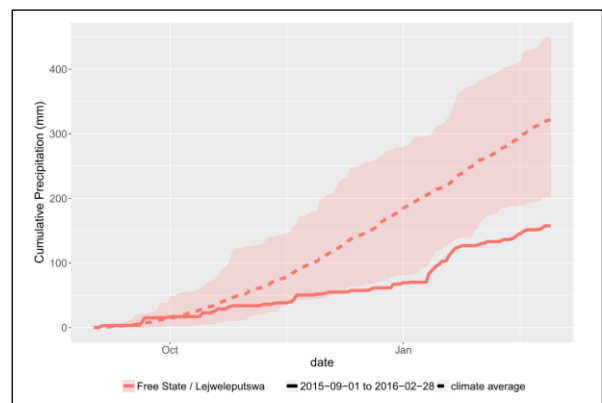
Given the extreme rainfall deficit in the season Sep-Mar 15/16 and the corresponding lack of vegetation (see livestock insurance), we would expect significant drop in yield for non-irrigated crop production.



Graph 2: Rainfall seasonality Free State



Graph 3: Rainfall Anomalies Free State Sep-Mar



Graph 4: Rainfall actual vs. climate Sep-Mar 2015/16

6.2 Pasture Drought Index Insurance (PDII)

For PDII, vegetation data is typically used as proxy for forage availability and animal health with respect to drought conditions. The vegetation dataset most widely used in the insurance industry is NDVI (Normalized Differentiated Vegetation Index) from MODIS which comes at different grid level granularity.

For this study we use the 5*5km resolution dataset, aggregated on administration level III. For an insurance scheme we suggest however to remove grids that don't exhibit intra-annual variability as these areas are rocks, deserts, lakes and other areas where vegetation is not dominant. Therefore, only grids dominated by vegetation are aggregated for the pasture index.

6.3 Spatial Considerations

RSA is split in 52 districts, with the largest districts in the north east. While large districts appear to bear too much basis risk, they may be useful for an initial analysis as climatology and yields tend to correlate locally. (Graph 1)

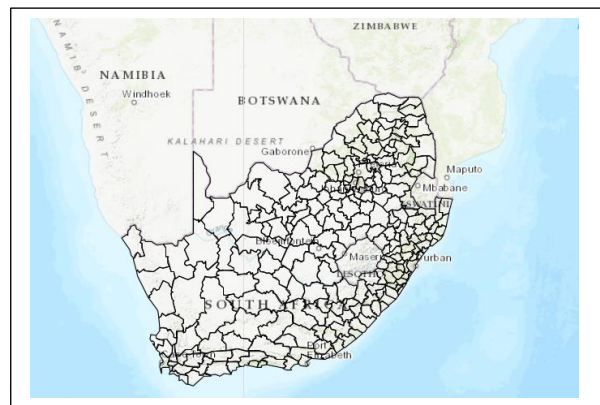
There are 226 local municipalities (Admin Level II) in RSA of which a large number seem more appropriate for a climate index insurance. (Graph 2)

Finer granularity can be achieved with gridded satellite data and land cover analysis. This approach improves the insurance accuracy for the large-scale farmers. However, it does not seem representative for small scale farmers as they also farm in areas not recognized as crop land by the satellite. (Graph 3)

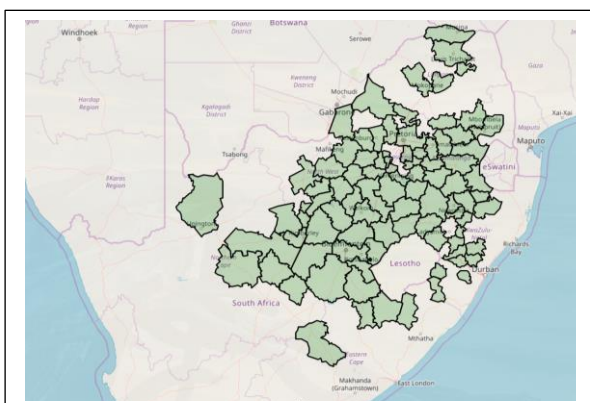
In the case of an area yield index insurance for crop, the representative area is given by the reporting region of the yield. These areas tend to have large similarities in cultivation, soil and climate and are oftentimes dominated by representative co-operatives and appear well homogenous and suited as representative regions for small scale farmers. (Graph 4)



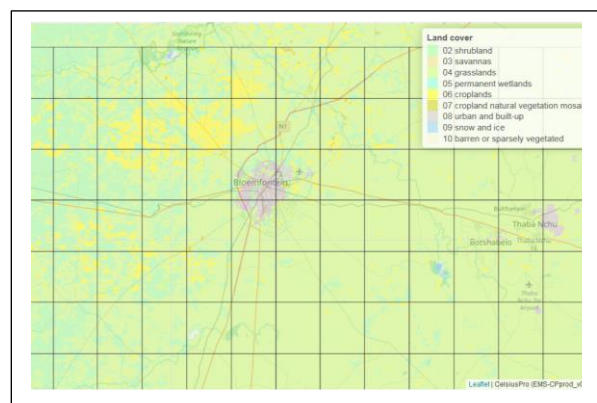
Graph 1: Admin Level II (Districts)



Graph 2: Admin Level III (Municipalities)



Graph 4: Yield reporting areas from DAFF co-workers



Graph 3: ARC2 Grid and Land Cover MODIS

6.4 Area Yield Index Insurance (AYII) Crop Insurance

Regional crop yields are used as proxy for the agricultural production of farmers within a region. Therefore, AYII pays policy holders when the representative area yield reported by DAFF is lower than a defined threshold. The area used for the example is the Free State, an agricultural region dominated by crop farming with a sowing period in Nov-Dec and harvest in Jul-Aug.

It must be understood that the absolute crop yield level varies from farm to farm and especially between larger and small-scale farmers, however the significantly 'bad' years, when the insurance is supposed to compensate, is very similar across heterogenous farm types in a yield reporting region.

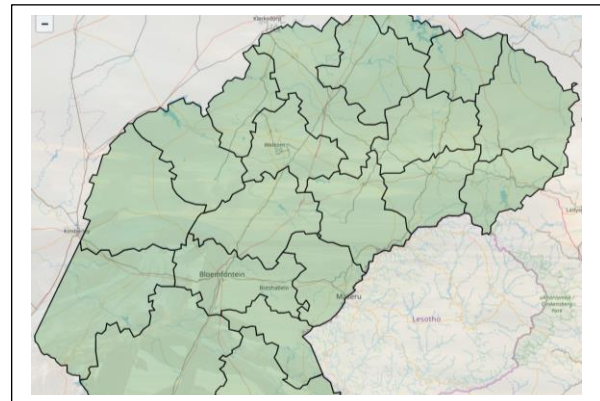
For the product prototype we sometimes have grouped the yield data reported for various sub-regions by DAFF into Admin Level III areas and averaged them. For an actual insurance scheme each of the contribution yield data for a region needs to be examined for its reliability, representativeness and accuracy before adding it. (Graph 1)

The following example is for Free State, Mafube with data of Frankfort, where yields for Frankfort is the only contributor to the Mafube admin level.

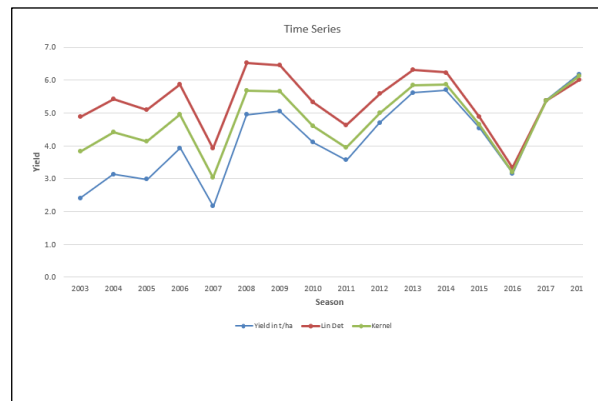
While the linear de-trending results in extremely high historical yields (red line), the Kernel distribution detrending (green line) shows the best fit and is therefore used for detrending the yield data for pricing. Clearly visible in the historical time series are yield drops in seasons 2015/16, 2010/11 and 2006/07. (Graph 2)

The Strike and the Exit yield are set in percentage of the average yield. Given the increase in productivity in overtime and hence the yield, only the last 5 years are suggested to be used to set the average.

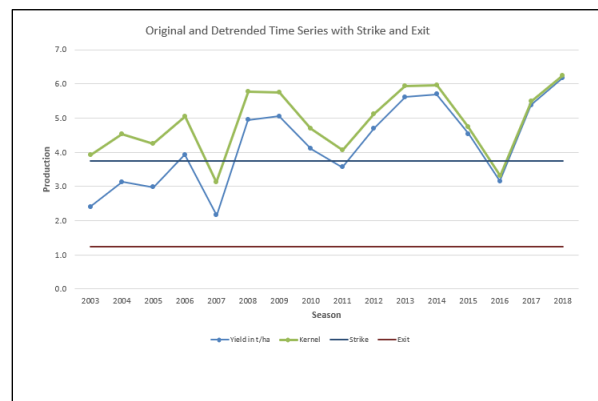
In addition to the difference in average reported yields and experienced yields as explained in the data chapter, the reporting time-lag is a key issue in AYII schemes as farmers require a swift payout after harvest of a bad season and the statistical office published yield data only month after harvest. The Crop Estimates Committee (CEC) of RSA however publishes monthly updates which could be used for early pre-settlement of the insurance. The reinsurers acceptance for such a pre-settlement needs to be assessed.



Graph 1: Free State, Admin Level III



Graph 2: Original data vs. Kernel and Linear detrended



Graph 3:

The determination of the sum insured for the AYII is calculated as follows:

Maize reference price per t:	ZAR 2'000
Average production per ha:	5t (yield)
Expected income per ha:	ZAR 10'000
Trigger (guaranteed yield):	4t/ha
Exit yield:	1t/ha
Cover length:	3t/ha

Sum insured:

Cover length x area in ha x Maize reference price per t
 $3\text{t/ha} \times 1 \times \text{ZAR } 2'000 = \text{ZAR } 6'000$

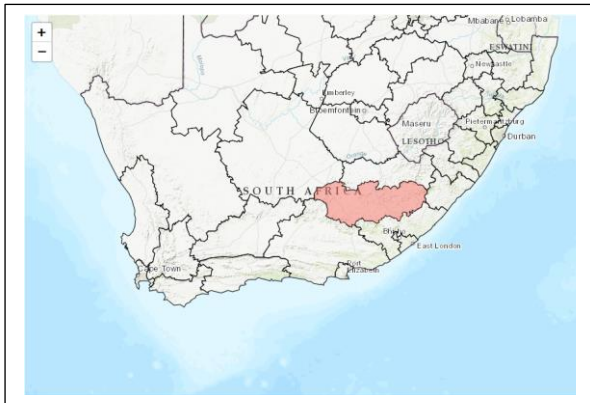
Premium range:

Assuming a premium of 5-10% of the sum insured, the farmer should be paying ZAR 300-600 per ha for an expected production value of ZAR 10'000.

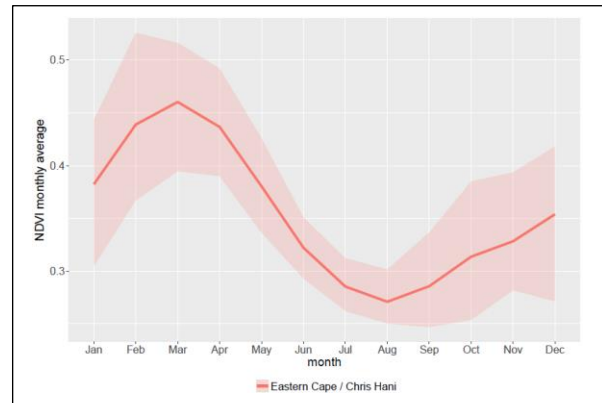
Prior to the sales process the Maize reference price is fixed (in this example at ZAR 2'000 per t.) for the country and season. The yield trigger and exit yields are set per administrative (yield) region. Therefore, the farmer only has to provide the region and the acreage to determine the sum insured and the associated premium.

6.5 Pasture Drouth Index Insurance (PDII)

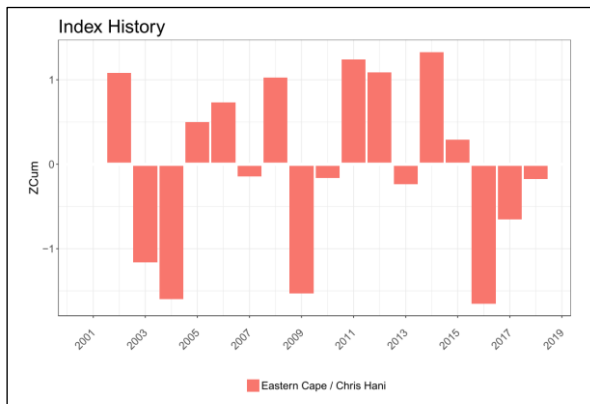
NDVI serves as proxy for forage availability and hence for milk production, animal health and mortality of livestock. Therefore, PDII pays policy holders when there is a lack of pasture reported by low NDVI values compared to normal levels. The area used for the example is the Eastern Cape, an agricultural region dominated by livestock farming (Graph 1). The NDVI seasonality over the Eastern Cape shows an increase in vegetation in the fourth quarter and peak values around the end of March (Graph 2). The 'worst' years in recent history, years with a deficit in vegetation, for a risk period of November to March are clearly visible 2004, 2009 and 2016 (Graph 3 and 5). The NDVI anomalies in the season 2015-2016 were observed widespread across southern Africa as the NDVI anomalies map demonstrates (Graph 6).



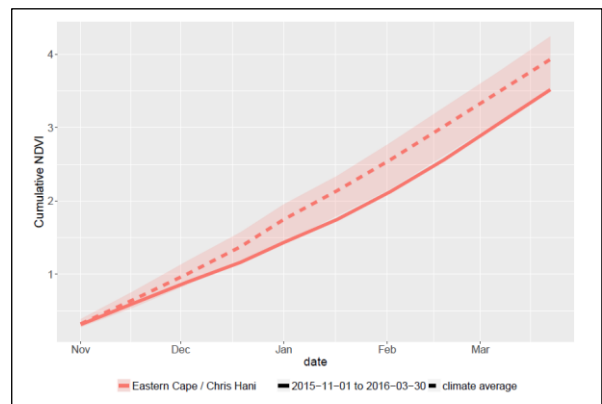
Graph 1: Sample Region Eastern Cape



Graph 2: Seasonal Cycle NDVI Sample Region



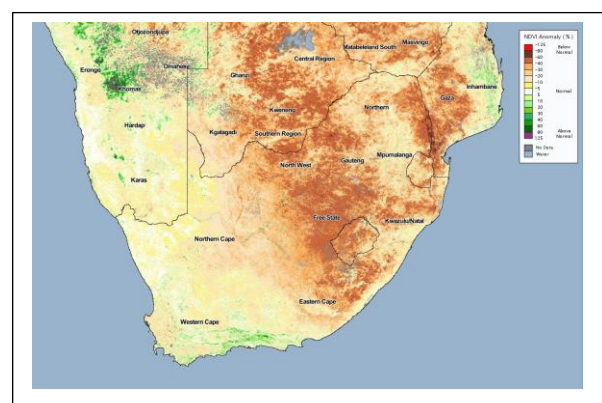
Graph 3: NDVI Anomalies Index (St.Dev) Nov-March



Graph 4: Actual NDVI Nov 2015 - March 2016 versus long term average



Graph 5: Payout Years



Graph 6: NDVI anomalies 01.01.2016
Source: <https://glam1.gsfc.nasa.gov/>

The determination of the sum insured for the PDII is calculated as follows:

Forage cost for one cow for one month: ZAR 700
Forage period: 6 months
Expected maximum forage cost: ZAR 4'200
Number of cows: 1 cow

Sum insured:

Expected maximum forage cost x number of cows or cow equivalents
ZAR 4'200 x 1 = ZAR 4'200

Premium range:

Assuming a premium of 5-10% of the sum insured, the farmer should be paying ZAR 210-420 per cow for an expected value of ZAR 14'000 per cow.

Prior to the sales process the Forage Period and the cost for one month (in this example at 6 month and ZAR 700) for the country and year.

The yield trigger and exit NDVI values are set per administrative region. Therefore, the farmer only has to provide the region and the number of cows to determine the sum insured and the associated premium.

Livestock units (LSU)

To convert the calculation from cows in other farm animals, a conversion table is used. Below outlined a sample conversion table²⁰:

Animal	Cow	Sheep	Goat	Pig
Factor	1	0.15	0.15	0.30

Therefore, the sum insured for one sheep is: Sum insured per cow x conversion rate Sheep
ZAR 4'200 x 0.15 = ZAR 630.

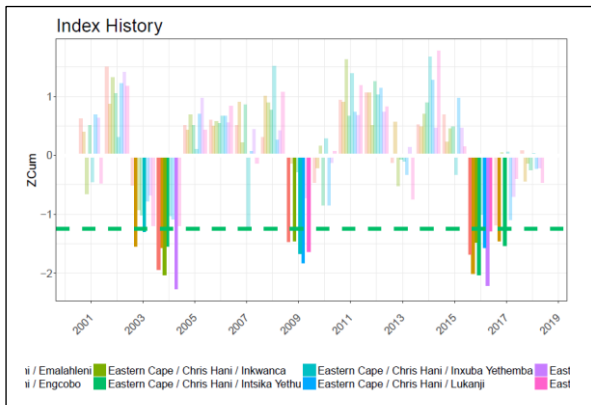
²⁰²⁰ <http://www.livelihoodstoolbox.org/?q=node/2336>

Pasture Drouth Index Insurance (PDII) Structuring and Pricing Example I

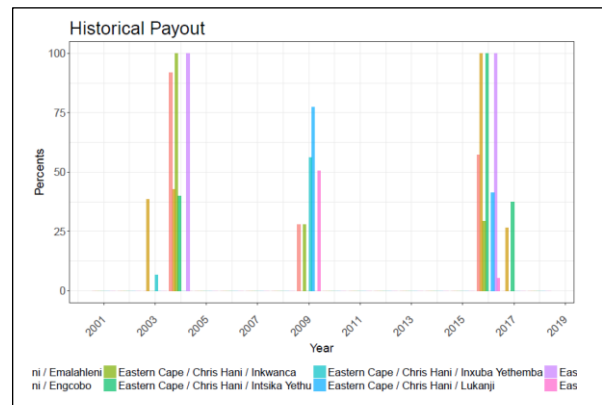
Eastern Cape Admin Level III: (Inxuba Yethemba, Tsolwana, Inkwanca, Emalahleni, Lukanji, Sakhisizwe, Engcobo, Intsika Yethu)

Risk period: Nov 1st to March 31st
 Index: NDVI variability in **Standard Deviation**
 Triggers: Strike: -1.25StDev Exit: -2.0StDev

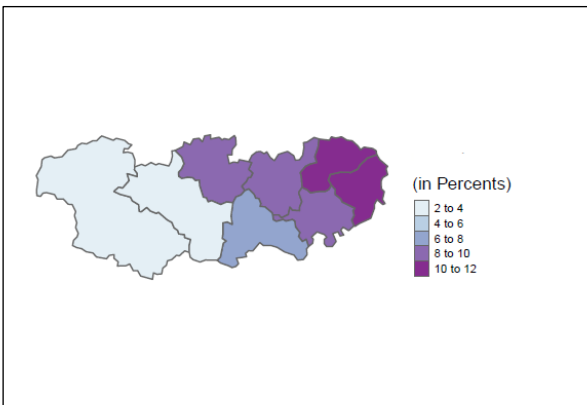
The Index history clearly identifies 2004, 2009 and 2016 as the years with lowest vegetation across most regions. The historical pay-outs trigger in these years accordingly. The burn cost varies across the regions is clearly higher in north east. The historical pay-outs for 2004, 2009 and 2016 spread differently across the regions.



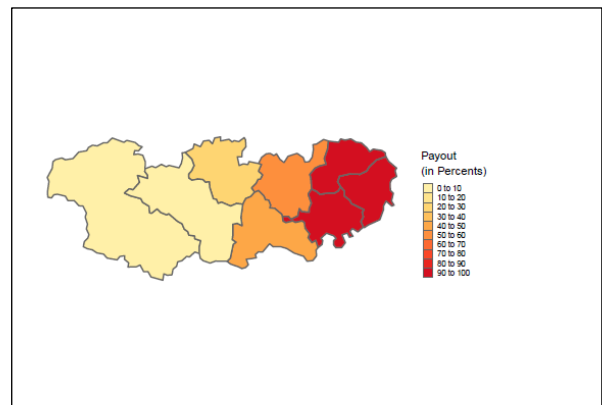
Graph 2: Historical NDVI Index in z scores



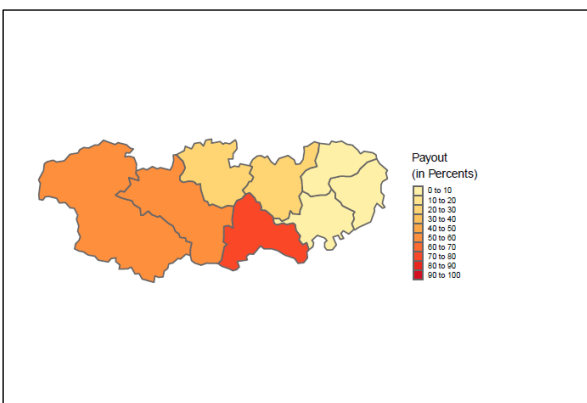
Graph 3: Historical Payouts in % of sum Insured



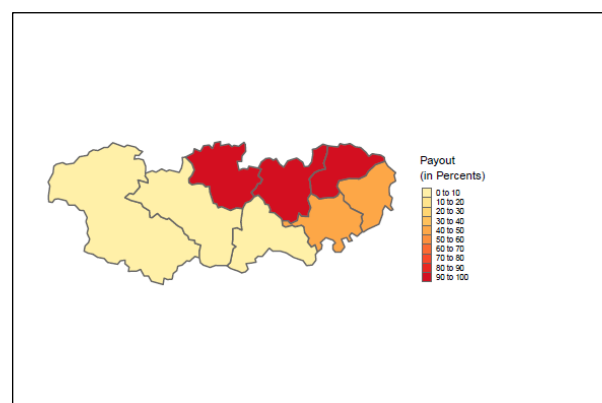
Graph 3: Burning Cost in % of sum Insured



Graph 4: Payout in % of sum insured 2016



Graph 5: Payout in % of sum insured 2009



Graph 6: Payout in % of sum insured 2004

Pasture Drouth Index Insurance (PDII) Structuring and Pricing Example II

Eastern Cape Admin Level III: (Inxuba Yethemba, Tsolwana, Inkwanca, Emalahleni, Lukanji, Sakhisizwe, Engcobo, Intsika Yethu)

Risk period:

Nov 1st to March 31st

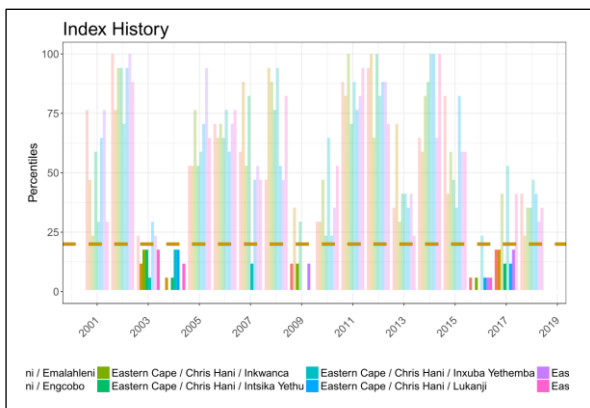
Index:

NDVI variability in **Percentiles**

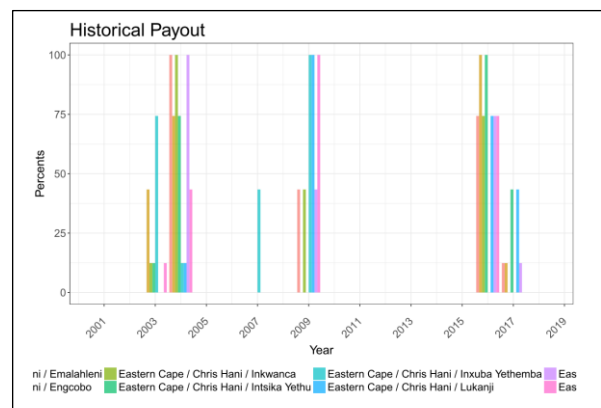
Triggers:

Strike: 20perc (5 year return period) Exit: 1perc (20 years)

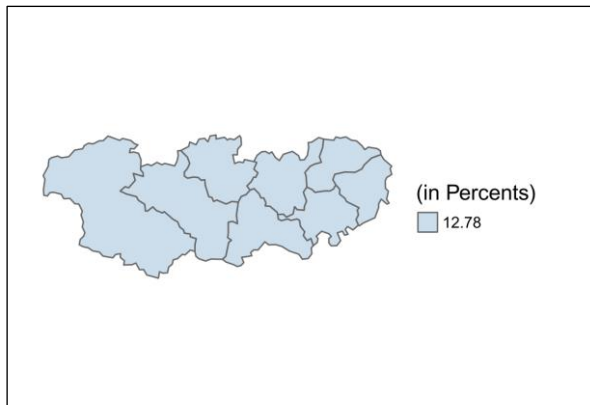
The Index history clearly identifies 2004, 2009 and 2016 as the years with lowest vegetation index across most regions. The historical pay-outs trigger in these years accordingly. The average pay-out cost sums up to 13% with the strike and exit being equal. Trigger is set per region that the average historical pay-out is the same and hence premium will be very similar across the regions. Therefore, all regions have the same overall pay-outs across the history.



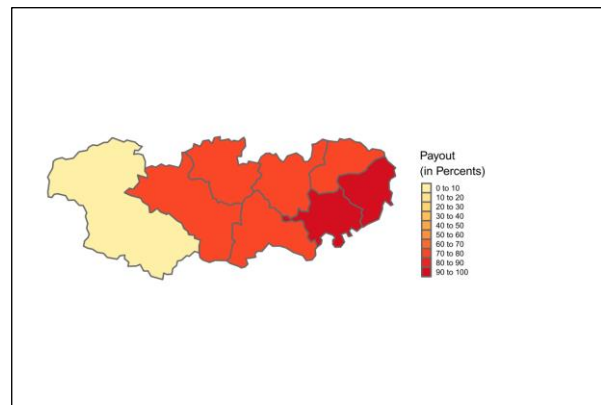
Graph 2: Historical NDVI Index in z scores



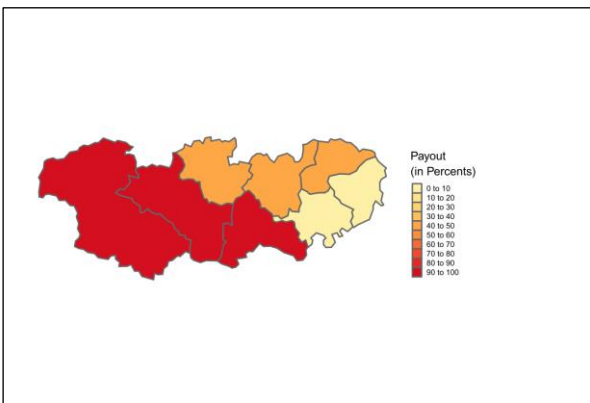
Graph 3: Historical Payouts in % of sum Insured



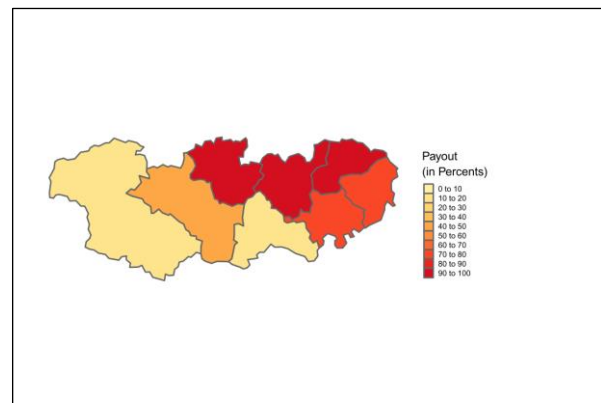
Graph 3: Burning Cost in % of sum Insured



Graph 4: Payout in % of sum insured 2016



Graph 5: Payout in % of sum insured 2009



Graph 6: Payout in % of sum insured 2004

a. General Product Considerations

Premium considerations

From experience and the feedback of the questionnaire we see that insurance premiums to the farmer should not exceed around seven percent. Anything above ten percent to the farmer is not realistic and will not be purchased unless it's mandatory. However, from a risk and coverage perspective we feel that the insurance should start paying at five-year event and covers up to a one-in-20-year event to be meaningful and live up to the farmers expectation. The proposed insurance will cost more than 10% in premium, subsidies should be applied to close the gap between the willingness and ability to pay the premium by the client and the expectations and meaningfulness of the product. Therefore, for the product structuring to find the target client premium it's essential to understand if governmental subsidies will be granted and at what level. Ideally government would be granting a 50% subsidy for the first few years on the drought insurance products for crop and livestock as this will allow for a significantly more attractive and impactful product.

Reinsurance considerations

Once the product is structured and priced, we suggest asking 2-3 reinsurers for pricing to assure we get competitive rates from the risk takers. For this type of new insurance product with presumably lower premium volume than we usually see on the commercial programs, we can expect a quota share reinsurance structure with maximum 80% cession²¹ to a single reinsurance company. Scaling up of the premium volume over the years could allow for a panel of two to three reinsurers. We know of several reinsurers who are interested in the engagement and exposure of drought in South Africa as it is a diversifying risk to the main agricultural risk they typically have on their books from the US, India and China.

Cost loading considerations

Given the lean operational set-up of an index product we expect to see a significant drop in operational cost layers of the insurer compared to traditional insurance. However, we see it as important that the sales commission of the distributors remains the same to incentivize them for the product distribution. If distributors are not incentivized, the product will not be promoted and sold accordingly which lead to low pick-up rates.

²¹ Regulatory minimum retention for the insurers is set at the minimum 20% . Anything below would fall into the fronting license.

7. Project management timeline

Definition of overall project outline.

N°	Deliverables	Months												
		1	2	3	4	5	6	7	8	9	10	11	12	
D-1	Confirm Overall Project Plan, Marketing Plan and Product Prototype, Project partner and Stakeholder meetings													
D-2	Product definition and pricing, Policy wording, Regulatory approval and reinsurance capacity,													
D-3	Develop Marketing Material (Training Manual/ Brochure/ Pamphlets), Train the trainers													
D-4	Specifications Report IT Platform													
D-5	Testable Version of the IT Platform													
D-6	Production Version of the IT Platform													
D-7	Marketing / Promotion/ Training / Cooperatives and Distributors													
D-8	Product Roadshow and Awareness Campaign / Sales / Enrolment													

We propose a multi-phased approach to this assignment, though several of the phases will overlap. The key activities that we envision for this project are described below.

Deliverables

D-1, Confirm Overall Project Plan, Marketing Plan and Product Prototype, Project partner and Stakeholder meetings:

We set aside one month to get-together at least once for a kick off workshop, iron-out and re-confirm our project, create core and extended teams and delegate responsibilities. Newly created teams will focus on convening project partners and organizing stakeholder meetings. Land Bank being the leading institution in the industry with natural authority and brand recognition, we expect fast pace for this initial phase.

D-2, Product definition and pricing, Policy wording, Regulatory approval and reinsurance capacity:

Basis of this work has been pre-agreed in the D-1. Consortium will work in close cooperation and in parallel on all the items. CelsiusPro will focus predominantly on the technicalities of the product: product definition and pricing, draft policy wording specific for parametric products. Wording to be worked on also by LBIC in order to fit the corporate guidelines and comply with local insurance legislation and consumer protection act. LBIC will focus predominantly on acquiring the regulatory approval and submitting the necessary paperwork. Reinsurance capacity can be accessed by engaging with LBIC's already existing reinsurance panel, and/or mandating reinsurance broker to market the call for reinsurance capacity. Both companies, CP & LBIC have strong and vast

networks among the reinsurance community and will focus on promoting the product with its strong storyline.

D-3, Develop Marketing Material (Training Manual/ Brochure/ Pamphlets), Train the trainers:

The teams will make use of any already existing marketing material of LBIC and focus on adapting it to the new product specifics and education around parametric insurance and concepts of basis risk. CelsiusPro has extensive experience with wide spectrum of educational activities on insurance and parametric insurance and convening clients in development context that have little to no experience with insurance.

D-4, Specifications Report IT Platform, D-5, Testable Version of the IT Platform, D-6, Production Version of the IT Platform:

D-4 to D-6 activities are core part of CelsiusPro day to day business. CelsiusPro will work closely with LBIC to ensure customization of its proprietary White Label Platform to LBIC environment.

D-7, Marketing / Promotion/ Training / Cooperatives and Distributors:

The teams will make use of the already existing marketing protocols, LBIC's business relationships and network. Combined educational experience will serve the training & educational purpose for cooperatives and distributors.

D-8, Product Roadshow and Awareness Campaign / Sales / Enrolment:

Considerate time will be spent on the ground to campaign the product and create the necessary traction among the target audience. Sales and enrolment will be done in format aligned to the IT Platform requirements, to ensure the best client experience and real time reporting. By registering the sales in the platform, we ensure that any necessary product enhancements will be done in real time.

Setting out high-level initial marketing and product distribution plan.

The drought insurance schemes will follow a bundling approach linking insurance with credit and distributed via Land Bank and cooperative channels as part of the credit origination process by these agencies. The Land Bank has 9 satellite offices representing a presence in each province of South Africa, along with 26 branches in key agricultural production areas across the country. LBIC's sales and distribution division periodically holds product training campaigns with each of the Land Bank branches and satellite offices to orientate credit origination personnel with potential insurance solutions that farmers can access. These existing structures will be utilized to run educational campaigns to ensure that staff at branch and satellite office level fully understand and are able to explain the drought insurance products to farmers completing credit applications.

A similar approach will be adopted with cooperatives to engage staff at branch level. In addition, LBIC participates in various farmer day events and agricultural exhibitions to promote its existing commercial asset and crop insurance products. Promotion of the drought insurance scheme will be combined with existing marketing and advertising strategies. Following D-8 on the project management timeline, the marketing plan over month 6 – 8 will be as follows on a provincial level:

	Provinces	Months											
		1	2	3	4	5	6	7	8	9	10	11	12
P-1	Gauteng, Mpumalanga, North West, Limpopo												
P-2	Limpopo, Free State, KwaZulu-Natal												
P-3	Western Cape, Norther Cape, Easter Cape												
P-4	Farmers Days												

8. Annexure A – Smallholder Survey Questionnaire

Question 1: Demographics

Gender?

1	Male	2	Female	
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Age?

1	18 – 29	
2	30 – 39	
3	40 – 49	
4	50 - 59	
5	60 – 69	
6	70 or older	

How many years have you been involved in crop farming?

1	Less than 5 year	
2	5 years – 10 years	
3	11 years –15 years	
4	16 years – 20 years	
5	More than 20 years	

How many hectares (ha) of agricultural land do you plant?

1	Less than 10 ha	
2	11 and 30 ha	
3	31 and 50 ha	
4	51 ha and 100 ha	
5	More than 100 ha	

Which crop do you mostly plant?

1	Maize		6	Barley	
2	Sunflower		7	Vegetables	
3	Beans		8	Fruits	
4	Sorghum		9	Nuts	
5	Wheat		10	Other	

Question 2: How often does drought affect your crops? (Tick where applicable)

	Almost every year	Roughly every 5 years	More seldom
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Drought Risk			
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Question 3: How much of your crops do you lose when the drought occurs?

	Less than a quarter	Half	More than three quarters
Drought Risk			

Question 4: Do you think the following things have increased, decreased or remained the same in the past 5 years? (Tick where applicable)

	Decrease	Stable	Increase
Dryness			

Question 5: Are you able to feed your family with the crops you grow?

Sometimes	Always	Rarely

Question 6: What level of preparation do you have to be able to deal with losses of your crops due to drought? (Tick where applicable)

Not prepared	Somewhat prepared	Very prepared

Question 7: Do you get compensated when your crops are lost due to weather challenges? (Tick where applicable)

Sometimes	Yes	No

Question 8: How do you cope financially when your farming activity fails? (Tick where applicable)

Borrow from family	Borrow from bank/micro-finance	Sale of property	Rely on Savings	Help from Government	Other (Specify)

Question 9: If another way of coping with farming losses is introduced to you, and you had to pay for it, would you be interested? (Tick where applicable)

Not interested	Interested	Very interested

Question 10: Have you heard of insurance? (Tick where applicable)

Yes	No

Question 11: If yes, what type of insurance have you heard of?

Life insurance	Motor	Fire insurance	Health/Medical/Hospital	Livestock	Crop

Question 12: Do you have an insurance policy of any kind?

Yes	No

Question 13: What is stopping you from buying crop/livestock insurance?

I am not aware	Is too expensive	Lack of pay-out in first seasons	Delayed claims	I don't trust

Question 14: If you were to purchase an agricultural insurance policy, what is your preferred method of enrolment into the scheme?

Mobile	Commercial bank	Private insurance companies	Agro-dealers

Question 15: If you were to purchase an agricultural insurance policy, what is your preferred method of premium payment?

Mobile-money	Commercial bank	Agro-Dealers	Direct to Insurer

Question 16: How much would you be willing to pay as premium to protect your crops/livestock?

Nothing	5% of Income	10%	15%

9. Annexure B – Drought Insurance Survey

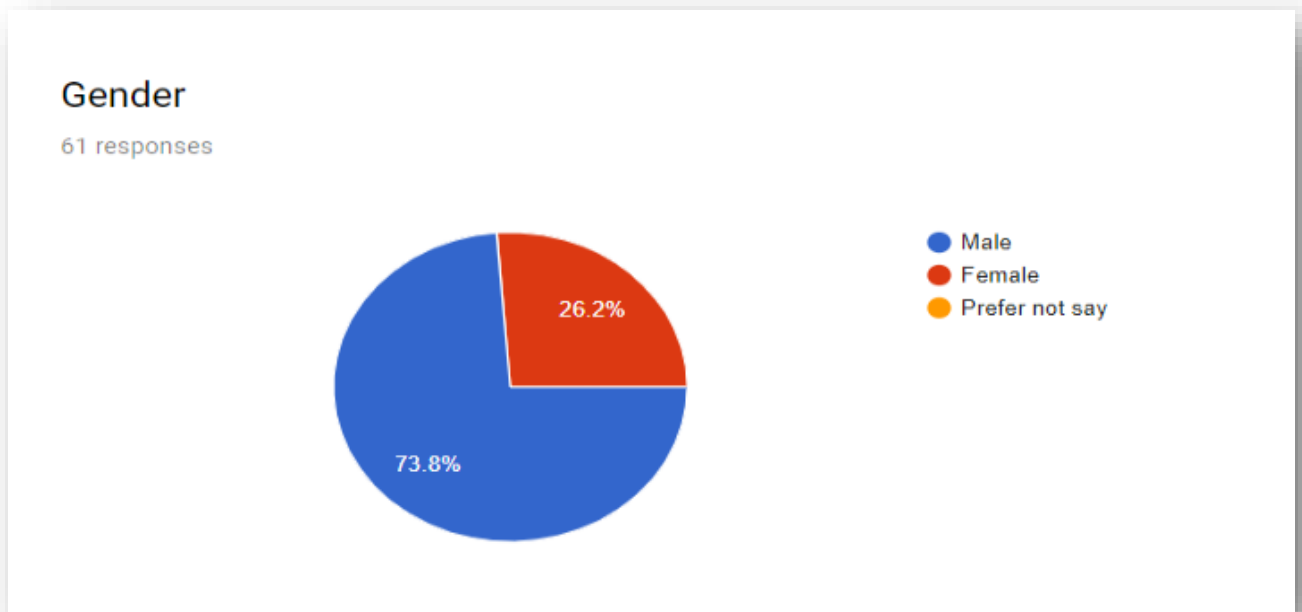


Figure 1

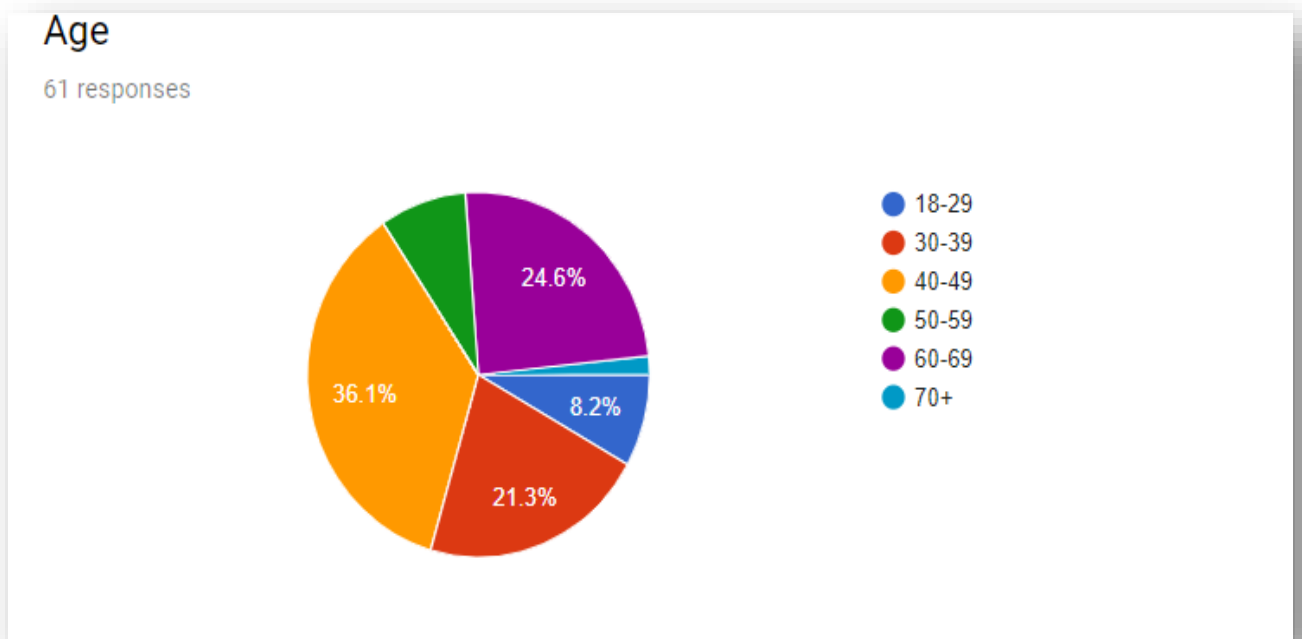


Figure 2

How many years have you been involved in crop farming?

61 responses

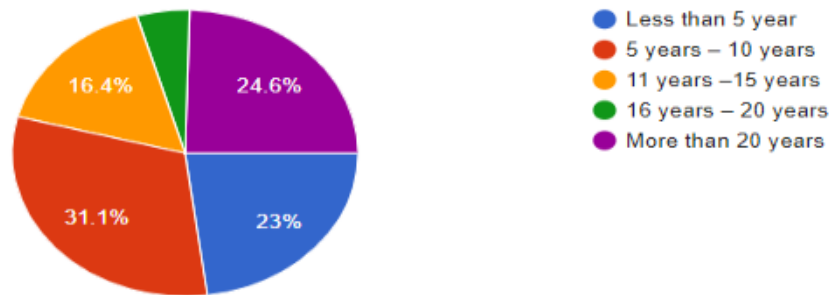


Figure 3

How many hectares (ha) of agricultural land do you plant?

61 responses

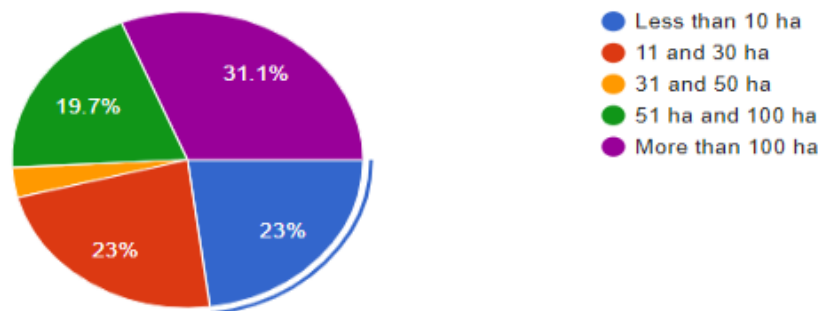


Figure 4

Which crop do you mostly plant?

61 responses

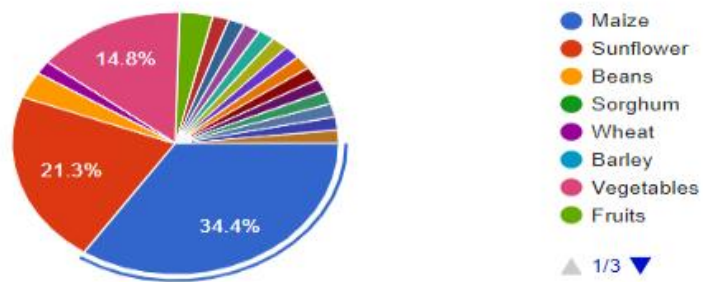


Figure 5

How often does drought affect your crops? (Tick where applicable)

61 responses

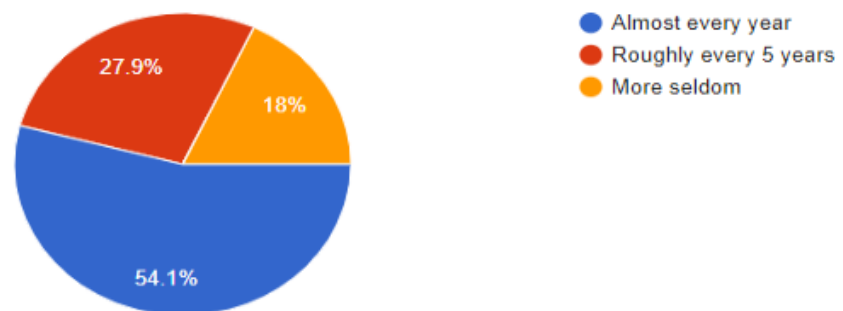


Figure 6

: How much of your crops do you lose when the drought occurs?

61 responses

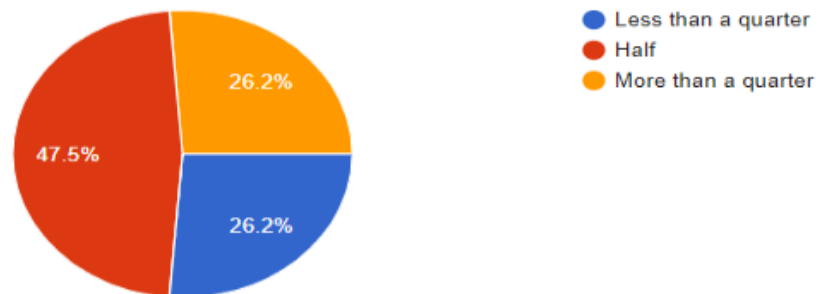


Figure 7

: Do you think the dryness has increased, decreased or remained the same in the past 5 years? (Tick where applicable)

61 responses

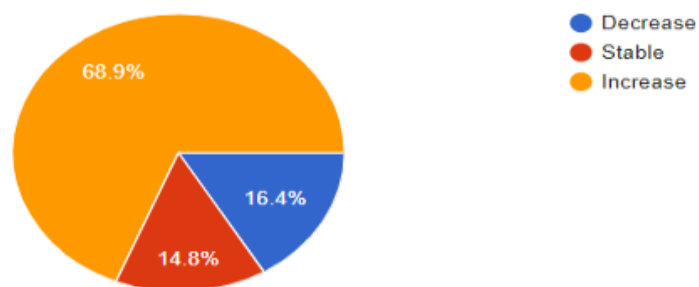


Figure 8

: Are you able to feed your family with the crops you grow?

61 responses

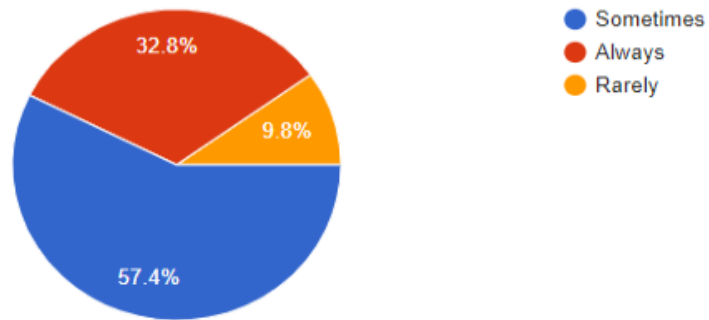


Figure 9

What level of preparation do you have to be able to deal with losses of your crops due to drought? (Tick where applicable)

61 responses

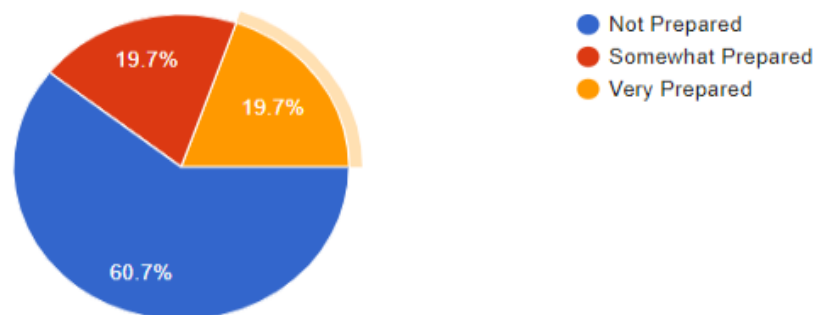


Figure 10

Do you get compensated when your crops are lost due to weather challenges? (Tick where applicable)

61 responses

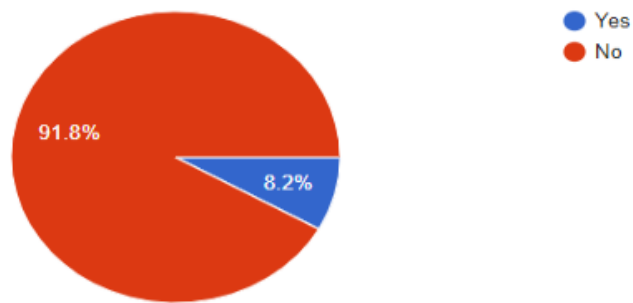


Figure 11

How do you cope financially when your farming activity fails? (Tick where applicable)

61 responses

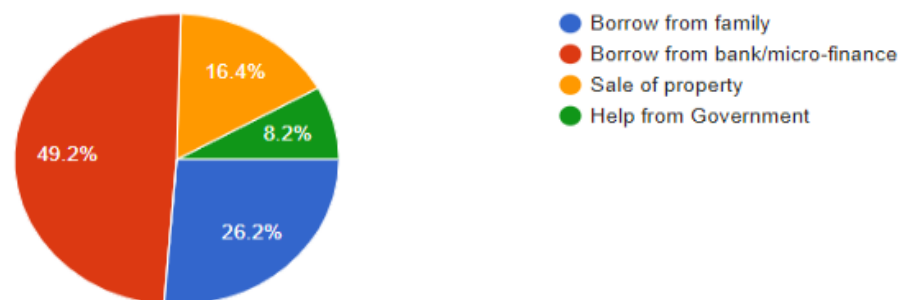


Figure 12

If another way of coping with farming losses is introduced to you, and you had to pay for it, would you be interested? (Tick where applicable)

61 responses

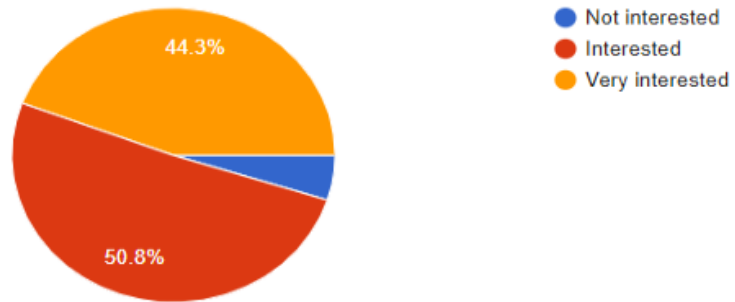


Figure 13

Question 10: Have you heard of insurance? (Tick where applicable)

61 responses

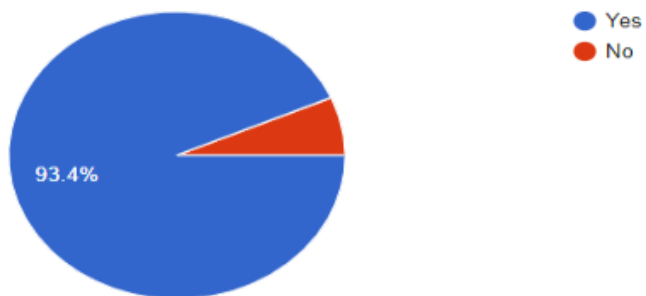


Figure 14

If yes, what type of insurance have you heard of?

61 responses

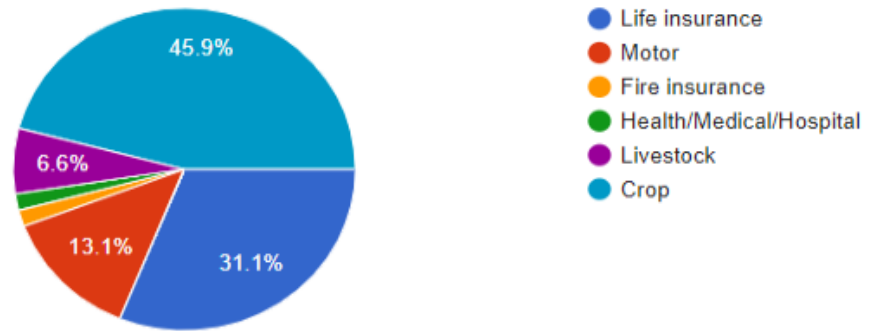


Figure 15

Do you have an insurance policy of any kind?

61 responses

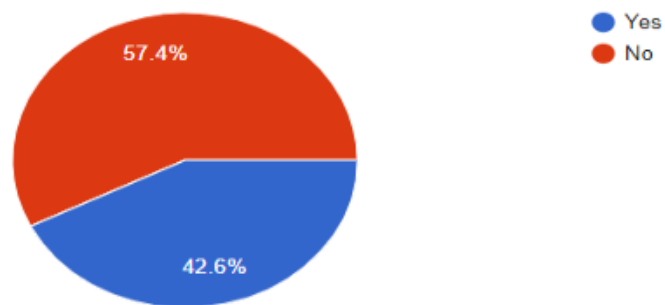


Figure 16

What is stopping you from buying crop insurance?

61 responses

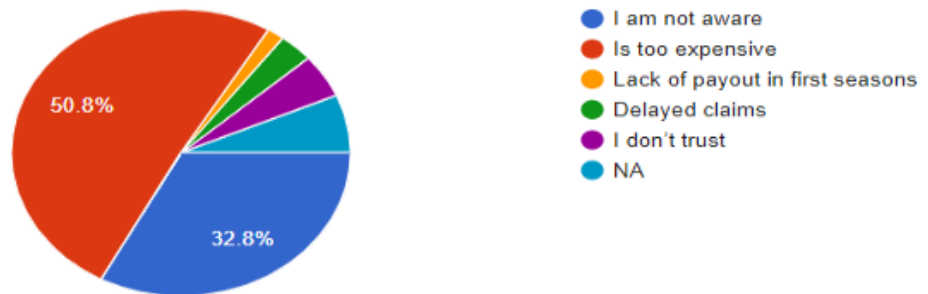


Figure 17

If you were to purchase an agricultural insurance policy, what is your preferred method of enrollment into the scheme?

61 responses

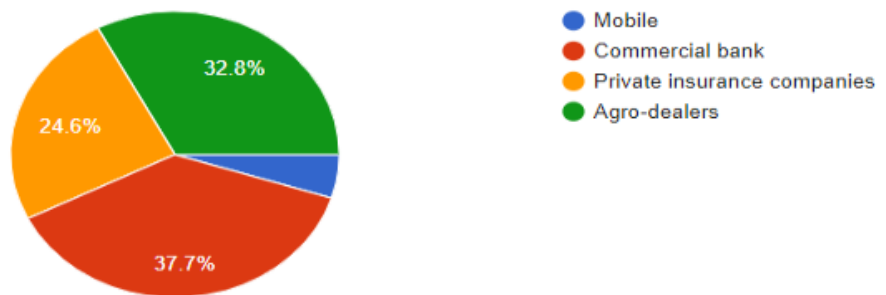


Figure 18

: If you were to purchase an agricultural insurance policy, what is your preferred method of premium payment?

61 responses

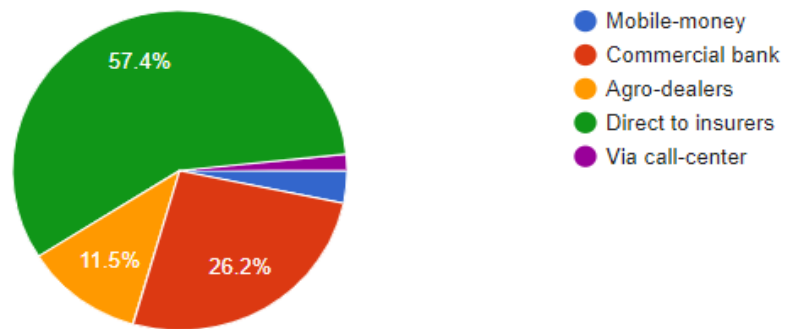


Figure 19

How much would you be willing to pay as premium to protect your crops?

61 responses

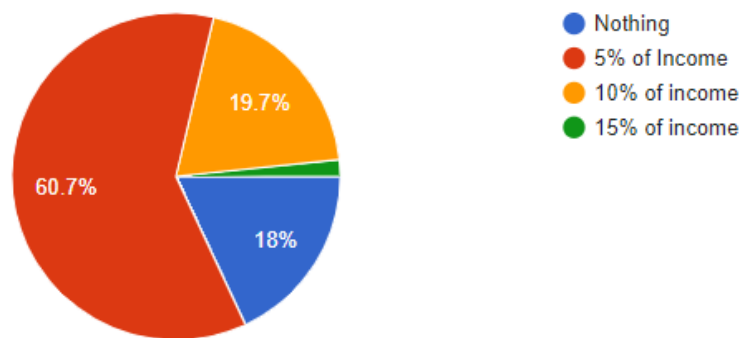


Figure 20

This study has been supported by the InsuResilience Solutions Fund.

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