

PROJECT SUMMARY

**INDEX BASED LIVESTOCK INSURANCE FOR
NORTHERN KENYA'S ARID AND SEMI-ARID LANDS:
THE MARSABIT PILOT**

January 2010

Project Leader and Contact

Dr. Andrew Mude

International Livestock Research Institute

a.mude@cgiar.org

+ 254 20 422 3000 x4369

Technical Team

Professor Christopher B. Barrett

Cornell University

cbb2@cornell.edu

Professor Michael R. Carter

University of Wisconsin, Madison

mrcarter@wisc.edu

Dr. Sommarat Chantararat

Cornell University

sc384@cornell.edu

Dr. Munenobu Ikegami

International Livestock Research Institute

m.ikegami@cgiar.org

Professor John McPeak

Syracuse University

jomcpeak@maxwell.syr.edu

In Kenya's arid and semi arid lands (ASALs), drought is the most pervasive hazard, natural or otherwise, encountered by households on a widespread level. This is especially true for northern Kenya, where more than 3 million pastoralist households are regularly hit by increasingly severe droughts. In the past 100 years, northern Kenya recorded 28 major droughts, 4 of which occurred in the last 10 years. For livelihoods that rely solely or partly on livestock, the resulting high livestock mortality rate has devastating effects, rendering these pastoralists amongst the most vulnerable populations in Kenya. As the consequences of climate change unfold, the link between drought risk, vulnerability and poverty becomes significantly stronger.

Index-based insurance products represent a promising and exciting innovation for managing the climate related risks that vulnerable households face. The creation of insurance markets for events whose likelihood of occurrence can be precisely calculated and associated to a well defined index is increasingly being championed as a way to make the benefits of insurance available to the poor. Over the past year, the International Livestock Research Institute (ILRI), in collaboration with its partners at Cornell University, the BASIS Research Program at the University of Wisconsin-Madison, and Syracuse University, has pursued a substantial research program aimed at designing, developing and implementing market-mediated index-based insurance products to protect livestock keepers - particularly in the drought prone ASALs – from drought-related asset losses.¹

Much of the initial preparatory phase, which included an extensive program of field work and stakeholder consultation, is now complete. An index-based livestock insurance (IBLI) contract has also been modeled, priced, and is ready for implementation. Sales of the IBLI contract will be piloted in January 2010 in Marsabit District. UAP Insurance Ltd., will provide the insurance services while Equity Bank Limited is the insurance agent directly engaging the target client.

The remainder of this note defines the key features of a general index-based contract, highlights the specifics of the IBLI contract, and lays out a pilot strategy to test its effectiveness and commercial sustainability.

1. Advantages and Limitations of Index Based Insurance

Like any insurance product, index-based insurance aims to compensate clients in the event of a loss. Unlike traditional insurance, which makes payouts based on case-by-case assessments of individual clients' loss realizations, index-based insurance pays policy holders based on an external indicator that triggers payment to all insured clients within a geographically-defined space. For index insurance to work, there must be a suitable indicator variable (the index) that is highly correlated with the insured event. Using a data source that is promptly, reliably, and inexpensively available (and not manipulable by either the insurer or the insured), an index insurance contract makes the agreed indemnity payment to insured beneficiaries whenever the data source indicates that the index reaches the "strike point," or insurance activation level.

For example, if one is insuring against livestock mortality, then rainfall or forage availability may be suitable indicators if drought or a shortage of forage, or a combination of the two, often result in above-normal livestock mortality. One could then write an insurance contract based on

¹ This work would not have been possible without the generous financial support of the USAID and the World Bank.

(some statistically-specified function of) a rainfall or forage indicator to protect against specified levels of aggregate livestock losses. The contract would specify its geographical reach, temporal (or seasonal) coverage, the strike level, the relevant premium and payment terms.

An index-based insurance product has significant advantages over traditional insurance. Traditional insurance requires that the insurer monitor the activities of their clients and verify the truth of their claims. For relatively small clients in infrastructure-deficient environments like the northern Kenyan ASALs, the costs of such monitoring are often prohibitive. With index-based insurance products, all one has to do is monitor the index, thereby sharply reducing costs. Furthermore, by using an index based on variables that cannot be influenced by any insuree's behaviour, index-based insurance products overcome the key problems with traditional insurance contracts of an individual's experience: that more (less) risk-prone individuals will self-select into (out of) the contract and that insured individuals have an incentive to take on added risk – phenomena known as “adverse selection” and “moral hazard,” respectively.

These gains from index-based insurance come at the cost of “basis risk”, which refers to the imperfect correlation between an insuree's potential loss experience and the behaviour of the underlying index on which the insurance product payout is based. Individuals can suffer losses specific to them but fail to receive a payout because the index does not trigger. On the other hand, lucky individuals may receive indemnity payments that surpass the value of their losses. While this problem cannot be completely eliminated, we have carefully designed the IBLI contract to minimize basis risk and therefore to maximize its value to the insured population.

2. Overview of Index-Based Livestock Insurance (IBLI) for the ASAL

2.1 Economic and Social Returns to IBLI

The economic and social returns to an effective program that insures pastoral and agro-pastoral population against drought-induced livestock losses can be substantial as it can:

- *Stabilize Asset Accumulation and Enhance Economic Growth.* Insuring assets against catastrophic loss addressed the high risk of investment in such environments. This should improve incentives for households to build their asset base and climb out of poverty.
- *Crowd-in Finance for Ancillary Investment and Growth.* The negative effect of a risky environment on investment incentives is not limited to households. Private creditors presently unwilling to lend for such ventures due to the risk associated with big shocks like drought might become willing to lend if the assets that secure their loans could be insured. Insurance can thereby “crowd-in” much-needed credit for enterprises in the region without leaving poor ASAL residents excessively vulnerable to losing assets when nature fails them.
- *Stem the Downward Spiral of Vulnerable Households into Poverty.* Because it provides indemnity payments after a shock, livestock insurance should help stem the collapse of vulnerable-but-presently-non-poor households into the ranks of the poor following a drought (or related crisis) due to irreversible losses from which they do not recover.

2.2 IBLI Design and Implementation Challenges

Despite the contractual advantages of an index based insurance product as well as the potential economic and social benefits that could arise, four major challenges confront the creation of an IBLI contract.

- *High quality data* are required to accurately design and price insurance contracts and determine when payouts should be made.
- *Design of an optimal insurance index* that to the maximum extent possible reduces the risk borne by the target population so that the value and potential demand for the product are high;
- *Effective demand* for IBLI insurance among a target clientele largely unfamiliar with insurance in general and index-based agricultural insurance in particular; and,
- *Cost-effective ways of delivering* IBLI insurance to small and medium scale producers in remote locations.

We now briefly describe solutions to each of these problems. It is important to emphasize that in designing the insurance contract our objective is to catalyze a commercially sustainable market to deliver the product. Our preliminary investigations lead us to believe that a market-mediated product is indeed feasible and would be the most effective delivery method. However, it is worth noting that the genesis of our intent to design IBLI was our desire to manage the risks faced by vulnerable pastoral and agro-pastoral populations and provide them with a productive safety net that can be implemented as a government or donor-driven social protection program. Nevertheless, these two objectives are not mutually exclusive and would utilize both the same contract and delivery channel. Where governments want to utilize IBLI as a productive safety net, they could simply subsidize the premiums for recipient households.

2.3 Satellite Imagery Solves the IBLI Data Problem

The country of Mongolia currently has an IBLI contract for pastoralists that is based on directly measured livestock mortality. While there are both advantages and disadvantages² to the use of directly measured livestock mortality data, it is not a feasible option in Kenya. While some data on herd mortality in northern Kenya is available, coverage is spotty and inadequate to write a contract. To devise a contract, we therefore had to find a measure that is (1) highly correlated with local livestock mortality; (2) reliably and cheaply available for a wide range of locations; and, (3) historically available to allow pricing of product.

The Normalized Difference Vegetation Index (NDVI) meets these conditions. Constructed from data remotely sensed from satellites, NDVI is an indicator of the level of photosynthetic activity in the vegetation observed in a given location. As livestock in pastoral production systems depend almost entirely on available forage for nutrition, NDVI serves as a strong indicator of the vegetation available for livestock to consume. The NDVI data are available at the resolution of

² The biggest disadvantage that has been noted in Mongolia is the reliability of the reported mortality rate, since large insurance payoffs depend on the number that is reported by the government.

8.0 × 8.0 km. Since the late 1980s, the United States' NASA and NOAA have used AVHRR data³ to produce dekadal (10-day) composite NDVI images of Africa, and have built a valuable archive of these data from June 1981 to present, which are available in real time and free of charge.⁴

2.4 Using NDVI to Create a Livelihood-optimized IBLI

While NDVI has properties that make it reliable as the basis for an insurable index, it must also have value for the insured. In other words, NDVI data has to predict livestock mortality rates reasonably precisely. We used household-level livestock mortality data collected monthly since 2000 in various communities in Kenya's ASAL districts by the Government of Kenya's Arid Lands Resource Management Project (ALRMP) and by the USAID-funded Pastoral Risk Management (PARIMA) Project to statistically estimate the relationship between NDVI measures and observed livestock mortality. Our current contract is based on Marsabit District, the focus for the pilot. We modeled an optimal insurance index of predicted mortality defined as a function of the NDVI data that is simple, replicable, commercially implementable and highly correlated with the herd mortality data so that it provides the maximum possible insurance value to the pastoralist population.

2.5 Insurance Simulation Games to Create Informed Effective Demand for IBLI

Experience with other index-insurance pilots has shown that a carefully designed program to educate potential clients about these products is a necessary prerequisite to both initial uptake and continued engagement with insurance. Index-insurance products are complex to understand, especially for populations in remote rural areas with minimal previous experience with formal insurance products and low literacy levels. In order to generate sufficient demand and ensure that the risk-management benefits of insurance effectively serve IBLI clients, they must clearly understand the value of IBLI and, in particular, how the product works.

In order to design an extension tool that adequately captures the complexities of the IBLI product and communicates the key features of the contract terms, we took a cue from the growing field of experimental economics. Experimental games, the main tool of this field, offer methods by which complex concepts can be distilled and taught in a relatively simple manner. Dynamic decisions or processes can be easily repeated during game play to mirror the consequences of alternative choices and to elicit behavioral responses that could otherwise take years to understand.

Though the games are both time- and resource-intensive, participants come away with quite a clear understanding of the key aspects of an index insurance product: That they would have to pay for insurance before the season began and for each season of expected coverage; that index insurance would not cover non-drought related losses; that indemnity payments were triggered

³ NDVI is derived from data collected by National Oceanic and Atmospheric Administration (NOAA) satellites, and processed by the Global Inventory Monitoring and Modeling Studies group (GIMMS) at the National Aeronautical and Space Administration (NASA). The NOAA-Advanced Very High Resolution Radiometer (AVHRR) collects the data used to produce NDVI. Values of NDVI for vegetated land generally range from about 0.1 to 0.7, with values greater than 0.5 indicating dense vegetation.

⁴ Further details about NDVI are available at <http://earlywarning.usgs.gov/adds/readme.php?symbol=nd>.

as a result of covariate climate events (droughts); that if a drought did not trigger payments, the premium was not returned.⁵

In our preparatory phase, we played the game with over 200 participants in 5 sample communities across Marsabit District. As both an extension and marketing tool, it would be hard to beat such a game. Not only did participants seem to come to understand the product, but they also appeared to enjoy the game and there was animated discussion throughout the day. Most of them grew excited about the product and appear eager to have it introduced. While resource constraints will likely limit the reach of such games across the target marketing area, games can be played among opinion leaders expected to diffuse the information and can also be summarized in video documentaries or the like that can be more cost-effectively shown in various community educational fora.

2.6 A Cost-Effective Implementation Model for IBLI

The pilot district, Marsabit, is a remote, sparsely populated and relatively infrastructure deficient area. As such, in thinking through product and implementation, one cannot ignore the challenges that may arise in targeting clients, accepting premiums, and making indemnity payments within a system that generates enough confidence to allow for active market mediation. Insurance companies would need to develop a cost-effective administrative infrastructure and identify the agents necessary to conduct transactions on their behalf as well as partners with local experience to help facilitate the requisite community interaction.

Fortunately, a substantial social protection program, the Hunger Safety Net Program (HSNP), funded by the United Kingdom's DfID, began rolling out in four of Kenya's poorest districts in early 2009. For the first four-year phase of its ten-year expected duration, the HSNP plans to deliver regular cash transfers to 60,000 households spread across Mandera, Marsabit, Turkana and Wajir Districts. This is a huge task requiring a well-designed delivery channel with a wide network across these regions.

The Financial Sector Deepening Trust (FSD), in conjunction with Equity Bank, have developed the necessary information, communications and financial infrastructure needed to support the HSNP. Equity Bank opened a new branch in Marsabit town in mid 2009 and has made steady headway into establishing the over 150 new Points of Sale (PoS) agents across these regions that will be able to facilitate and provide the HSNP cash transfers to recipient households. Using new hi-tech wireless portable devices within a sophisticated computing system, these PoS devices have been configured to accept premiums for certain insurance contracts and register indemnity payments when necessary.

2.7 Integrated Research Design to Measure the Impacts of IBLI

The IBLI insurance scheme will initially be piloted in one district so that implementation problems can be fully resolved and its impacts reliably evaluated. To determine these impacts,

⁵ Additional details on this and similar games to improve financial literacy and understand index insurance can be found in the BASIS Brief "Insuring The Never Before Insured: Explaining Index Insurance Through Financial Education Games", available at <http://www.basis.wisc.edu/live/amabrief08-07.pdf>.

random samples of over 900 households in 16 sub-locations across Marsabit have been surveyed in a baseline conducted between October and November 2009. These households will be revisited for repeat surveys annually for the next three year. In addition, in order to get a sense of the optimal pricing of the IBLI product, as well as test the hypothesis that subsidizing insurance premiums can serve as a cost-effective social protection program, we aim to induce price variation amongst a subset of the study sample. Sixty percent of the study sample will be randomly selected to receive premium discounts ranging from 10%-60% of the market premium. This research offers an important learning opportunity not only for the private sector, but also for governments and the development community worldwide.

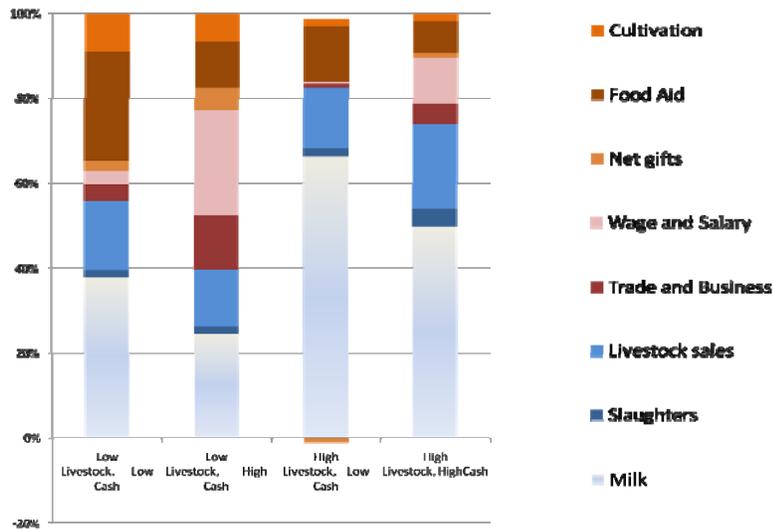
3. The Marsabit IBLI Pilot

3.1 Overview of the Livestock Economy in Marsabit District

Northern Kenya's climate is generally characterized by bimodal rainfall with short rains falling October – December, followed by a short dry period from January-February, and long rains in March-May, followed by a long dry season from June-September. Pastoralists rely on both rains for water and pasture for their animals, as well as occasional dryland cropping. Pastoralism in the arid and semi-arid areas of northern Kenya is nomadic in nature, where herders commonly adapt to spatiotemporal variability in forage and water availability through herd migration.

Livestock represent the key source of livelihood across most ASAL households. As Figure 1 shows, when households are split across four categories – high and low cash income and high and low livestock holdings (where the threshold for high/low is determined by median value), only the low livestock, high cash households obtain less than 50% of their income from livestock.

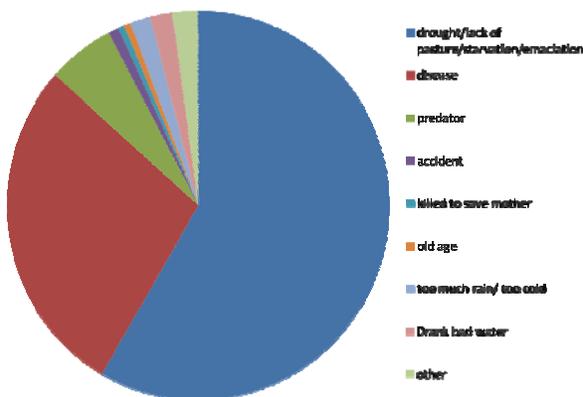
Figure 1: Income Sources By Livelihood Grouping



Source: PARIMA 2000-2002 data

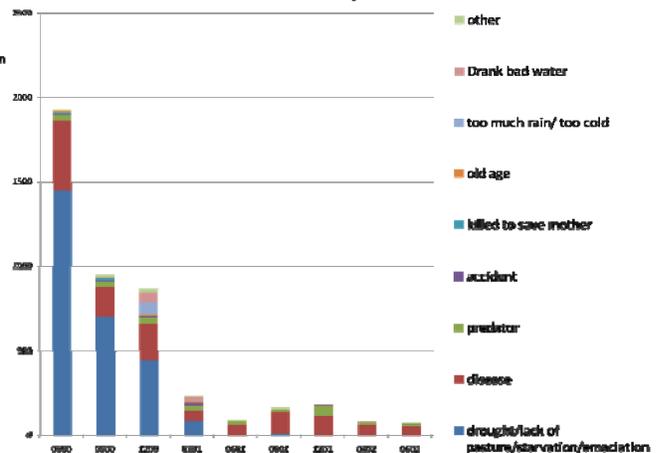
The danger is that livestock face considerable mortality risk, rendering pastoralist households vulnerable to herd mortality shocks. Among these, drought is by far the greatest cause of mortality (Figure 2A) and drought-related deaths largely occur during severe shocks, as during the rain failure of 2000 (Figure 2B). IBLI is designed to for precisely these instances of considerable loss. During times of relative normalcy, mortality arises relatively randomly due to non-drought related mortality causes such as diseases and predators, which IBLI will not cover.

Figure 2A: Causes of Livestock Mortality



Source: PARIMA 2000-2002 data

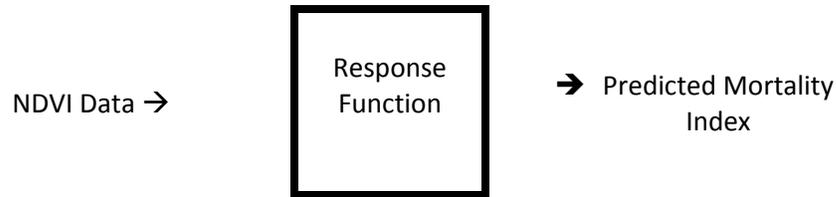
Figure 2B: Causes and Relative Number of Livestock Losses by Season



3.2 Contract terms

Following the strategy laid out in the prior section, we have designed an IBLI contract for Marsabit District. At the core of the contract is a response function that translates observed NDVI data into a statistically reliable predictor of livestock mortality, as depicted in Figure 3 below.

Figure 3: Translating NDVI Data into Estimated Livestock Mortality



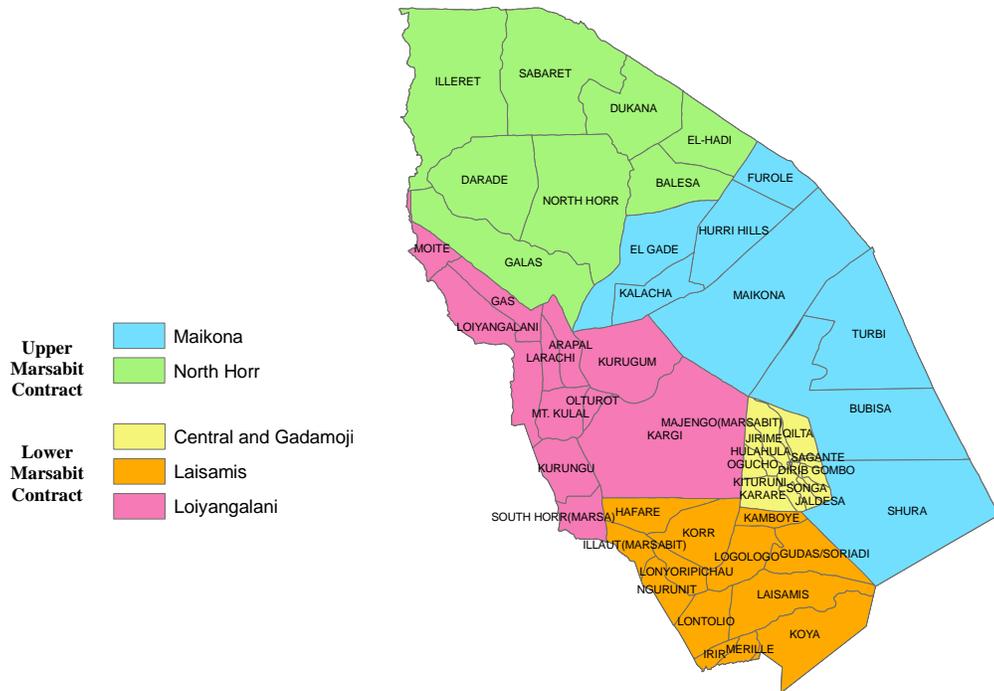
The IBLI contract stipulates five key parameters:

1. The geographical area that the contract covers.
2. The “premium” or the price paid for insurance coverage.
3. The “strike point,” meaning the index level at which the insurance is activated and payouts begin.
4. The value that will be paid for each livestock unit that is later estimated to have been lost.
5. The length of time for which paid coverage lasts

3.2.1 Geographical Coverage of Contract:

Larger Marsabit District will be covered by two separate contracts. We have the Upper Marsabit contract consisting of Maikona and North Horr divisions, and the Lower Marsabit contract consisting of Central, Gadamoji, Laisamis, and Loiyangalani divisions (See Figure 4). The boundaries were chosen due to clear agro-ecological and pastoral production system differences as well as differences in risk. Upper Marsabit has a higher fraction of camels and small stock in their herds than do Lower Marsabit. In addition, Upper Marsabit has a higher likelihood of experiencing significant herd mortality rates, as such, the price for insurance coverage in Upper Marsabit is higher.

Figure 4: Contract Spatial Coverage



3.2.2 Contract premiums and strike point:

For the Marsabit Pilot launching in January of 2010, the consumer prices as established by UAP insurance and her related partners are as below. These prices are specified for a contract with a strike point at 15%. One can think of the strike point as a deductible. Individuals will cover any losses upto 15% predicted mortality and insurance will compensate for any losses above that.

Table 1: IBLI Premiums for 15% Strike Contracts in Marsabit

Contract Cluster	Consumer Price
Upper Marsabit	5.5%
Lower Marsabit	3.25%

3.2.3 Insurable livestock unit and value of herd:

The standard livestock types for a pastoral herd will be covered. These are: Camel, Cattle, Sheep and Goats. To arrive at an value for the insured herd, the four livestock types will be transformed into a standard livestock unit known as a Tropical Livestock Unit (TLU), where: 1 TLU = 1 Cow, 1 TLU = 0.7 Camel, 1 TLU = 10 goats and 1 TLU = 10 sheep.

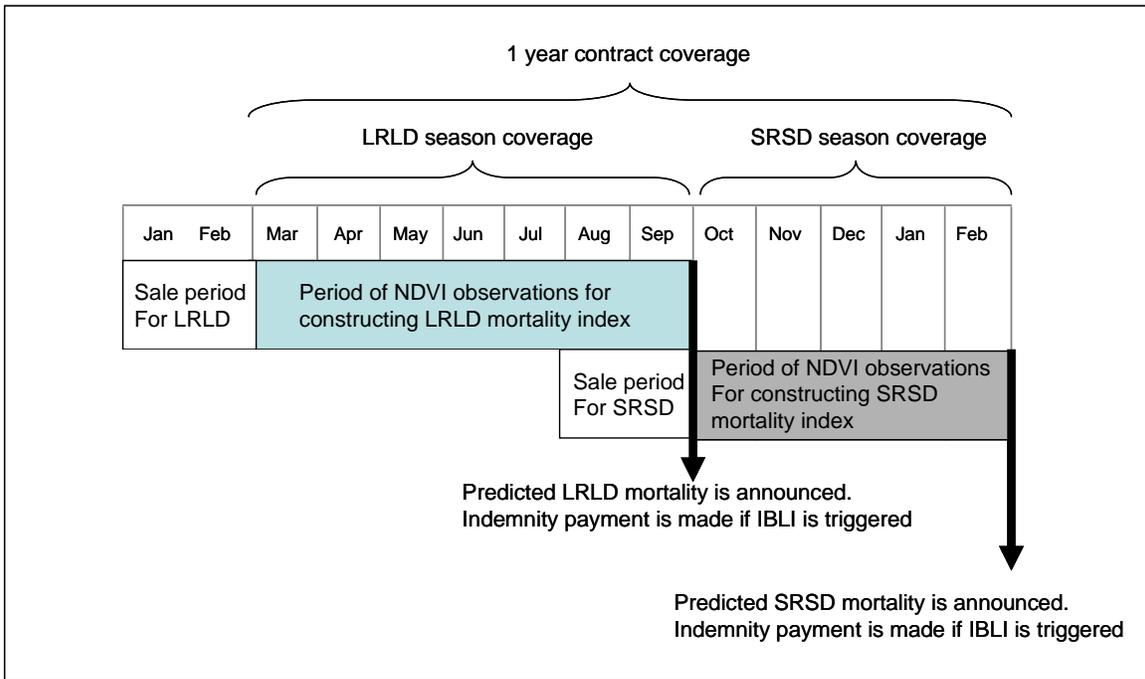
Using average prices for livestock across Marsabit we have arrived at a set price per TLU insured of Ksh 12,000.

3.2.4: Temporal Structure of Contract

Figure 5 below presents the time coverage of the IBLI contract being piloted. The contract is an annual contract whose coverage spans from March 2010 to Feb 2011. IBLI contracts (and other Index-Based Insurance contracts) can only be purchased within a specific time window which in this case is in Jan and Feb 2010. Contracts must be sold within this time frame as the rainy season beginning right after that may give the potential buyer information about the likely conditions of the season to come that would unfairly affect his purchase decision.

This annual contract has two potential payout periods: At the end of the long dry season in September and at the end of the short dry season in February. At these points of time, if the index reads greater than 15%, insurance will pay clients.

Figure 5: Temporal Structure of IBLI contract



3.3 How IBLI will work?

As an example, let us consider the Gudere family in Kargi who purchase 10 tropical livestock units of IBLI insurance for the 2009 long rain/long dry season. At Ksh 12,000 per livestock unit, Gudere's herd would be valued at Ksh 120,000 ($=12,000*10$). As Kargi is located in Lower Marsabit, Gudere would pay Ksh 3900 (which is 3.25% of Ksh 120,000) to cover his entire herd for the annual coverage period.

Once Gudere has purchased insurance, he will now wait to see if he receives any compensation. At the end of September, we would obtain the 2010 long rain/long dry NDVI data for Laisamis Division which Kargi is in and feed those data into the response function, generating the predicted mortality index. Suppose the predicted mortality rate is 13%. Gudere would not receive any compensation. However, let's imagine that at the next possible payout period, in February 2010, the predicted mortality for Laisamis at that time is 25%. This 25% mortality index is then compared to the contractually stipulated strike point of 15%. In this example, the Gudere family would receive compensation for 10% ($=25\%-15\%$) of their covered herd of 10 livestock units. They would thus receive a payment of KSh12,000 ($= 10\%$ of Ksh 120,000, the insured herd value). All the Gudere's insured neighbors in Laisamis would receive compensation at the same predicted rate of 10% of their insured herds. Those who bought no insurance would receive no indemnity payment.