Colombia

Policy Note on the Implementation of Catastrophe Agricultural Insurance

Prepared for: FINAGRO

Prepared by: World Bank Group

February 2017
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<tr>
<td>ARC</td>
<td>African Risk Capacity</td>
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<tr>
<td>AYII</td>
<td>Area Yield Index Insurance</td>
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<td>CADENA</td>
<td>Component for the Attention of Natural Disasters</td>
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<td>CCRIF</td>
<td>Caribbean Catastrophe Risk Insurance Facility</td>
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<td>CNCA</td>
<td>National Agricultural Credit Commission (La Comisión Nacional de Crédito Agropecuario)</td>
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<tr>
<td>CAT-DDO</td>
<td>Development Policy Loan (DPL) with a Catastrophe Deferred Drawdown Option</td>
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<td>FASECOLDA</td>
<td>National Association of Insurance Companies (Federación National de Aseguradores)</td>
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<td>FINAGRO</td>
<td>Fund for the Financing of the Agriculture and Livestock Sector (Fondo para el Financiamiento del Sector Agropecuario)</td>
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<td>GoC</td>
<td>Government of Colombia</td>
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<td>GFDRR</td>
<td>Global Fund for Disaster Risk Reduction</td>
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<td>KLIP</td>
<td>Kenya Livestock Insurance Program</td>
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<td>NAIS</td>
<td>National Agricultural Insurance Scheme</td>
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<td>MADR</td>
<td>Ministry of Agriculture and Rural Development (Ministerio de Agricultura y Desarrollo Rural)</td>
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<td>MHCP</td>
<td>Ministry of Finance and Public Credit (Ministerio de Hacienda y Crédito Público)</td>
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<td>MPCI</td>
<td>Multiple peril crop insurance</td>
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<tr>
<td>PCRAFI</td>
<td>Pacific Catastrophe Risk Assessment and Financing Initiative</td>
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<tr>
<td>PNGRD</td>
<td>National Disaster Risk Management Plan (Plan Nacional de Gestión del Riesgo de Desastres de Colombia)</td>
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<td>SAC</td>
<td>Catastrophe Agricultural Insurance (Seguro Agrícola Catastrófico)</td>
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<td>SNGRD</td>
<td>National Disaster Risk Management System (Sistema Nacional de Gestión del Riesgo de Desastres)</td>
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<td>UNGRD</td>
<td>National Unit for Disaster Risk Management (Unidad Nacional de Gestión del Riesgo de Desastres)</td>
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<tr>
<td>WBCIS</td>
<td>Weather based Crop Insurance Scheme</td>
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<td>WBG</td>
<td>World Bank Group</td>
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<td>WII</td>
<td>Weather index insurance</td>
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Executive Summary

Context

1) **Colombia is very exposed to natural and climatic disasters** and especially to large-scale hydro-meteorological drought and excess rain/flood events related to the ENSO El Niño/La Nina phenomena which impact very severely on the agricultural sector. The El Niño Phase is associated with severe drought in agriculture and increased incidence of forest fires. Conversely, La Niña is associated with excess rain and flooding, flash floods and landslides which can cause severe damage to infrastructure, property and agriculture. Between 1970 and 2011 there were 13 El Niño events and 11 La Niña events affecting Colombia, including the 2010/11 La Niña where exceptionally heavy rainfall and flooding affected approximately 3.5 million people and damages were estimated at around 2 percent of GDP.

2) **In Colombia a high proportion of the rural population are small-scale poor crop and livestock family farmers who are extremely vulnerable to these natural disasters.** At a national level Colombia has been successful in reducing poverty, but in rural area poverty has remained stubbornly high at 40.3% of the 11.4 million rural population or a total of 4.6million rural people below the poverty line (2015 estimates). Small-scale subsistence farmers predominantly grow food crops for their own consumption including maize and plantains. Smallholder cash crops include cotton and tobacco.

3) **Since the end of the rural conflict in 2016, Government of Colombia (GoC) has given major priority to the eradication of rural poverty** through the regeneration of the agricultural sector with a focus on the most vulnerable small crop and livestock producers located in post conflict municipalities. This program called the *Misión para la Transformación del Campo* identifies six pro-poor strategic policies including: (i) territorial planning and development and land reform, (ii) social inclusion (iii) productive inclusion and family farming (iv) development of a competitive agricultural sector (v) environmentally sustainable development and finally (vi) institutional reform

4) **To date public and private sector commercial agricultural insurance in Colombia has been relatively underdeveloped; uptake and penetration rates for crop insurance are very low and the products do not meet the needs of small vulnerable farmers.** Colombia has nearly 20 years of experience with public and private crop insurance provision: however, despite very high levels of premium subsidy support, demand and uptake of crop insurance remains very low at less than 2.5% of cultivated area. There are 2 main crop insurance products in the market: (i) an individual farmer loss of yield-based policy for cereals and oilseeds and (ii) a damage-based policy for tree crops and forestry. Neither of these products are very well suited to the needs of the large numbers of vulnerable family farmers in Colombia.

5) **As part of its commitment to transform the rural sector, GOC is seeking to develop suitable catastrophe agricultural insurance products and programs for the small family farming sector.** These catastrophic agricultural insurance (*Seguro Catastofico Agrícola* or SAC) products are being developed under the umbrella of large scale macro-level insurance programs which will be purchased by the Ministry of Agriculture and Rural Development (MADR) on behalf of the targeted subsistence farmers. The Fund for the Financing of the Agriculture and Livestock Sector
(FINAGRO) is expected to coordinate the design and implementation and financing of the SAC products and programs.

6) **This Policy Note presents to a series of policy guidelines and recommendations for GoC to consider relating to the design and implementation of large-scale Catastrophe Agricultural Insurance programs as part of the government’s integrated disaster risk management and risk financing strategy for Colombia.**

Disaster Risk Financing and Insurance in Agriculture: the Role of Large Scale-Catastrophic Agricultural Insurance as a Social Protection Cover for Small Farmers in Colombia

**Integrated Disaster Risk Financing and Insurance Framework**

7) **It is stressed that the use of Catastrophe Agricultural Insurance in Colombia as a risk transfer tool for government must be developed and implemented as part of an integrated disaster risk financing strategy which includes other financial tools.** It is widely accepted that for high frequency low impact disaster events that governments should use budgetary reserves and disaster funds to finance these losses. For less frequent but more severe disasters, it is more cost-effective to draw down on contingent loans including Development Policy Loans with a Catastrophe Deferred Drawdown Option (DPL-CAT-DDO). For low frequency, catastrophe loss events such as those experienced in Colombia in EL Nino and La Nina years, governments should consider using risk transfer including derivatives, traditional and parametric or index insurance and Catastrophe bonds.

8) **The role of agricultural insurance within such an integrated risk management framework for agricultural disasters is generally considered to be most cost-effective where this is designed to protect against relatively low frequency but high severity natural, climatic and biological events.** Agricultural insurance is a more expensive risk financing instrument than contingency funds or contingent lines of credit, but it has the advantage of being able to generate large amounts of capacity and insurance payouts are generally paid out very quickly post-disaster.

9) **Today, Colombia is widely considered a leader in instituting a policy and legal framework that enables a comprehensive, multi-sectoral approach to disaster risk management.** Colombia has developed a National Disaster Risk Management Plan (Plan Nacional de Gestión del Riesgo de Desastres de Colombia) which is coordinated through and implemented by the National Unit for Disaster Risk Management (Unidad Nacional de Gestión del Riesgo de Desastres) in conjunction with other public sector and private sector stakeholders under the National Disaster Risk Management System (Sistema Nacional de Gestión del Riesgo de Desastres).

10) **Starting in 2008, GoC has been strengthening its financial response capacity to natural disasters through planned ex-ante disaster risk financing instruments** including contingency funds and the contracting of contingent lines of credit and is now using catastrophe insurance as a sovereign risk financing instrument

**International Experience with Large-scale Catastrophe Agricultural Insurance Products**

11) **Over the past 15 years there has been major interest in development circles in the design and implementation of large scale macro-level parametric or index agricultural insurance products**
which can be purchased by national or regional governments to protect against natural and climatic disasters. These index insurance covers may be classified into two types: (i) programs that are designed as disaster risk financing instruments aimed at providing immediate cash liquidity post disaster to finance emergency relief and (ii) programs that are designed as large-scale social protection covers to compensate vulnerable subsistence farmers in the aftermath of a major disaster.

12) Section 3 of this Policy Note and Annexes 4 and 5 present an overview of the main country programs where governments are purchasing catastrophe agricultural index insurance (SAC) covers as part of their natural and climatic disaster risk financing programs. Mexico has the largest agricultural index insurance program in the world termed the CADENA Program which insures large numbers of vulnerable small-holder crop and livestock farmers against climatic shocks. The program is jointly funded and implemented by the Federal and state governments. Given the similarities between farming systems and natural and climatic hazards affecting agriculture in Mexico and in Colombia, the CADENA insurance product types, lessons and experience are of direct relevance to the design of any SAC program in Colombia. In Africa there have been several macro-level drought index insurance initiatives including Ethiopia (2006), Malawi (2008 to 2012) and most recently the African Risk Capacity (ARC) Program which represents a regional risk pool of 6 African countries which purchase drought index insurance as a sovereign risk financing instrument for early drought relief payments. By pooling their drought risk the ARC participants can obtain much cheaper reinsurance cover than if they were to place their programs individually. Kenya is also piloting macro-level satellite-based vegetation index insurance under the Kenya Livestock Insurance Program (KLIP) to protect very poor nomadic pastoralists against severe drought which result in loss of pasture and grazing: the index insurance product provides timely payouts via mobile-phone banking to enable the pastoralists to purchase fodder and feed supplements for their breeding animals and to keep them alive until the drought has ended. Finally, this section deals with two regional windstorm index insurance programs, the Caribbean Catastrophe Index Facility (CCFIF) for Caribbean and Central American countries and the Pacific Catastrophe Risk Assessment and Financing Initiative (PCRAFI).

Proposals for Large-Scale Catastrophe Agricultural Insurance (SAC) In Colombia

13) During 2016-17 the World Bank Group has been conducting a feasibility study into the options for designing and implementing a Catastrophe Agricultural Insurance (SAC) Program to protect small family farmers in Colombia. This study has been conducted in close collaboration with working group from MADR, FINAGRO and FASECOLDA. The feasibility study has designed an area yield index insurance product which uses satellite weather data modelling to estimate area average yields for 8km x 8 km grids. It is planned to pilot test this SAC cover for maize in two Departments, Antioquia and Tolima which were chosen because they are important maize producing areas, they have a high percentage of post-conflict small and marginal family farms and they have good historical weather data availability. The maize index area yield index insurance cover is designed to trigger payouts when actual area yields fall below and agreed threshold e.g. 50%, 40% or 30% of average yield. All farmers in the unit area of insurance will receive the same per payout per hectare where the policy has been triggered by systemic risks -e.g. drought or flood. For localised perils such as hail or frost, it is proposed to adjust and indemnify losses on an individual farmer basis. The sum insured will be designed to reflect the costs incurred in growing
the crop and a flat rate per hectare will be used in both districts for the 1st and second cycle maize crops to simplify the product understand among the beneficiary farmers. Full details of the pilot maize index insurance program are presented in the feasibility study report (World Bank 2017a).

**Design and Operational Challenges for introduction of SAC Products and Programs in Colombia**

14) **The legal position of Parametric or Index insurance policies needs to be approved by the Financial Superintendence of Colombia (Superintendencia Financiera de Colombia - Superfinanciera or SFC).** The General Insurance Act in Colombia does not recognise index insurance as an admitted class of insurance. It had, however, been the World Bank’s understanding that the proposed macro-level PPP Catastrophe Agricultural Insurance (SAC) product would be governed by the original law on agricultural insurance, Law 69 of 1993 and subsequent additions and this Law appears to encompass both indemnity-based and index-based agricultural insurance products. The proposed SAC product is in any case a hybrid area yield index and conventional yield indemnity cover: for systemic risk yield payouts are triggered by sample maize farm yield estimation to establish the actual average yield in the unit area and in-field damage assessment for idiosyncratic perils. Furthermore, given the fact that Crop index insurance has been approved by Insurance Regulators in about 50 developed and developing countries and is operating successfully within existing legislation, it is hoped that these products will equally be approved in Colombia.

15) **The Institutional and Operational Framework for Macro-level Catastrophe Agricultural Insurance will need to be closely examined and, in this context, GoC will need to decide on the process for awarding the contract on this government purchased policy to one or more companies on an annual or multi-year basis.** Currently there is a group of 6 agricultural insurers in Colombia which operate separately and compete for business mainly with commercial farmers: each company employs its own small team of crop insurers and claims managers and teams of field loss adjusters. Options for the implementation of the SAC program include:

- **Insurance companies operating individually.** This would require each Insurer to registering its interest with government to underwrite the SAC program in each Department and to go through an annual bidding process to win the business. The company that wins the order would then need to show that it has the necessary systems and procedures in place to register the large number of smallholder beneficiaries and to provide them with insurance literacy and awareness and training; to develop procedures for area crop yield sampling to establish actual average yield and special loss assessment procedures to deal with idiosyncratic losses which will be adjusted on an individual farmer basis; to put in place procedures for distributing the payouts to the beneficiaries (e.g. opening back accounts) and finally to put in place their own reinsurance program, or

- **Insurance companies elect to form a coinsurance pool** where they agree to pool the business and to purchase common account reinsurance cover. The pool would be able to share the costs of setting up a single underwriting and claims unit to manage the business on behalf of the pool which would result in major cost savings. Further advantages of a pool approach are reviewed in Section 3 and in Annex 7.

16) **Identifying and Registering the Target beneficiaries for the SAC in each Department and Insured Unit will require careful planning.** This task is complicated by two facts (a) there is no unique farmer register in Colombia and different organisations use different criteria to classify vulnerable family farmers and (b) the proposed Unit Area of Insurance (UAI) is an 8km x 8km pixel or grid.
While this can be located accurately using GPS latitude and longitude measures, the farmer registers that are maintained in Colombia are currently based on administrative units (departments, municipalities and veredas). It will be necessary for the key stakeholders to work closely with the Departmental Administrations in the farmer identification and registration process.

17) The SAC appointed Insurer(s) will need to establish teams of trained agronomists to conduct crop yield sampling in each UAI to establish the actual average area yield in that UAI to determine if a claims payout has been triggered or not. Furthermore, the teams will need to be trained in crop loss damage assessment for idiosyncratic risks such as hail which will be adjusted on an individual farmer and field basis. Until recently the lack of security has made it very difficult for the insurance companies to recruit and deploy teams of crop loss adjusters, but hopefully this situation will be improved now that the peace agreement has been signed.

18) The costs of SAC administration and especially field-based crop yield assessment and loss assessment will need to be analysed carefully if these costs are to be covered under the commercial premium rate alone. The current costs of operational and administration on the programs for commercial farmers is relatively expensive: according to Fasecolda, the total administrative and personal costs for agricultural insurance varied between a low of 5.6% of written premium in 2015 to a high of 19.4% in 2013 (Fasecolda 2016). These costs can be expected to be considerably higher under a small family farmer program.

Policy Recommendations for the Implementation of large-scale Catastrophe Agricultural Insurance in Colombia

Public Private Partnership for Catastrophe Agricultural Insurance

19) The proposed large scale agricultural insurance program in Colombia is likely to require major innovation and investment and action from both the public and private sectors under a suitable Public Private Partnership (PPP) Program. Private sector insurers, acting alone, are seldom able to meet the agricultural insurance needs of large numbers of small-scale farmers and where they have introduced pilot programs targeted specifically at small farmers these have tended to fail to reach scale and or sustainability.

20) Key market-problems faced by private sector insurers often include: (i) lack of knowledge and experience in the design and rating of traditional indemnity-based and /or new index-based crop and livestock insurance products and programs (ii) information asymmetries whereby the insurers lack information and data on the target population (iii) lack of awareness and understanding by the target beneficiaries on the role and purpose of agricultural insurance, (iv) lack of rural insurance infrastructure, staffing systems and procedures with which to promote, market and administer agricultural insurance and to adjust claims with potentially very large numbers of resource poor small farmers and (v) often limited access of insurers to reinsurance capacity.

21) Public investments to address these market issues under suitable PPP frameworks can enable sustainable development of agricultural insurance products and services for small farmers. The key stakeholders under such a PPP insurance initiative for Colombia will include MARD-FINAGRO representing national government interests, FENASEG representing the private insurance sector,
the Departmental Governments who will assume a key role in implementing the SAC programs, and small farmer organisations.

22) **It is very important that GoC investment in large scale agricultural insurance is carried out as part of the National System for Disaster Risk Management (Sistema Nacional de Gestión del Riesgo de Desastres (SNGRD) and not in isolation.** This means that the proposed SAC for vulnerable farmers should be planned as part of an appropriate mix of ex-ante risk financing and insurance instruments for agricultural risks. MADR-FINAGRO should work closely with the UNGRD, the National Disaster Risk Management Unit (Unidad Nacional de Gestión del Riesgo de Desastres) which is responsible for directing and coordinating disaster risk management and financing under the SNGRD in Colombia.

**GoC Roles in Supporting the Implementation of Catastrophe Agricultural Insurance in Colombia**

23) **GoC can potentially play a vital role in supporting the development of the large-scale macro-level Catastrophe Agricultural Insurance Program for Small-Scale farmers in 6 key areas:**

1) Creating an Enabling Legal and Regulatory Environment
2) Provision of Technical Support to Product Design and Development and to program implementation
3) Strengthening Data Collection, auditing and management and analysis of data
4) Ensuring outreach through farmer awareness creation, education and training, linkage to credit and input and output markets
5) Financing of premium subsidies to ensure inclusion of vulnerable resource poor farmers
6) Risk financing through the promotion and capitalisation of Insurance Pools and or provision of catastrophe reinsurance protection

**Creation of an Enabling Legal and Regulatory Framework**

24) **MADR-FINAGRO are well placed to work with the Insurance Supervisory Authority, SFC, to ensure that the proposed Catastrophe Agricultural Insurance (SAC) Program for small family farms which is a hybrid parametric and indemnity-based product complies with existing Insurance Law.** Over the past 15 years, parametric or index agricultural insurance products have been widely promoted and implemented in about 50 countries, either as micro-level individual farmer retail policies or as macro-level disaster response policies purchased by governments on behalf of rural and urban populations. In these countries the parametric insurance products and programs have been approved by the Insurance Regulators as a class of non-life (general) insurance business and it is recommended that Colombia should not be an exception to this rule.

**Technical Support to Product Design and Rating and Program Implementation**

25) **It is recommended that MADR-FINAGRO consider forming a dedicated Technical Support Unit (TSU) to support the design and implementation, monitoring and management of the large-scale PPP agricultural insurance programs in Colombia.** The key functions of the TSU would include to: (i) support GoC Policy and Planning for the Commercial and Small Farmer Agricultural Insurance programs including preparation of annual business plans and budgets for government financial support including premium subsidies; (ii) provide Departmental Government with technical analysis and tools to evaluate the large-scale Catastrophe Agricultural Insurance
Proposals made by the private sector insurers; (iii) promote the development of and piloting of new agricultural crop, livestock and forestry insurance products and programs in Colombia; (iv) provide specialist support to the design and rating of traditional and index insurance products and in the development of catastrophe risk assessment models; (v) establish a centralised database for agricultural crop production and damage related data, climatic data and agricultural insurance data; (vi) support the development of outreach awareness and education programs for small farmers throughout Colombia; (vii) support development of standardised crop yield estimation and loss assessment systems and procedures for adoption at departmental level and finally (viii) conduct monitoring and evaluation of the performance and impacts of the commercial and small farmer insurance programs. The TSU could conveniently be housed in FINAGRO.

**Strengthening Data Collection, auditing and management and analysis of data**

26) **Governments can play a central role in coordinating public and private sector investments in collecting, auditing and managing agricultural insurance related data and in ensuring this is freely available to all public and private stakeholders.** In Colombia there is are a wide range of organisations involved in the collection of crop production and yield data, crop damage data, weather data and insurance related data and data on the rural and farming communities. Very little of this data is, however, coordinated at present. Going forward, it is recommended that the TSU take a leading role in the collection and processing and storage and dissemination of agricultural crop production and damage related data, climatic data and agricultural insurance data.

**Increasing Insurance Outreach and the role of premium subsidies**

27) **Governments can increase the outreach and ensure that agricultural insurance schemes reach scale in several ways:**

- Investment in public awareness and education and training programs for farmers
- Enforcing some form of compulsion of insurance on the target audience
- Subsidising of insurance premiums
- Automatic enrolment of targeted farmers into public safety net cum social protection agricultural insurance schemes

28) **In Colombia, the low voluntary demand for crop insurance suggests that there is a strong need to accompany any large-scale crop insurance program for small farmers with a suitable insurance literacy and awareness and education campaign.** Central government and departmental and municipality governments could play a very important role in conducting these insurance literacy campaigns through their agricultural extension service departments. The TSU could perform a useful role in designing suitable crop insurance promotional and training materials.

29) **Under the proposed catastrophe agricultural insurance program for Colombia, GoC plans to target small vulnerable farmers particularly those in the post-conflict zones and to automatically enrol them under the program as beneficiaries.** These farmers will be provided with free (i.e. fully funded) crop insurance compensation payments when actual yields fall below 50% to 30% of the modelled area average crop yield. The insurance payouts will be designed to enable the predominantly subsistence family farmers to replant their crops in the next season and to get back
into production. It is likely that the Departmental Administrations and specialist agencies working with small farmers will take a leading role in identifying and registering the farmers that will be the beneficiaries of the SAC programs.

**Risk Financing**

30) The GoC could assist the domestic insurance companies to pool their agricultural risks thereby achieving a larger, more diversified and better structured portfolio than if they try to insure their own separate portfolios. In the short term while the SAC is being implemented on a pilot scale with only one or two crops in one or two departments, it is likely that the optimal vehicle would be a simple coinsurance agreement, but in the medium term if the SAC scales-up, then the government and participating insurers may wish to capitalise and register a new Pool Agricultural Insurance Company specifically underwriting large-scale PPP crop and livestock insurance programs. In this instance GoC could support the insurers by contributing towards financing the initial capitalization of the pool insurance company under a suitable loan agreement. Going forward, this pool insurance company would be well placed to underwrite all public-sector macro-level catastrophe risk insurance programs in Colombia including for example, earthquake.

31) In some countries governments also support the reinsurance program by assuming a portion of the catastrophe risk layer. In many countries governments provide support to the reinsurance of their agricultural insurance programs, either through a national reinsurance company or through assuming the responsibility for funding a catastrophe risk layer on the reinsurance program. In Colombia, La Previsora is both an insurer and reinsurer and is well placed to support the SAC initiative.

**Role of Departmental Governments in Implementing SAC**

32) Under the proposed Large-scale PPP Catastrophe Agricultural Insurance Program, the Departmental and Municipality Governments can play a central role in the implementation of the program. The key roles are likely to include: (i) Identification and registration of target Beneficiaries; (ii) provision of crop insurance awareness creation, education and training for the targeted farmers; (iii) support to Insurance Companies in the end of season area yield measurement exercise based on sample crop crops cuts, and the mid-season assessment of losses caused by idiosyncratic risks; (iv) contributing towards the financial costs of premium subsidies and (v) Monitoring and Evaluation of the SAC Program results and impacts.
1. Introduction and background

1.1. Background

**Colombia is very exposed to natural and climatic disasters and especially to large-scale hydro-meteorological drought and excess rain/flood events related to the ENSO El Niño/La Niña phenomena which impact very severely on the agricultural sector.** The great hydro-meteorological disasters have caused serious damages to the country; for example, El Niño 1997-1998 caused phytosanitary (plant protection) problems and a reduction in agricultural and livestock production, resulting in losses estimated at US$101 million. La Niña 2007-2008 affected nearly all agricultural subsectors, in which coffee suffered a 28% reduction in production, equivalent to a loss of US$340.5 million in coffee exports. Furthermore, La Niña 2010-2011 resulted in the most important historic impact in the agriculture sector caused by a hydro-meteorological event. It caused crop damage in a total of 1,324,000 hectares, losses in coffee production valued at US$285.7 million, and the loss of more than 130,000 head of cattle, among other negative consequences (GFDRR 2011).

**In Colombia 11.4 million people (24% of the total population) live in rural areas and a high proportion of these are small-scale poor crop and livestock family farmers who are extremely vulnerable to these natural disasters.** Many small farmers in Colombia are below the poverty line, they are subsistence farmers who produce for consumption and do not have savings and assets to draw down on in the event of severe crop damage and or losses to their livestock caused by climatic or other disasters. They are therefore extremely vulnerable to major natural and climatic and biological shocks which can impact very negatively on their livelihoods.

**Since the end of the rural conflict in 2016, Government of Colombia (GoC) has given major priority to the eradication of rural poverty through the regeneration of the agricultural sector with a focus on the most vulnerable small crop and livestock producers.** This program termed the Rural Transformation in Colombia (Misión para la Transformación del Campo) or Misión Rural was launched in 2016 and aims to develop the small farmer agricultural sector through a series of institutional, social, technological reforms and strategies. Further details of the Misión Rural strategy are presented in Chapter 2.

**In the livestock and agriculture sectors, the traditional response by GoC to major natural and climatic disaster events has usually been through implementing ex-post disaster financial compensation and relief programs.** This includes debt write-offs for small producers, refinancing and amnesty on interest for medium and large producers, and soft credits and guarantees for restoring production capacities. In the case of agriculture there has also been a special Livestock and Agricultural Solidarity Fund (1996) for purchasing debt portfolios in disaster situations.

**In Colombia GoC uses a range for sources to finance ex-post disaster response, rehabilitation, and reconstruction.** These sources include the (i) National Calamity Fund (Fondo Nacional de Calamidades, FNC) formed in 1984, or (ii) the National Royalties Fund (FNR) or (iii) central government budget reallocation. However, the funds available through FNC/FNR have always been inadequate to cover more than a fraction of the damages arising out of catastrophe natural events (GFDRR 2011).

**Since 2008, GoC has been strengthening its financial response capacity to natural disasters though planned ex-ante disaster risk financing instruments including contingency funds and the contracting of contingent lines of credit and is also considering using catastrophe insurance as a sovereign risk financing instrument.** Colombia was one of the first countries in 2008 to purchase from the World Bank a Development Policy Loan with a Catastrophe Deferred Drawdown Option (DPL with a CAT DDO) for US$ 150 million. The World Bank is now assisting GoC to develop parametric macro-level insurance covers as part of its sovereign risk financing strategy for major catastrophic events such as earthquake, volcanic eruption, flood etc.
To date public and private sector agricultural insurance in Colombia has been relatively underdeveloped, uptake and penetration rates for crop insurance are very low and the products do not meet the needs of small vulnerable farmers. Colombia has a history of public and private sector crop insurance dating back to the late 1990’s. Government through the Fund for the Financing of the Agricultural Sector (Fondo para el Financiamiento del Sector Agropecuario - FINAGRO) has actively tried to promote agricultural insurance through the provision of high levels of crop insurance premium subsidies. The demand for and uptake of crop insurance by farmers has, however, been much lower than anticipated and according to one estimate only 2.4% of the total sown crop area was insured in 2014 (Guzman et al 2015). Furthermore, the products that have been designed to date have been directed at the medium to large commercial farmers as opposed to the small and vulnerable farming sector. As such the agricultural insurance market does not currently offer smallholder farmers any form of protection.

As part of its commitment to transform the rural sector, GOC is seeking to develop suitable catastrophe agricultural insurance products and programs for the small family farming sector. This initiative is being coordinated by FINAGRO-MADR and centres on the design of catastrophe agricultural index insurance products and programs to complement the existing national and departmental ex-post natural disaster compensation programs for farmers. FINAGRO-MADR is studying applications of parametric or index insurance cover to protect the smallest and most vulnerable farmers in Colombia against catastrophe natural, climatic and hydrological events.

1.2. Objectives of this Policy Note

This report presents to a series of policy guidelines and recommendations for GoC to consider relating to the design and implementation of Catastrophe Agricultural Insurance programs as part of the government’s integrated disaster risk management and risk financing strategy for Colombia. This Policy Note should be read in conjunction with the detailed Technical Report for a Catastrophe Agricultural Insurance Pilot Program in Colombia (World Bank 2017a). The note was prepared and discussed in an ongoing dialogue with key sector stakeholders¹, and includes their input and feedback. The reminder of this Policy Note is divided into three main sections starting with Section 2 which provides an overview of agriculture in Colombia, government proposals for the post conflict development of the agricultural sector with a focus on family farmers and an analysis of the main natural, climatic and biological risk exposures affecting agriculture and their impacts. Section 3 focuses on the key planning issues and options for large-scale catastrophe agricultural insurance (Seguro Agricola Catastrofico - SAC) in Colombia as part of an integrated risk management and risk financing framework for natural disasters and draws on the lessons and experiences from similar large-scale PPP initiatives for agricultural insurance such as the CADENA program in Mexico which is targeted at small and marginal farmers. Finally, Section 4 presents a series of policy recommendations for GoC to consider for the development of its own large-scale crop and livestock insurance PPP

¹ The institutions that participated of the discussions with the World Bank team for the preparation of this policy note include: Fondo para el Financiamiento del Sector Agropecuario (FINAGRO), Dirección de Financiamiento y Riesgo Agropecuario del Ministerio de Agricultura y Desarrollo Rural (MADR), Departamento Nacional de Planeación (DNP), Secretaría de Agricultura del Departamento de Antioquia, Secretaría de Agricultura del Departamento de Tolima, Unidad Nacional de Gestión de Riesgos de Desastres (UNGRD), CORPOICA, IDEAM, MADR, especially its Dirección de Financiamiento y Riesgos Agropecuarios; MHCP, Unidad de Planificación Rural Agropecuaria (UPRA), Banco Agrario, MAPFRE Colombia, La Previsora Seguros, Producción Agrícola de Colombia S.A.S (PROAGRO), Sociedad de Agricultores de Colombia (SAC), Federación de Aseguradores Colombianos (FASECOLDA), Federación Nacional de Cultivadores de Cereales (FENALCE), and Federación Nacional de Cafeteros (FNC).
initiatives and which would be aimed at protecting small vulnerable farmers against catastrophe climatic events.
2. Importance of Agriculture, GoC Priorities for Small Farmer Development, and Major Agricultural Risk Exposures and Impacts

2.1. Importance of Agriculture in Colombia

In Colombia, agriculture (including crop and livestock production) is an extremely important socio-economic sector employing 3.5 million people or 16.5% of the national workforce and accounting for 7.12% of Gross Domestic Product (DANE 2013; World Bank 2016\(^2\)). Agriculture comprises three main sub-sectors, (i) food crop production dominated by maize, rice, soya, potatoes, beans and horticultural crops and commercial field crops such as cotton and tobacco; (ii) a high value export crop sector including coffee, plantains, bananas, sugar cane and flowers and finally (iii) livestock production including beef cattle production, pig and poultry rearing.

Agriculture is a major source of export earnings for the country. In 2016 total exports from Colombia were valued at US$ 31.0 billion, of which exports of crude petroleum and coal accounted for 54% of the total value of exports. Coffee was the 3rd largest export commodity valued at US$ 2.45 billion (8.1% of total value of exports); cut-flowers were the 5th most important source of export earnings or $1.31 billion (4.3% of total value of exports) and bananas with exports valued at US$ 915 million (3.0% of the value of exports). Overall, agricultural exports amount to about 20% of the total value of exports\(^3\). In 2016 imports of agricultural products amounted to 11.1% of the total value of imports including maize, wheat and soya bean residues and oil\(^4\).

Coffee is by far the most important crop produced in Colombia. It is cultivated by more than half a million farmers located in 23 of the 32 departments in Colombia with total average annual cultivated area of 0.911 million hectares and about one third of all production is concentrated in the departments of Antioquia, Huila and Tolima. This is followed by maize which is grown in 100% of departments in Colombia, with average annual sown area of 0.610 million hectares; rice which is grown in 26 departments and with total average area of 0.510 million hectares and with 52% of rice area located in Tolima, Casanare and Meta; oil palm, grown in 20 departments in an average 0.438 million hectares and plantains which are grown in all departments with an average area of 0.426 million hectares with the main departments being Antioquia, Quindo and Huila. Altogether these principal 5 crops account for about 60% of the total average cultivated area of 6.85 million Ha\(^5\). Smallholder farmers are widely involved in coffee, maize and plantain production: coffee is a cash crop, maize and plantains are the main subsistence food crops.

Over the last 25 years, the rate of growth in the agricultural sector has been only half the rate of growth in the overall economy. This trend is illustrated in Figure 1 over the past 9 years (2008 to 2016) during which Gross Domestic Product (GDP) has grown at an average of 3.79% per annum, but agricultural GDP has only grown at an average of 1.78% per annum: indeed, negative growth was recorded in agriculture between 2008 and 2010 which were severe ENSO-El Nino/La Nina years. The main causes of the stagnation in agricultural productivity has been the lack of adequate production support policies, a disorganized land registration system and poor land use (IFAD 2016). These problems have also been aggravated by the lack of security and rural conflict which have led to low

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\(^3\) https://atlas.media.mit.edu/en/profile/country/col/


\(^5\) These figures are based on MADR average crop sown area data by department for the period 2007 to 2014 and are reported in the World Bank Feasibility Study 2017.
levels of investment in rural and agricultural infrastructure and as a result agricultural production and output has tended to stagnate.

Figure 1. Colombia: Growth Rate in Gross Domestic Product (GDP) and in Agricultural GDP

![Graph showing growth rates](image)

Source: World Bank Development Indicators

**There are about 3.7 million rural farm properties covering 61.3 million hectares: most farmers are small-scale producers and agricultural land is very unevenly distributed among the farming population.** According to data from the 3rd National Census for Agriculture and Livestock there are a total of 2.3 million Agricultural Production Units (UPAs) in Colombia of which 817,714 UPA's are predominantly involved in agriculture with a total farm area of 20.6 million hectares. The census reported that 74% of total UPAs were less than 5 Ha in size and accounted for only 4.2% of total farm area; while at the other extreme UPAs larger than 1,000 Ha accounted for only 0.2% of the UPA's, but as high as 63% of total farm area.

**Many rural farming households are very poor and live below the poverty line.** Between 2008 and 2015 Colombia achieved major successes in reducing poverty from 42.0% to 27.8% of the national population. During this same period the levels of rural poverty, however remained disproportionately high: in 2008, 56.6% of the rural population were classified as living below the poverty level and in 2015 this level was still extremely high at 40.3% of the 11.4 million rural population or a total of 4.6 million rural people below the poverty line. Other measures also highlight the disparity between urban and rural populations: in 2016, 84.4% of the national population had access to basic sanitation services, but this applied to only 72.0% of the rural population; while 71.1% of the national population had access to "safely managed water services", this applied to only 39.8% of the rural population.

2.2. Government of Colombia Plans to Transform the Rural & Agricultural Sectors

**Since the end of the conflict and signing of the peace agreements in 2016, the Government of Colombia (GoC) in conjunction with the regional governments have placed a very high priority on eradication of rural poverty through the regeneration of the agricultural sector with a focus on the most vulnerable small crop and livestock producers.** According to IFAD the government’s vision for post-conflict Colombia emphasizes rural development coupled with an integral approach, including efficient land use, improved infrastructure, and the importance of family farming. The signing of the peace agreement is also expected to increase public and private investment in the rural sector, in projects geared to increasing small farmers’ productivity and improving infrastructure and services.

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In 2015 government published a major policy document and strategy for Rural Transformation in Colombia (Misión para la Transformación del Campo). The central objective of the Rural Transformation Mission or Misión Rural is to promote government policies that will enable rural society to realise all its potential thereby contributing to the wellbeing of the nation and to play a decisive role in creating peace. In recognition of the need to realign government policy towards development for the most vulnerable and neglected rural population, the Misión Rural identifies six pro-poor strategic policies including: (i) territorial planning and development and land reform, (ii) social inclusion (iii) productive inclusion and family farming (iv) development of a competitive agricultural sector (v) environmentally sustainable development and finally (vi) institutional reform (DNP 2015). Further details of each strategic component of the Misión Rural are presented in Box 1).

**Box 1. Colombia: Six Strategic Policies of the Rural Transformation Plan (Misión Rural)**

1. **Territorial organization and development:** this strategy seeks to develop instruments (norms, laws, incentives, etc.) that regulate the ownership, use, distribution, conservation and exploitation of the land and natural resources of the territory, seeking a balance between the social, the economic and the environmental.

2. **Closure of social gaps with a rights-based approach:** aims at the social inclusion of the rural population through the provision of social interest goods with intervention models that respond to the needs of the field.

3. **Productive inclusion:** this strategy has the objective of incorporating the rural population into economic dynamics, complementing the social inclusion strategy. It seeks to develop mechanisms for small producers and rural workers to integrate into markets, achieve a fair remuneration and improve their well-being.

4. **Development of a competitive rural economy with an emphasis on the agricultural sector:** the country has great economic potential based on rurality. The purpose of this strategy is to promote competitiveness through the adequate provision of public goods and the promotion of an appropriate macroeconomic and financial environment.

5. **Elements of environmental sustainability for rural development:** this strategy aims to generate sustainability conditions for rural activities through instruments that contribute to the conservation of the country’s heritage in terms of water, soil, biodiversity, forest wealth and adaptation to climate change.

6. **Deep institutional reform:** aims to have a comprehensive and multi-sectoral institutional arrangement, with clear policies, with a broad presence and implementation capacity at the territorial level, involving organized civil society and the private sector in planning, decision making, the execution of programs and projects and the monitoring of results, to give rural inhabitants a leading role as managers and actors of their own development.

Source: National Department of Planning (Departamento Nacional de Planeacion) 2015

In December 2015, three new agencies, the National Land Agency, the Agency for Rural Development and the Agency for the Renewal of the Territory were created to carry forward the

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8 A wide range of entities were involved in the preparation of the Misión Rural plan and strategy, starting with the President of the Nation and multiple institutions of National Government including most notably the National Department of Planning (DNP), Ministry of Agriculture and Rural Development (MADR) and its key departments of CORPOICA, FINAGO and UPRA), the Ministries of: Social Prosperity, Finance and Public Credit, Health & Social Security, Employment, Industry and Tourism, Education, Environment and Sustainable Development, the Peace Commission and the Secretaries of Agriculture from each Department in Colombia. Various international organisations and development agencies also contributed to the Misión Rural report.
ambitious reforms in the rural sector contemplated in the Misión Rural report and in the peace agreements (IFAD 2016).

In October 2015, the government launched the program “Colombia Siembra” to encourage the production of food staples. Colombia Siembra involves an investment of USD 500 million through 2018 and aims to boost agricultural growth by 6.2 percent. Colombia Siembra will address productivity and competitiveness of this sector by investing in machinery, irrigation, and technology.

After the peace accord was ratified in October 2016 between the government and the FARC guerrillas, the agricultural sector could be one of the biggest beneficiaries since rural development has been identified as one of the government’s priority sectors in the post-accord era.

2.3. Main risk exposures and impacts in the agricultural sector

Sources of Risk in Agriculture in Colombia

Risk and uncertainty in agriculture can arise from a wide range of sources. Jaffee et al 2010 provide a useful classification of the main types of risk and uncertainty affecting agricultural supply chains, including: (i) the vagaries of weather and occurrence of natural disasters; (ii) the unpredictable nature of biological processes; (iii) pronounced seasonality of production and market cycles and farmers often face pronounced market price risk; (iv) geographical separation of production and end uses and logistical and infrastructural risks that can impact on agricultural supply chains; (v) agricultural production management and operations risks at the farm level, (vi) policy and institutional risks - the unique and uncertain political economy of food and agriculture sectors, both domestic and international and (vi) political risks. Table 1 contains further details on each of these major sources of risk in agriculture.

Table 1. Categories of major risks facing agricultural supply chains

<table>
<thead>
<tr>
<th>Type of risk</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weather related risks</td>
<td>Periodic deficit and/or excess rainfall or temperature, hail storms, strong winds.</td>
</tr>
<tr>
<td>Natural disasters (including extreme weather events)</td>
<td>Major floods and droughts, hurricanes, cyclones, typhoons, earthquakes, volcanic activity.</td>
</tr>
<tr>
<td>Biological and environmental risks</td>
<td>Crop and livestock pests and diseases, contamination related to poor sanitation, human contamination and illnesses, contamination affecting food safety, contamination and degradation of natural resources and environment, contamination and degradation of production processes and processing.</td>
</tr>
<tr>
<td>Market related risks</td>
<td>Changes in supply and/or demand that impact domestic and/or international prices of inputs and/or outputs, changes in market demands for quantity and/or quality attributes, changes in food safety requirements, changes in market demands for timing of product delivery, changes in enterprise/supply chain reputation and dependability.</td>
</tr>
<tr>
<td>Logistical and infrastructural risks</td>
<td>Changes in transport, communication, energy costs, degraded and/or undependable transport, communication, energy infrastructure, physical destruction, conflicts, labour disputes affecting transport, communications, energy infrastructure and services.</td>
</tr>
<tr>
<td>Management and operational risks</td>
<td>Poor management decisions in asset allocation and livelihood/enterprise selection, poor decision making in use of inputs, poor quality control, forecast and planning errors, breakdowns in farm or firm equipment, use of outdated seeds, not prepared to change product, process, markets, inability to adapt to changes in cash and labour flows, etc.</td>
</tr>
</tbody>
</table>
Policy and institutional risks | Changing and/or uncertain monetary, fiscal and tax policies, changing and/or uncertain financial (credit, savings, insurance) policies, changing and/or uncertain regulatory and legal policies, and enforcement, changing and/or uncertain trade and market policies, changing and/or uncertain land policies and tenure system, governance related uncertainty (e.g. corruption), weak institutional capacity to implement regulatory mandates.

Political risks | Security-related risks and uncertainty (e.g. threats to property and/or life) associated with politico-social instability within a country or in neighbouring countries, interruption of trade because of disputes with other countries, nationalization/confiscation of assets, especially for foreign investors.

Source: Jaffee, Siegel and Andrews, 2010

**In Colombia the World Bank Group has recently conducted a qualitative study into identifying the main sources of risk and uncertainty in agriculture and in ranking these risks by frequency and severity and impact.** This study was based on a questionnaire survey conducted with 210 public-sector, private sector, academic and other specialists involved in the agricultural sector representing 19 departments of Colombia and the Federal District Bogota. The respondents were required to complete a questionnaire for 10 categories of risk listed below in Table 2. and more fully described in Annex 1 (The system of risk classification used in Colombia is like that proposed by Jaffey et al in Table 1). For each category of risk and sub-categories of risk the respondents were asked to state if they perceived this to be a risk affecting agriculture or not in their own department. In the case the factor was perceived to be a risk they were then required to rank this in terms of (i) low to very high frequency of occurrence and (ii) severity / impact against using a range from low to very high impact. For each sub-category of risk and for the 210 respondents, the total frequency scores were then multiplied by the total impact scores to provide a measure of the size or scale of the risk.

**Table 2. Colombia: Sources of Risk in Agriculture used for Perceptions Survey 2017 (Major Categories)**

| 1. Eventos Climáticos Extremos. |
| 2. Sanidad Animal. |
| 3. Sanidad Vegetal. |
| 4. Gestión de la producción. |
| 5. Gestión de los insumos de producción y los recursos naturales. |
| 7. Crédito. |
| 8. Comercio Internacional. |
| 9. Marco Regulatorio y políticas públicas. |
| 10. Infraestructura y logística. |

Source: World Bank 2017

**The results of this study for the top 10 sub-categories of risk according to their size of impact (frequency x severity) show that respondents ranked drought in first place as the most severe weather risk affecting Colombian agriculture, followed in second place by the risk of market price fall and thirdly the risk of poor soil management by farmers** (Figure 2). The top 10 risks facing agriculture include:

- **Three Weather risks, drought, excess rain and flood** which are highly influenced by the ENSO El Nino / la Nina phenomena and which are commonly reported as causing severe losses in Colombian agriculture. Agricultural insurance can play a role in protecting farmers against these severe weather events which cause production & yield losses in their crops.
• **One Market related risk**, in this case the fall in crop prices which is often experienced at the time of harvest. Agricultural insurance is currently practiced in more than 100 countries: however, market price risk insurance is only widely available in one country namely the USA, and in this case only for major commodities such as soya, maize, wheat. In other countries price risk insurance is not available and farmers usually rely on price hedges and futures market contracts to protect against price loss for their crops.

• **Four sub-categories of risk relating to management of production inputs and natural resources** namely, inadequate soil management, inadequate water management, inadequate management of seeds and fertilisers and inadequate pesticide management. These are factors which are highly related to access to technical education and training and skills and suggest a concerted need in Colombia to invest in public and private sector agricultural extension and field-level technical advisory services.

• **Two sub-categories of production management risk**, including inadequate technology and lack of technical assistance. Low technology use is usually related to a combination of factors such as lack of access to credit to purchase improved seed and fertiliser technology, coupled with lack of access to technical assistance to provide training in the use of the new technology. Sometimes farmers are risk averse to borrowing credit to invest in new technology in case they incur severe crop losses and are unable to repay the loan, while banks are often very reluctant to lend to farmers because they consider agriculture too risky a class of business to provide credit too. Also, many small farmers (including tenants and sharecroppers) are unable to meet the collateral requirements of financial lenders. Agricultural insurance can play an important role in protecting the interests of both the financial lender and the farmer and therefore in leveraging access to credit. Indeed, in many countries, crop insurance is linked on an automatic or compulsory basis to bank seasonal crop loans (e.g. India, Philippines, Brazil, Mexico).

*Figure 2. Colombia: Top Ten Risks in Agriculture (ranked by magnitude of risk)*

![Graph showing the top ten risks in agriculture](image)

Source: World Bank Group December 2017

*Further information on the results of this World Bank 2017 Study are included in Annex 1 including a comparison of the main risk exposures as perceived by the three main groups, Public Sector specialists in agriculture, Private Sector and finally the Academic Sector.* While the ranking of risk exposures is very similar for the public and private sector respondents, it is notable that the group of academics adopted a much narrower definition of risk in agriculture focussing on climatic risk exposures.
Frequency and Severity of Natural Disasters in Colombia

The most comprehensive historical database on natural disasters in Colombia is probably the CRED_EM_Dat database that records a total of 176 natural disasters (occurrences) that have affected the country between 1900 and 2017 and shows that flood was by far the most frequent type of disaster accounting for 78 reported events (44% of all reported occurrences) over this period, affecting 16.2 million people (90% of total affected people). Landslide was the second most frequent event with 42 reported occurrences (23% of total) followed by Earthquake (25 events or 14% of total occurrences) and affecting more than 2.3 million people (33% of total affected people). Volcanic eruption accounted for 6% of all reported events but was associated with 67% of all reported deaths over this 117-year period. Windstorm accounted for 5% of the events, but less than 1% of the total affected people.

Only 2 droughts (0.6% of all events) were reported in Colombia over this 117-year period: drought is a slow onset peril that impacts on people’s livelihood over a long period of time and it is seldom reported (Figure 3 and Annex 2). The fact that drought is seldom reported as a disaster may explain the major difference in the perceptions of the Colombian specialists reported in Figure 2 that drought is the most frequent and biggest risk to agriculture in the country and the EM_Database reported figures which suggest that drought is not an issue in Colombia.

The total estimated value of damage over the 117-year period was US$ 7.1 billion of which flood damage accounted for US$ 3.6 billion or 51% of the total value of damage, followed by earthquake (33% of total value of damage), volcanic activity (14%), insect infestation (1.5%) and storm (1%). (Figure 3 and Annex 2).

The volcanic eruption of 1985 was the single worst event in terms of loss of life, with 21,800 reported deaths and reported damage valued at US$ 1.0 billion. This was followed by the 1999 earthquake with 1,186 total deaths and damage of US$ 1.86 billion. The 1970 floods were, however the worst events in terms of the total numbers of people affected (5.1 million), but with losses valued at only US$ 138,850 million. Under the 2010 la Niña very severe flooding, 418 people died, 2.8 million people were affected, and damages amounted to US$ 1.0 billion (Annex 2).

Figure 3. Colombia: Damage Record by Type of Natural, Climatic and Biological Event, 1900 to 2017

Source: CRED-EM-Dat.
There is clear evidence that the frequency and severity of natural disasters are increasing over time in Colombia. Figure 4 shows that since the 1950’s the number of reported events has increased significantly each decade as has the total number of affected people and the reported value of damages.

Figure 4. Colombia: Analysis of Historical Disaster Record by Decade, 1900 to 2017

The EM-Dat damage data tend, however, to be under-reported. The Disaster Risk Financing and Insurance Program (DRFIP) of the Global Fund for Disaster Reduction and Recovery (GFDRR) of the WBG report that there are about 600 natural disasters in Colombia every year making this the highest recurrent rate of natural disasters in Latin America (DRFIP 2012). This is very much higher than the number of disasters recorded by EM-Dat of only between 34 and 48 per decade since 1990, suggesting that small events are not reported to CRED-EM-Dat. Furthermore, DRFIP report that the 2010/11 La Niña affected approximately 3.5 million people and damages were estimated at around 2 percent of GDP (DRFIP 2012). With 2010 GDP of 276 Billion⁹, this would suggest that the 2010 flood damage was about US$ 5.6 billion) or more than 5 times higher than the US$ 1 billion damaged recorded by EM-Dat.

According to a separate study, between 1970 and 2011, 4,679 events were registered in Colombia resulting in damages and losses to the agricultural sector, of which floods represented nearly half (49%) of all events, followed by forest fires (12% of all events), landslides (8% of all events) pests and diseases (6% of all events) and windstorm (5% of all events). Droughts only accounted for 3% of all events (Figure 5). (GFDRR 2011).

⁹ World Development Indicators for Colombia (GDP Constant 2010 USD).
**Figure 5. Hydrometeorological emergencies in the agricultural sector, 1970-2011**

![Graph showing percentage of total events](image)


**Natural and Climatic Risks and their Impacts**

*Natural disasters are GoC’s second most important source of contingent liabilities, with an Annual Expected Loss (AEL) to public assets and low-income housing estimated at US$490 million, or 0.7 percent of GoC’s 2010 budget. The Probable Maximum Loss (PML) for a 1 in 100-year return period is estimated at US$2.9 billion (4.4% of budget and 1.2% of GDP) and for a 1 in 500-year return period, considerably higher at US$ 5.6 billion (8.4% of budget and 2.3% of GDP) (DRFI 2012a; 2012b).*

*Colombia is exposed to the highest number of geological, geomorphic, hydrological and climatic risks of any country in Latin America.* The country is located on the Pacific plate which runs down the west coast of South America and it is subject to a high number of earthquakes and volcanic eruptions. The country is also highly influenced by the ENSO El Nino and La Nina phenomena which are associated respectively by excess rainfall leading to floods, flash flooding and landslips and then severe droughts. A recent study showed that 86% of the population is exposed to high and medium seismic activity, 28% is exposed to high flooding and 31% to high and medium landslide hazards (GFDRR 2010; GFDRR 2011).

*In Colombia earthquakes have the potential to cause huge damage to property and infrastructure in large urban centres such as Bogota, Medellin and Cali and to cause high loss of life, but generally does not cause severe losses to the agricultural crop and livestock sectors.* There are currently 20 active volcanoes in the main Andes mountain chain of Colombia: volcanic eruption exposure has not been formally quantified in Colombia, but volcanic fall-out and ash, larva and mud flows may cause severe damage to both property and agriculture over wide areas as well as severe loss of life. GFDRR 2011 estimate that at least 1.9 million people in Colombia live in areas of volcanic influence.

*In Colombia flood and landslide are the biggest causes of loss of property and life after volcanic eruption.* Some 12% of the country’s total land area is subject to riverine flooding. The departments with the highest exposure to floods are Valle del Cauca, Atlántico, Cundinamarca, Magdalena, Antioquia, Cordoba, Cesar, Cauca, and Meta and 28% of the country’s total population live in these most flood prone areas (GFDRR 2011).

*These natural and climatic events cause high losses to agriculture in Colombia.* According to DesInventar database (OSSO Corporation and EAFIT, 2011) between 1970 and 2011, close to 3.25 million hectares of crops were damaged or an average of 79,500 hectares/year. The economic value of the losses to agriculture were estimated at US$ 972 million (current values) and US$ 1,621 million
(constant values) between 1972 and 2000. According to GFDRR, however, there appears to be a tendency for the above crop area losses to be considerably under-reported and actual affected area may be between four to five times higher (GFDRR 2011).

**Losses in Agricultural Gross Domestic Product (AgGDP) are increasing because of hydrometeorological phenomena.** (GFDRR 2011). During the three decades from 1970 to 2000 the value of losses in the agricultural sector increased from an average of 1.52% of AgGDP (1971-1980) to 4.52% (1981-1990) to a high average of 5.60% (1991-2000). This growing tendency of losses in agriculture is explained by increased environmental degradation, the expansion of planted areas and the low adoption of measures to reduce risk in agriculture (GFDRR 2011).

Table 3 Accumulated losses caused by minor events in the agriculture sector

<table>
<thead>
<tr>
<th>Period</th>
<th>Hectares of Crops Affected</th>
<th>Current Value of Crop Losses (Constant)</th>
<th>GDP in the agricultural sector for the last current period (Constant)</th>
<th>Loss of the Sectoral GDP (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1971 - 1980</td>
<td>327,497</td>
<td>98.25 (172.64)</td>
<td>6,466 (11,352)</td>
<td>1.52%</td>
</tr>
<tr>
<td>1981 - 1990</td>
<td>738,743</td>
<td>295.50 (689.50)</td>
<td>6,539 (15,257)</td>
<td>4.52%</td>
</tr>
<tr>
<td>1991 - 2000</td>
<td>964,450</td>
<td>578.67 (758.38)</td>
<td>10,330 (12,358)</td>
<td>5.60%</td>
</tr>
</tbody>
</table>

# Note: Values listed for millions of dollars and average GDP

**Agriculture is highly exposed to flood damage in Colombia.** The GFDRR 2011 study modelled the impact of flood damage on agriculture in terms of crop area affected and value at risk and showed very high 1 in 500 year losses in excess of 50% of the total exposed value in the departments of Cesar, Arauco and Casanare (Figure 6). With total estimated crop values at risk of US$ 2.7 billion, the corresponding economic value of flood losses in agriculture were estimated at US$ 47 million, 103 million and 228 million for return period of 1 in 50 years, 1 in 100 years and 1 in 500 years (GFDRR 2011).

**Figure 6.** Probable maximum losses in the agriculture sector caused by floods for a return period of 500 years, by department

![Figure 6](image-url)

Source: GFDRR 2011

**Colombia is highly influenced by the El Niño/La Niña Southern Oscillation, ENSO phenomenon.** The el Niño Phase is associated by severe drought in agriculture and increased incidence of forest fires.
Conversely, La Niña is associated with excess rain and flooding, flash floods and landslides which can cause severe damage to infrastructure, property and agriculture. Between 1970 and 2011 there were 13 El Niño events and 11 La Niña events affecting Colombia, including the 2010/11 La Niña where exceptionally heavy rainfall and flooding affected approximately 3.5 million people and damages were estimated at around 2 percent of GDP (DRFIP 2012a; DRFIP 2012b). Box 2 presents further details of the severe losses experienced by the crop and livestock and aquaculture sectors associated with the extreme El Niño 1997-1998 drought, La Niña 2007-2008 excess rain/floods and La Niña 2010-2011 excess rain/floods. (GFDRR 2011).


<table>
<thead>
<tr>
<th>Event</th>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>El Niño 1997-1998</strong></td>
<td>Manifested itself in having a generalized precipitation deficiency in the main producing regions of the country, thus generating plant health problems and a reduction in the output of the sector, with estimated damages of US$101 million, adjusted to 2000 currency (CAF, 2000). Additionally, it is estimated that indirect losses produced by the negative effects in the balance of payments and the nonexistence of exports had an approximate value of US$124 million. A huge part of the damage was concentrated in the departments of Tolima, Hulia, Sucre, Bolivar, Cesar, Santander and Norte de Santander.</td>
<td></td>
</tr>
<tr>
<td><strong>La Niña 2007-2008</strong></td>
<td>Affected the output and production of coffee and flowers, two of the main driving forces in exports in the country. Coffee production underwent losses of 28% or US$340.5 million in lost exports. Some 848 municipalities were affected with losses in transitory crops worth Col$86.9 billion. Losses inflicted on permanent crops were Col$49.5 billion and losses in livestock were Col$8.7 billion. Overdue loans to small producers were refinanced for Col$2 billion and a Rural Capitalization Incentive (ICR) was applied (Col$2.7 billion). Furthermore, direct support was given for Col$150,000 per hectare to identified producers with the aid of the Technical Agrarian Aid Municipal Units (UMATA). For this concept, the Agrarian Fund disbursed a total of Col$569 million. In recovery activities, the principal interest was to promote employment and this represented an investment of US 1.5 million (MADR, 2011).</td>
<td></td>
</tr>
<tr>
<td><strong>La Niña 2010-2011</strong></td>
<td>Produced the greatest impact in the agriculture sector related to hydrometeorological phenomena. In total, 1,324,000 hectares were affected. The National Federation of Coffee Growers reported that 190,580 hectares were affected resulting in crop damage to 221,567 coffee producers. Furthermore, it is estimated that 1 million sacks of coffee were not produced in 2010, which is equivalent to Col$500 billion. Plagues such as coffee rust (Hemileia vastatrix), root wilt disease (PC) in the coconut palms, moniliasis in cacao, and other diseases spread more quickly. As many as 98 key roads were affected impeding transport of food from the provinces to consumer centers. Livestock affected at the national level was estimated at 130,000 dead cattle and 1.5 million mobilized from 60,500 farms. An additional 1.5 million cattle that were not moved resulted in having nutrition deficiency with different impacts in the Caribbean and the Cundiboyacense plateau. The aquaculture lost their young fish. Some 13 million square meters of agrarian infrastructure were affected including greenhouses, sheds for rearing or fattening cattle, barns, stables, corrals and, crochet and wood stockyards, pigsties, and other buildings for different agrarian production systems. The La Niña phenomenon culminated in May 2011 having affected the Cundiboyacense plateau, the Atlantic coast, the Eastern Plains, and the departments of Santander and Santander North and influenced the Cauca River in the south of the country (MADR, 2011).</td>
<td></td>
</tr>
</tbody>
</table>

Source: GFDRR 2011.

Climate Change in Colombia

In Colombia the agricultural sector is at high risk from climate change impacts. According to UNDP 2010 the climate scenarios presented in Colombia’s Second National Communication on Climate Change, predict an increase in the average temperature between 2° and 4° C by 2070, along with changed hydrological conditions (for example, certain regions may see their rainfall reduced by up to 30%). The same study notes that many of the agro-ecosystems of the country are vulnerable to increased aridity, soil erosion, desertification, and changes in the hydrological system. In addition, there is a greater risk of crop flooding as well as other natural events that affect agricultural production (windstorms, hailstorms etc). There is also an increased risk of sea level rises in coastal areas. GFDRR (2011) highlight the damage that has already been caused by rising temperatures to Colombia’s glaciers most of which are predicted to have disappeared by 2050 with major adverse environmental consequences.
Subsistence farming in Colombia is and will continue to be more vulnerable and at the same time will be more affected by climate variation. This situation is especially prevalent in the departments of Nariño, Boyacá, Cesar, and Cauca (GFDRR 2011).

According to WFP in the northern Andean Counties of Colombia, Ecuador, Peru and Bolivia, climate change is increasing the frequency and intensity of natural disasters, such as droughts, floods, hail, snowstorms, frosts and the melting of glaciers, which could result in an increase in the population in need of food assistance. WFP has worked closely with local specialist institutions to produce an Atlas of Food Security, Disasters and Climate Change, which shows that for Colombia, six departments (Atlántico, Magdalena, Cesar, Sucre, Cordoba and Bogota) were identified under the category 5 "Serious Vulnerability" to climate change and food insecurity and another six (RED: La Guarjira, Arauca, Boyacá, Cundinamarca, Quindío and Huila) under Category 4 "Very High Vulnerability" (Figure 7) (WFP 2014).

Figure 7. Colombia: Atlas of Food Security, Disasters and Climate Change

To address the impacts of climate change, Colombia has approved and implemented a range of measures in varying degrees, including: adopting the UN Framework Convention of Climate Change (1994), adopting the Kyoto Protocol (2000), establishing climate change adaptation (CCA) as a priority in the National Development Plan 2010-2014, and establishing a National Climate Change System.

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10 Map is available at: http://es.wfp.org/noticias/comunicado/atlas-area-vulnerables-region-andina
(SNCC) to improve coordination among the institutions involved. While advances have been made in CCA and DRM, integrating both into planning and public investments remains a high priority (GFDRR 2014b).
3. Disaster Risk Financing and Insurance in Agriculture: The Role of Large Scale-Catastrophic Agricultural Insurance as a Social Protection Cover for Small Farmers in Colombia

3.1. Importance of an Integrated Financial Risk Management Strategy

**Disaster risk financing and insurance are key pillars of a comprehensive DRM (Disaster Risk Management) strategy.** As prevention and mitigation efforts cannot fully protect a country against adverse natural events, the main goal of a DRFI strategy is to increase financial response capacity while reducing the fiscal burden generated by the government liabilities associated to natural hazards (GFDRR 2014a). The World Bank has developed a DRFI framework (See Figure 7) that takes account of different layers of risk that a country might be exposed to and considers the most appropriate financial instruments for financing responses to disasters.

The DRFI framework uses risk assessment and risk modelling to identify risk layers according to the risk profile (frequency and severity of natural hazards and their modelled losses) in each country and then structures different financial tools accordingly:

- **Low risk layer** (typically with a return period of up to 5 years): it is recommended that Governments use annual budget allocation and contingency budgets to finance these more frequent but relatively low severity loss events.

- **Medium layer** (typically with a return period of between 5 and 20 years): it is recommended that Governments use contingent credit instruments such as CAT-DDOs to finance these less frequent but more severe loss events.

- **High risk layer** (typically return period of over 20 years): it is recommended that Governments use private sector risk transfer instruments (derivatives, catastrophe insurance and catastrophe bonds) to finance low frequency but severe loss events (Figure 8).

**Figure 8. Integrated Disaster Risk Financing and Insurance Framework for Agriculture**

![Image of the framework](image)

Source: World Bank

The role of agricultural insurance within such an integrated risk management framework for agricultural disasters is generally considered to be most cost-effective where this is designed to protect against relatively low frequency but high severity natural, climatic and biological events. Agricultural insurance is a more expensive risk financing instrument than contingency funds or
contingent lines of credit, but it has the advantage of being able to generate large amounts of capacity and insurance payouts are generally paid out very quickly post-disaster.

3.2. Disaster Risk Financing and Insurance in Colombia

*Natural disasters are the GoC’s second most important source of contingent liabilities,* with annual expected losses estimated at US$490 million (0.7 percent of its budget) and one in 100-year losses estimated at US$3.0 billion or 4.4 percent of its budget (DRFIP 2012).

*In Colombia GoC traditionally used a range for sources to finance ex-post disaster response, rehabilitation, and reconstruction.* These sources included the (i) National Calamity Fund (Fondo Nacional de Calamidades, FNC) formed in 1984, or (ii) the National Royalties Fund (FNRR) or (iii) central government budget reallocation. However, the funds available through FNC/FNRR have always been inadequate to cover more than a fraction of the damages arising out of catastrophe natural events. In response to the massive losses incurred in the Coffee Growing Region earthquake of 1999, GoC created the Coffee Growing Region Reconstruction Fund (Fondo para la Reconstrucción del Eje Cafetero, FOREC) which was funded by budgetary reallocations, international loans and a new Financial Transactions Tax and between 1999 and 2001 this fund paid for more than Col$1.7 trillion in rehabilitation and reconstruction costs. In the case of the La Nina 2010 floods, GoC was faced with a Col$30 billion bill for response, recovery and rehabilitation and elected to create a new fund termed the Adaptation Fund which is financed through the sales of assets of Ecopetrol (national petroleum company) to contribute towards the costs of this catastrophe event. In future, the Government may also use resources from the Stabilization Fund, created in 2011, for disasters (GFDRR 2011).

*Since the mid-1990s, Colombia has moved from disaster response towards disaster risk management* by: (i) strengthening actions in disaster risk prevention and mitigation; (ii) reducing fiscal vulnerability to natural hazards; and (iii) improving land use planning (GFDRR 2014b).

*Today, Colombia is widely considered a leader in instituting a policy and legal framework that enables a comprehensive, multi-sectoral approach to disaster risk management.* Colombia has built a National System for Disaster Management and Prevention, articulated around a comprehensive National Disaster Prevention and Attention Plan. Since the early 2000s, Colombia has decentralized disaster risk management responsibilities and made disaster risk management a national development priority (GFDRR 2011).

*Starting in 2008, GoC has been strengthening its financial response capacity to natural disasters though planned ex-ante disaster risk financing instruments including contingency funds and the contracting of contingent lines of credit and is now using catastrophe insurance as a sovereign risk financing instrument.* Colombia was one of the first countries in 2008 to purchase from the World Bank a Development Policy Loan with a Catastrophe Deferred Drawdown Option (DPL with a CAT DDO) for US$ 150 million. This instrument is a pre-negotiated credit line, which may be activated immediately in case a national disaster occurs, and at the exact moment that the President declares a National Disaster. GoC used the CAT-DDO instrument in full in December 2010 to provide immediate liquidity to finance early response to the La Niña 2010-2011 catastrophe flood damage. In 2011, Colombia became the first country to engage in a program by the World Bank and Switzerland’s State Secretariat for Economic Affairs (SECO) that assists countries in developing an integrated DRFI strategy within their broader fiscal risk and disaster risk management agendas. In 2012, the GoC legally established a new National Disaster Risk Management Fund and signed a new US$250 million Cat DDO. (GFDRR 2011; DRFIP 2012).

*Since 2013 Colombia has formulated a new National Disaster Risk Management Plan (Plan Nacional de Gestión del Riesgo de Desastres de Colombia) (PNGRD) which is coordinated through and
implemented by the National Unit for Disaster Risk Management (Unidad Nacional de Gestión del Riesgo de Desastres) in conjunction with other public sector and private sector stakeholders under the National Disaster Risk Management System (Sistema Nacional de Gestión del Riesgo de Desastres). PNGRD was formulated under the Decree No. 1974 of 2013 and replaces the former National System for the Prevention and Attention to Disasters (Sistema Nacional de Prevención y Atención de Desastres, SNPAD). The PNGRD provides a detailed framework for (a) disaster risk assessment and evaluation work, leading into (b) risk mitigation and risk prevention activities at national, regional and local levels, through to (c) disaster management including emergency response, preparation for post-disaster recovery, and execution of rehabilitation and reconstruction and includes ex-ante risk financing instruments and ex-post disaster relief funding.11

The World Bank is now assisting GoC to develop parametric macro-level insurance covers as part of its sovereign risk financing strategy for major catastrophic events such as earthquake, volcanic eruption, flood etc. In the agricultural sector this has taken the form of a feasibility study into the design of a Macro-level Catastrophe Agricultural Insurance Product (Seguro Agricola Catastrofico) which was conducted in 2016-17 (World Bank 2017b).

3.3. Agricultural Insurance in Colombia

Government support to agricultural insurance

In Colombia, government support to agricultural insurance started in 1993 with the enactment of the Agricultural Insurance Law (Ley de Seguro Agropecuario) No 69 of 1993 with the aim of promoting crop-credit insurance through the creation of a National Commission for Agricultural Credit (CNCA) and a National Fund for Agricultural Risks (FNRA) which was designed to provide reinsurance protection to for companies offering agricultural insurance.

In order to promote the adoption of agricultural insurance, government also enacted legislation under the Law 101 of 1993 to authorise crop insurance premium subsidies. Over time the level of premium subsidy support has been increased by CNCA from about 20% of the cost of premiums to the current levels of between 60% for any farmer, through to 70% for medium and large farmers accessing credit from Fund for the Financing of the Agricultural Sector (FINAGRO) and finally as high as 80% for small farmers also accessing credit from FINAGRO.

Governing Bodies

The National Agricultural Credit Commission-CNCA sets the percentages of the subsidy to the premium, which must be assumed as an incentive by the State, charged to the resources of the General Budget of the Nation, in accordance with Law 101 of 1993. Currently, the resolution that regulates the percentages to be subsidized is Resolution 3 of 2017 of the CNCA.

The Ministry of Agriculture and Rural Development (MADR), indicates the coverages, the crops prioritized in the Colombia Sowing Program12, the promising export crops and the guidelines for the studies foreseen in Resolution 140 of the MADR of 2017.

The Fund for the Financing of the Agricultural Sector, FINAGRO, manages the National Fund for Agricultural Risks (NFRA), following the guidelines of Article 6 of Law 69 of 1993, modified by Article 20 of Law 812 of 2003. For 2017 a partial financial contribution from the NFRA was stipulated for application of the subsidy to premiums for a maximum value of CoS 4,040 million.

In addition, the decree number 3377 of 2003 regulates the provisions of Law 101 of 1993 on the participation of the representatives of the insurance companies and the farmers associations,11 For further details see UNGRD (undated), Plan Nacional de Gestión del Riesgo de Desastres 2015-25.
12 Programa Colombia Siembra
indicating that these will be chosen by Fasecolda and by the SAC and Fedegan, respectively, and points out aspects such as the insured value, the calculation of premiums, grace periods and deductibles.

**Evolution of Agricultural Insurance, Key Products and Results**

The first commercial insurance program providing windstorm protection for export banana production in Magdalena and Uraba was launched by the national Agricultural Credit Bank (Caja Agraria Agricola) in 1998. The Caja Agraria was liquidated in 1999 and the banana insurance program was transferred to La Previsora, the national insurance and reinsurance company. The banana insurance program was re-launched by La Previsora in 2000 with reinsurance protection from PartneRe, an international reinsurer.

Between 2005 and 2006 two private sector insurance companies, Mapfre and Sul America started offering agricultural insurance in this case weather index insurance (WII) against excess rainfall and rainfall deficit in cotton and maize. The outcomes of the weather index insurance program were poor, and the pilot index insurance products were discontinued. In 2006 La Previsora ceased underwriting bananas, leaving this sector to Mapfre which was the sole agricultural insurer in Colombia for the next 5 years.

Today in 2017, 5 private insurers underwrite crops, forestry and livestock insurance in Colombia including Mapfre the market leader, Sura, Seguros Bolivar and Allianz and Liberty, one state insurer, La Previsora. PROAGRO Seguros, the leading Mexican agricultural insurance company has also registered a new company in Colombia and plans to introduce a new range of agricultural insurance products and services into the market.

For crops there are two main traditional indemnity based individual farmer crop insurance policies in the market, (i) a loss of yield policy (Seguro del Rendimiento) for cereals and other row crops and (ii) a damaged-based Policy (Seguro por Planta) which is offered for perennial tree crops such as bananas and for forestry. These products are based on the standard crop insurance policies that have been offered in Mexico for many years. Over the period 2010-14 bananas were the most important crop insured accounting for 29% of total insured area, followed by maize (19% of insured area), sugar cane (16%), rice (15%) forestry fire-insurance (14%), tobacco (4%) and cotton (3%). (See Annex 2 for further details).

The agricultural insurance penetration is very low in Colombia and approximately only 2.4% of the sown area of approximately 7.1 million hectares is insured (Guzman et al 2015). On the supply side, few insurance companies have decided to enter this specialist class of business, either because they consider it to be too exposed to catastrophe risk or because of operational and security difficulties experienced during the many years of the rural conflict. Reasons for the low uptake appear to centre on the fact that most insurers do not have rural-branch networks or specialist agricultural staff to promote and market agricultural insurance to the farmers nor to conduct field inspections and loss assessment; while farmers lack knowledge and experience with general insurance let alone specialist crop insurance products and the range of products in the market is fairly limited and does not necessarily meet their needs.

The current crop insurance policies that are available in the Colombian market have been designed primarily for medium and large commercial farmers as opposed to smallholder family farmers. As noted above most crop insurance has been targeted at the commercial export banana sector, sugar cane producers, forestry owners, tobacco, cotton and rice producers. maize is the only insured crop which is grown in any scale both by commercial farmers and small subsistence farmers. As such, the large percentage of vulnerable smallholder farmers in Colombia do not have access to suitable crop risk transfer and insurance products.
Over the past 11 years, Colombia’s agricultural insurers have on average incurred negative underwriting results as shown by the long-term loss ratio of 108%. While underwriting results were generally good between 2007 and 2013, in the past three years underwriting results have deteriorated badly with a worst loss ratio in 2014 of 175% followed by 140% loss ratio in 2015 and 119% loss ratio in 2016 (Figure 9 and Annex 3).

Figure 9. Agricultural Insurance Results (Crops, Livestock, Forestry) 2006 to 2016

<table>
<thead>
<tr>
<th>Year</th>
<th>Primas emitidas (Col$)</th>
<th>Siniestros pagados (Col$)</th>
<th>Tasa de Siniestralidad %</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>20,000,000</td>
<td>287%</td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>40,000,000</td>
<td>68%</td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>60,000,000</td>
<td>71%</td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>80,000,000</td>
<td>31%</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>100,000,000</td>
<td>63%</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>120,000,000</td>
<td>71%</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>140,000,000</td>
<td>44%</td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>160,000,000</td>
<td>175%</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>180,000,000</td>
<td>140%</td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>200,000,000</td>
<td>119%</td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td>220,000,000</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>


3.4. International Experience with Large-Scale PPPs for Agricultural Insurance

Parametric or index insurance is a very flexible cover that can be offered at different levels of aggregation, starting at a micro-level where cover is retailed to individuals (e.g. farmers), through to meso-level applications to protect the financial exposure of regional aggregators such as input suppliers and agricultural lending banks and microfinance institutions (MFIs) and finally at a macro-level where governments are increasingly using index insurance as a risk transfer instrument as part of their national disaster risk financing programs and/or as large-scale social protection covers.

International experience with macro-level Index Insurance Programs for Small Farmers

The first Macro-level disaster weather index insurance program was launched in 2003 by Agroasemex, the Mexican Pariastatal Reinsurer as a catastrophe drought protection cover for small subsistence farmers in Guanajuato state. This program termed CADENA offers a range of catastrophe parametric crop weather and crop area yield index insurance covers, a satellite pasture drought vegetative index cover for livestock producers and a traditional livestock indemnity cover. Since 2003 the Government of Mexico has invested massively in the development of these macro-level index insurance programs for crops and livestock which are implemented jointly with the state governments as part of government's national disaster relief program for small vulnerable farmers and livestock producers. The costs of agricultural insurance premiums are financed on an 80:20 basis by Federal and State Governments and annual premiums are in the order of about US$ 200 million per year. The CADENA program now operates in all Mexico’s 32 states and provides protection for several million crop and livestock producers. Further information on the CADENA Mexican program including details of farmer eligibility criteria, the cover design features, premium rates, underwriting results and economic impacts are contained in Annex 4 and Annex 5.

In Africa, the first macro-level rainfall deficit program was implemented in Ethiopia in 2006, followed by Malawi in 2009 with a rainfall deficit cover designed to protect against major drought
losses in the national staple crop, maize, and most recently the African Risk Capacity (ARC) drought index program which was launched in 2014/15 in 4 African Countries. The Ethiopia program only operated for one year and was free of claims, while the Malawi program ran for 3 years with no payouts. In 2013/14 year 11, ARC made drought payouts valued at US$ 26.3 million in three of the four insured countries (Senegal, Mauritania and Niger); there was one payout to Malawi in 2015/16 and in 2016/17 seven countries subscribed to ARC which was free of claims13.

In 2015/16 Kenya launched an innovative modified macro-level index insurance program for vulnerable pastoralists located in the ASAL regions of Kenya termed the Kenya Livestock Insurance Program, KLIP. The program uses a satellite vegetative index to trigger timely payouts to pre-identified vulnerable pastoralists when drought leads to severe shortages of forage and grazing in order for the pastoralists to purchase fodder and feed supplements to keep their breeding animals alive during the drought. The program is fully funded by Government of Kenya and is insured by a coinsurance pool of seven local insurance companies. An innovative feature of this program is that pastoralists are pre-registered as KLIP beneficiaries and program management assists them either to open bank accounts or mobile phone banking to enable payouts to be channelled directly to each beneficiaries account thereby speeding up the post-disaster response and reducing the potential for rent seeking in the distribution process. KLIP was launched in 2015 and currently insures about 20,000 pastoralists on an automatic basis: the program has made major drought payouts both in 2016 and again in 2017.

There are two macro-level catastrophe windstorm index pool programs, the Caribbean Catastrophe Risk Insurance Facility, CCRIF and PCRAFI, the Pacific Catastrophe Risk Assessment and Financing Initiative. These two programs are not specific to agriculture but are examples of the use of macro-level index insurance for sovereign disaster risk financing. CCRIF was launched in 2007 to provide catastrophe tropical cyclone (& earthquake) sovereign risk financing to Caribbean Island governments: by pooling risk, CCRIF can purchase reinsurance at much cheaper terms than if each government purchased cover separately. Currently 16 Caribbean governments are members of CCRIF and since 2014 CCRIF has extended its coverage to include Central American governments. CCRIF has recently added excess rainfall cover to the range of perils that governments can purchase. Over the past decade, CCRIF has made 22 payouts to 10-member governments valued at US$ 69 million14.

A feature of these catastrophe agricultural index insurance programs is that in order to provide meaningful livelihood protection they need to be designed to trigger payouts on a fairly frequent basis and this is reflected in the generally high average commercial premium rates. For example, in the Horn of Africa and Southern Africa where severe ENSO-El Nino droughts occur every 3 to 5 years, the ARC program has been designed to trigger payouts in each country for a 1 in 5-year return period and this also applies to the Kenya Livestock pasture drought index insurance program. The average premium rates applying on these macro-level disaster risk financing or social protection programs are summarised in Table 4.

Table 4. Key Features of Large-scale Catastrophe Insurance Program (mainly applied to agriculture)

<table>
<thead>
<tr>
<th>Country</th>
<th>Program Name</th>
<th>Type of Program</th>
<th>Insured Perils</th>
<th>Sum Insured (Layer) US$</th>
<th>Average Premium Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mexico (since 2003)</td>
<td>CADENA</td>
<td>Social Protection for small farmers</td>
<td>Climatic</td>
<td>&gt; US$ 1 billion (annual, 2 seasons)</td>
<td>Average all program 11.9% (2003-11)</td>
</tr>
</tbody>
</table>

14 Source: CCRIF SPC http://www.ccrif.org/content/about-us
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethiopia 2006</td>
<td>Ethiopia Drought Index</td>
<td>Disaster Risk Financing</td>
<td>Rainfall deficit (drought) Rainfall station index</td>
<td>US$ 7.1 million</td>
<td>13.1%</td>
<td></td>
</tr>
<tr>
<td>Caribbean &amp; Central American countries</td>
<td>CCRIF</td>
<td>Disaster Risk Financing</td>
<td>Catastrophe windstorm, earthquake, excess rain. Windstorm 1 in 15 years; Earthquake 1 in 20 years</td>
<td>US$ 100 million Limit per peril per country</td>
<td>n.a.</td>
<td></td>
</tr>
<tr>
<td>Pacific Islands (since 2012)</td>
<td>PCRAFI</td>
<td>Disaster Risk Financing</td>
<td>Catastrophe windstorm, earthquake, Tsunami</td>
<td>US$ 40 million (5 Islands)</td>
<td>n.a.</td>
<td></td>
</tr>
<tr>
<td>Africa (6 countries)</td>
<td>Africa Risk Capacity (ARC)</td>
<td>Disaster Risk Financing</td>
<td>Rainfall deficit (drought) Satellite rainfall: Trigger 1 in 5 years event</td>
<td>US$ 30 million per season per country</td>
<td>Range 10% to 20% by country according to drought exposure</td>
<td></td>
</tr>
<tr>
<td>Kenya Livestock Insurance Program</td>
<td></td>
<td>Social protection for vulnerable pastoralists</td>
<td>Lack forage availability due to drought NDVI Index Trigger: 1 in 5 years event</td>
<td>15,000 pastoralists @US$ 700/pastoralist</td>
<td>Average Rates 15% to 17%</td>
<td></td>
</tr>
</tbody>
</table>

Source: Authors

To date these macro-level weather index insurance programs are showing considerable potential for funding government’s disaster risk response and/or financing social protection for the poorest sectors. Annex 5 provides a review of the financial and economic benefits of the CADENA program to small vulnerable farmers.

3.5 Proposals for Large-Scale Catastrophe Agricultural Insurance (SAC) In Colombia

This section summarises the key features of the proposed Catastrophe Agricultural Insurance (Seguro Agrícola Catastrófico -SAC) program recommended by the World Bank, full details of which are contained in the technical report (World Bank 2017a) which accompanies this Policy Note. In accordance with the agreement with MADR and Finagro a pilot project approach was adopted in which 2 crops (maize and plantains) and 2 departments (Antioquia and Tolima) were selected for the feasibility study.

Selected Catastrophe Agricultural Insurance (SAC) Product

Drawing on international experience, the feasibility study considered three possible parametric or index options for the design of the underlying Catastrophe Agricultural Insurance Product (or policy) namely:
1) Weather Index Insurance (WIII) Cover using ground-based meteorological weather stations (Seguro de Índice Climático basado en Estaciones Meteorológicas). The feasibility study conducted a detailed analysis for all weather stations under the jurisdiction of the national meteorological agency the Institute of Hydrology, Meteorology and Environmental Studies (Instituto de Hidrología, Meteorología y Estudios Ambientales-IDEAM), but concluded that the density of weather stations with the required time series daily rainfall data, minimum and maximum daily temperatures was inadequate to support such a WII Program. (World Bank 2017a).

2) Area Yield Index Insurance (AYII) (Seguro de Rendimiento de área). To operate an AYII cover it is necessary to have (a) historical crop-area production and yield data for a minimum of 15 years or more and (b) an accurate, and timely methodology for estimating actual average area yield at the time of harvest for each insured crop. A detailed analysis was conducted of MADR historical crop yield data for major cereal and other crops at municipality level, but concluded that the maximum of 9-years time-series was inadequate to construct such an area yield index.

3) Modelled Damage Insurance (Seguro de Pérdidas Modeladas). For the purposes of the Catastrophe Agricultural Insurance (SAC) product in Colombia the consultants recommend the design of a modified Area-Yield Index (AYII) cover using modelled crop yields. The yield model used was Simulation Model of the Ecological Potential of Crops (Modelo de Simulación del Potencial Ecológico de los Cultivos -MSPEC) which uses key variables of rainfall, minimum and maximum temperature to simulate crop yields for defined satellite grid areas, in this case at a resolution of 8 km x 8 km grids. MSPEC was used to generate synthetic yields in the selected departments and for the selected crops for up to 37 historical years. Full details of the area yield simulation methodology are presented in World Bank 2017a.

Further details of the three-catastrophe agricultural insurance (SAC) product design options are presented in Annex 6.

Targeted Beneficiaries

Currently in Colombia there are several different systems for classifying small family farms and there is no unique or single database for these farmers at National, Departmental and Municipality levels. For the purposes of the feasibility study, it is proposed to use the IGAC Classification to include all microfundio, minifundio and pequeño farms that are properties less than or equal to 20 hectares. Using this classification there are approximately 7 million hectares of farmland in Colombia which are cultivated by family farmers. The distribution of these family farms with up to 20 ha land by crop type for the five main crops: (1) coffee 370,000 farms; plantains 265,000 farms, maize 112,000 farms; rice 25,000 farms and finally oil palm 5,000 farms (World Bank 2017a).

Selected Crops

Two crops, maize and plantains were selected for the pilot study on account of these being smallholder subsistence crops and because they are grown throughout most of Colombia and are the second and third largest crops in terms of cultivated area. The average sown area of maize is about 599,000 Ha and for plantains 426,000 Ha. Coffee was not selected for the pilot study as DIB were conducting a separate study for FINAGRO into insuring this crop in 2016-17. However, in future, if requested, the World Bank Group will assist FINAGO to study options for coffee insurance in Colombia. See Technical report for full details (World Bank 2017a).

It is important to note that although the modelled AYII product performed well for maize in terms of the correlations between modelled and actual yields, the model did not perform well for plantains and therefore a major conclusion of the technical feasibility study is that the product should only be launched for maize. (World Bank 2017a).
Selected Departments

The Departments of Antioquia and Tolima were selected for the pilot feasibility study. The criteria for selecting these departments included: 1) a high proportion of family farmers with less than 20 Ha landholding; (2) these are very important maize and plantain growing departments and (3) they have a relatively high density of IDEAM Ground meteorological stations, the data from which has been used to complement the satellite weather data used to model the 37 years of yields for maize and plantains in each 8 km x 8 km pixel in the 2 departments.

3.6 Key Issues and Options for Large Scale (Macro-level) Agricultural Insurance in Colombia

Legal and Regulatory Framework for Macro-Level Agricultural Insurance

In Colombia, the Insurance Supervisory Authority falls under the Financial Superintendency of Colombia (Superintendencia Financiera de Colombia - Superfinanciera or SFC). During the conduct of the feasibility study constructive discussions were held with the SFC to ensure that the proposed macro-level modified Area Yield Index Insurance Cover complies with general (non-life) insurance legislation in Colombia. SFC’s position is that parametric or index insurance is not a class of insurance business that is permitted under insurance law because it generally does not involve actual measurement or damage or loss to an insured good or object. The WBG contracted a special study by an insurance lawyer who concluded that the proposed macro-level PPP Catastrophe Agricultural Insurance (SAC) would be governed by the original law on agricultural insurance, Law 69 of 1993, and subsequent additions such as law 101, 1993, to establish government premium subsidies for agriculture, and Law 812 and Decree 3377 of June and November 2003 respectively that established a partnership between government and the private sector to set up an agricultural crop insurance scheme.

The proposed SAC modelled area yield index insurance cover is a combined area yield index and indemnity-based cover and therefore the World Bank believes that it complies with insurance legislation in Colombia. The insured crop yields are based on simulated (modelled) yields, but losses will be adjusted according to actual average area yields which will be measured for each crop in each Unit Area of Insurance, based on pre-agreed methods of field-level crop area yield sampling. Furthermore, for idiosyncratic risks (frost, hail, excess rain etc), farmers will adopt conventional indemnity-based insurance procedures of submitting a loss declaration to the Insurer which will then adjust the losses in field and compensate individual farmers who have incurred such losses accordingly.

Since their introduction in 2003, Parametric Agricultural Insurance Products have been widely promoted and accepted in about 50 countries, either as micro-level individual farmer retail policies or as macro-level disaster response policies purchased by governments on behalf of rural and urban populations. In these countries the parametric insurance products and programs have been approved by the Insurance Regulators as a class of non-life (general) insurance business and it is recommended that Colombia should not be an exception to this rule.

Institutional and Operational Framework for Macro-Level Catastrophe Agricultural Insurance

Currently there is a group of 6 agricultural insurers in Colombia which operate separately and compete for business mainly with commercial farmers. Each company therefore has established its own agricultural insurance marketing and underwriting and claims adjusting departments and separate reinsurance arrangements. Each company also has established a network of field-based crop inspectors and crop loss adjusters. Most companies focus on medium and large commercial farmers and their number of policy sales typically run into hundreds of policies per year.

Under the design of the large-scale Catastrophe Agricultural Insurance (SAC) program MADR/FINAGRO and the interested private insurance companies face the options of:
1) **Operating individually.** This would require each Insurer to registering its interest with government to underwrite the SAC program in each Department and to go through an annual bidding process to win the business. The company that wins the order would then need to show that it has the necessary systems and procedures in place to register the large number of smallholder beneficiaries and to provide them with insurance literacy and awareness and training; to develop procedures for area crop yield sampling to establish actual average yield and special loss assessment procedures to deal with idiosyncratic losses which will be adjusted on an individual farmer basis; to put in place procedures for distributing the payouts to the beneficiaries (e.g. opening back accounts) and finally to put in place their own reinsurance program, or

2) **To form a coinsurance pool** where they agree to pool the business and to purchase common account reinsurance cover. The pool would be able to share the costs of setting up a single underwriting and claims unit to manage the business on behalf of the pool which would result in major cost savings.

Coinsurance Pools are fairly common features of major national or regional Public Private Partnership (PPP) agricultural insurance programs including the Agroseguro Program in Spain, the Tarsim Pool program in Turkey and various regional coinsurance pools in China. Key features of the Spanish and Turkish Agricultural Insurance Pool Programs are presented in Annex 5. Similarly, several developing countries in Africa including Senegal, Malawi, Ghana and Kenya have formed agricultural insurance pools in recent years.

Potential advantages of Pools include: (i) cost-sharing in the research and development and start-up stages, (ii) cost-savings in establishing a single underwriting unit, staffing and equipment, either within the lead coinsurer or as a separate underwriting entity i.e., a Special Purpose Vehicle (SPV), (iii) ability for each company to select a share according to its risk appetite, and (iv) major cost savings in purchasing pooled reinsurance (common account) protection because of risk diversification (Mahul & Stutley 2010). Further information on the advantages and disadvantages of Coinsurance Pools are contained in Annex 7.

**Beneficiary Targeting and Registration**

GoC, through MADR is actively targeting the SAC program at farmers located in the post-conflict municipalities.

**In the implementation planning phase for SAC, it will be necessary to consider carefully how to identify and register the small family farmers with up to 20 hectares.** This task is complicated by the fact that the proposed Unit Area of Insurance (UAI) is an 8km x 8km pixel or grid. While this can be located accurately using GPS latitude and longitude measures, the farmer registers that are maintained in Colombia are currently based on administrative units (departments, municipalities and veredas).

**In addition to registering the beneficiaries it will also be very important to establish bank accounts for each beneficiary** to ensure that in the event of a catastrophe yield loss in that UAI that the farmers receive their payouts in a timely fashion.

**Establishing Field-based Teams of Specialist Inspectors/Loss Adjusters**

The proposed SAC will require that **at the time of harvest, teams of trained agronomists conduct crop yield sampling in each UAI to establish the actual average area yield in that UAI** in order to determine if a claims payout has been triggered or not. The Technical Report details the methodology...
for selecting farms and fields at random within the UAI and then for in-field measurement of actual crop yield. The sampled farm yields are then averaged to establish the actual average area yield for the insured crop (World Bank 2017a).

The field teams will also need to be training in crop loss damage assessment for idiosyncratic risks such as hail which will be adjusted on an individual farmer and field basis. The Technical Report again details the procedures for assessing idiosyncratic perils at the individual farmer-level.

The costs of SAC administration and especially field-based crop yield assessment and loss assessment will need to be analysed carefully if these costs are to be covered under the commercial premium rate alone. The current costs of operational and administration on the programs for commercial farmers is relatively expensive: according to Fasecolda, the total administrative and personal costs for agricultural insurance varied between a low of 5.6% of written premium in 2015 to a high of 19.4% in 2013 (Fasecolda 2016). These costs can be expected to be considerably higher under a small family farmers program.

4.1. Public Private Partnerships for Large-Scale Agricultural Insurance

The proposed large scale agricultural insurance program in Colombia is likely to require major innovation and investment and action from both the public and private sectors under a suitable Public Private Partnership (PPP) Program. There is increasing evidence to show that private sector insurers acting alone are unable to meet the agricultural insurance needs of small-scale farmers and where they have introduced pilot programs targeted specifically for small farmers these have tended to fail to reach scale and or sustainability (Mahul & Stutley 2010, IFAD&WFP 2010).

Key market-problems faced by private sector insurers often include: (i) lack of knowledge and experience in the design and rating of traditional indemnity-based and/or new index-based crop and livestock insurance products and programs (ii) information asymmetries whereby the insurers lack information and data on the target population (iii) lack of awareness and understanding by the target beneficiaries on the role and purpose of agricultural insurance, (iv) lack of rural insurance infrastructure, staffing systems and procedures with which to promote, market and administer agricultural insurance and to adjust claims with potentially very large numbers of resource poor small farmers and (v) often limited access of insurers to reinsurance capacity (GFDRR 2016).

Public investments to address these market issues under suitable PPP frameworks can enable sustainable development of agricultural insurance products and services for small farmers. This final section reviews the potential ways in which both the public and private sectors in Colombia can work together in developing a catastrophe agricultural insurance market for poor family farmers.

It is very important that GoC investment in large scale agricultural insurance is carried out as part of the National Disaster Risk Management Plan (Plan Nacional de Gestión del Riesgo de Desastres), PNGRD and not in isolation. This means that the proposed SAC for vulnerable farmers should be planned as part of an appropriate mix of risk financing instruments for agricultural risks and that SAC stakeholders should work closely with UNGRD which is responsible for coordinating PNGRD implementation.

4.2. Key Roles for GoC in Promoting Macro-Level Agricultural Insurance in Colombia

GoC can potentially play a vital role in supporting the development of the large-scale macro-level Catastrophe Agricultural Insurance Program for Small-Scale farmers in 6 key areas:

1) Creating an Enabling Legal and Regulatory Environment
2) Provision of Technical Support to Product Design and Development and to program implementation
3) Strengthening Data Collection, auditing and management and analysis of data
4) Ensuring outreach through farmer awareness creation, education and training, linkage to credit and input and output markets
5) Financing of premium subsidies to ensure inclusion of vulnerable resource poor farmers
6) Risk financing through the promotion and capitalisation of Insurance Pools and or provision of catastrophe reinsurance protection (see Figure 10).

Figure 10. Potential Roles of Government of Colombia in Supporting PPP Catastrophe Agricultural Insurance for Small Vulnerable Farmers in Colombia

Source: World Bank Group

**Creation of an Enabling Legal and Regulatory Framework**

**GOC is well placed to work with the Insurance Supervisory Authority (Superintendencia Financiera de Colombia) to ensure that the proposed Catastrophe Agricultural Insurance (SAC) Program for small family farms complies with existing Insurance Law.** If necessary, government can also adjust the legal framework to ensure that index insurance products are legally recognised as being insurance products.

**Another area of insurance regulation that government may wish to strengthen is the linkage between rural credit and agricultural insurance.** The nature of agricultural risk is covariate, which rural banks find difficult to manage; agricultural shocks can lead to large numbers of defaults and threaten their solvency. In many countries, bank lending to farmers in the form of seasonal crop loans or livestock investment loans is protected by insurance on a mandatory or compulsory basis (e.g. India, the Philippines, Mexico, Brazil). Regulators and governments can therefore play an important role in requiring that rural loans are bundled with insurance.

**In Colombia, FINAGRO already manages an Agricultural Guarantee Fund (Fondo Agropecuario de Garantías - FAG) that acts as a specialised fund to guarantee credit and micro-credit loans to farmers. It is also understood that in the past FINAGRO has taken a lead in discussing the potential to make all its crop loans subject to compulsory insurance, but that to date the insurance companies have been reluctant to sign up to this agreement because it would require them significantly to increase their agricultural insurance portfolios and resources allocated to insuring the banks’ clients.**
**Technical Support to Product Design and Rating and Program Implementation**

It is suggested that MADR-FINAGRO considers forming a dedicated Technical Support Unit (TSU) to support the design and implementation, monitoring and management of the large scale PPP agricultural insurance programs in Colombia. Countries with strong TSUs (or risk management agencies) to support their agricultural insurance PPP programs include the USA, Italy, France, Spain, Mexico, Brazil, Chile, Argentina and Uruguay. In Colombia, FINAGRO already maintains a small core team to manage the Agricultural Insurance Incentive (Incentivos para Seguro Agrícola - ISA) program which centres on the financing of premium subsidies. Moving forward, if MADR-FINAGRO are to play a major role in the design and implementation of the proposed large-scale PPP catastrophe Agricultural Insurance program it may wish to consider forming a fully staffed TSU which would conduct the following functions:

- Support to GoC Policy and Planning for the Commercial and Small Farmer Agricultural Insurance programs including preparation of annual business plans and budgets for government financial support including premium subsidies
- Provide Departmental Government with technical analysis and tools to evaluate the large-scale Catastrophe Agricultural Insurance Proposals made by the private sector insurers
- Promote the development of and piloting of new agricultural crop, livestock and forestry insurance products and programs in Colombia;
- Specialist support to the design and rating of traditional and index insurance products and in the development of catastrophe risk assessment models etc
- Investment in a centralised database for agricultural crop production and damage related data, climatic data and agricultural insurance data
- Support the development of outreach awareness and education programs for small farmers throughout Colombia
- Support for the development of standardised crop yield estimation and loss assessment systems and procedures for adoption at departmental level
- Monitor and Evaluate the annual performance for the commercial and small farmer development programs that are subsidised by GoC and prepare reports for government.

**Strengthening Data Collection, auditing and management and analysis of data**

Governments can play a central role in coordinating public and private sector investments in collecting, auditing and managing agricultural insurance related data and in ensuring this is freely available to all public and private stakeholders (GFDRR 2016). In Colombia there is are a wide range of organisations involved in the collection of crop production and yield data, crop damage data, weather data and insurance related data and data on the rural and farming communities. Very little of this data is, however, coordinated at present.

Private sector insurers cannot be expected to invest in high quality data required to insure small vulnerable farmers and governments therefore can play a very important role in the development of such data. As noted above one important role that the TSU could perform would be to coordinate agricultural insurance data collection, access, auditing and management.

**Increasing Insurance Outreach**

Governments can increase the outreach and ensure that agricultural insurance schemes reach scale in several ways:

1) Investment in public awareness and education and training programs for farmers
2) Enforcing some form of compulsion of insurance on the target audience
3) Subsidising of insurance premiums
4) Automatic enrolment of targeted farmers into public safety net cum social protection agricultural insurance schemes

In Colombia, the low voluntary demand for crop insurance suggests that there is a strong need to accompany any large-scale crop insurance program for small farmers with a suitable insurance literacy and awareness campaign. Central government and departmental and municipality governments could play a very important role in conducting these insurance literacy campaigns through their agricultural extension service departments. The TSU could perform a useful role in designing suitable crop insurance promotional and training materials.

Subsidising insurance premiums can be a powerful way for governments to achieve larger scale. Premium subsidies are the most widely practiced form of government support to the mainly individual farmer agricultural insurance program operating in both developed and developing countries. In a study of agricultural insurance provision, Mahul and Stutley (2010) report that premium subsidies are the most common form of government support in nearly two thirds of countries with some form of agricultural insurance (See Annex 8 for list of countries where governments provide premium subsidies and typical levels of premium subsidy). However, as GFDRR 2016 note there are advantages and disadvantages of premium subsidies which must be carefully weighed against each other. Advantages include (i) promoting take-up by farmers through making insurance premiums more affordable, (ii) incentivising insurance companies to enter this difficult class of business, (iii) substituting post-disaster compensation payments for ex-ante subsidised insurance. Disadvantages of premium subsidies include: (i) poor targeting, (ii) difficulties of withdrawing premium subsidies and potential for an increasing fiscal burden to government as insurance uptake increases; (iii) disproportionate subsidy benefits for larger farmers who have a larger insured acreage; (iv) creation of perverse behavioural incentives to grow high risk crops in inappropriate areas because of the presence of premium subsidies.

Mexico was the first country to use Macro-level parametric crop and livestock insurance products to replace its disaster compensation schemes for the most vulnerable poor farmers and tenant farmers as a form of social protection cover. In this case, government justified their 100% financing of the premiums for these poor farmers in terms that this was more cost effective than conventional disaster relief payments. Various impact evaluation studies of the CADENA insurance programs have been carried out in Mexico over the years which tend to show (i) that the program reduces income poverty (Arias et al 2014); (ii) that index insurance has the possibility of improving welfare for rural households by providing resources to invest in the subsequent planting season, which in turn results in more land sowed. The payments may also prevent households from resorting to costly coping mechanisms, such as reducing consumption, as evidenced by the result for household expenditures (de Janvry et al 2016) and (iii) While the cost of insurance appears to be high relative to the payouts, the benefits exceed the costs for a substantial range of outcomes (de Janvry et al 2016). The Autonomous University of Chapingo 2009 study also shows that nearly 100% of surveyed beneficiaries had continued to remain in agricultural production following the catastrophe event due to the CADENA payouts they had received. Overall 75% of beneficiaries reinvested their payouts in their crop or livestock activities.

The above evidence suggests that in Colombia, GoC would be justified in developing fully subsidised catastrophe agricultural insurance cover for small vulnerable farmers as a more cost-effective alternative to existing ex-post disaster compensation programs. FINAGRO would be well placed to manage the premium budget for the SAC program(s), given the fact that it is already involved in managing the government’s premium subsidies on commercial agricultural insurance under the National Fund for Agricultural Risks (FIRA). It would also be very important for GoC to conduct impact evaluation studies over time to evaluate the cost-effectiveness of the SAC program.
**Risk Financing**

The GoC could assist the domestic insurance companies to pool their agricultural risks thereby achieving a larger, more diversified and better structured portfolio than if they try to insure their own separate portfolios. In the short term while the SAC is being implemented on a pilot scale with only one or two crops in one or two departments, it is likely that the optimal vehicle would be a simple coinsurance agreement with a lead insurer issuing cover on its own paper and the supporting coinsurers providing capacity as well as contributing to the leader insurer’s costs of scheme implementation. The lead coinsurers would be responsible for negotiating reinsurance protection. However, in the longer term if the SAC scales-up into a national program covering large numbers of small family farms and more crops in most Colombia’s Departments, then the government and participating insurers may wish to capitalise and register a new Pool Agricultural Insurance Company specifically underwriting large-scale PPP crop and livestock insurance programs. In this instance GoC could support the insurers by contributing towards financing the initial capitalization of the pool insurance company.

*In some countries governments also support the reinsurance program by assuming a portion of the catastrophe risk layer.* Countries with public sector reinsurance companies or government reinsurance agreements that support their national agricultural insurance programs include the UAS, Canada, Mexico (through Agroasemex), Brazil (through the Instituto do Reaseguro Brasileiro, IRB), Spain (Consortio National de Reaseguro), China and India. In Colombia, La Previsora is both an insurer and reinsurer and is well placed to support the SAC initiative. It is not likely that GoC would need to support the reinsurance of the SAC program because if this is actuarially rated and losses carefully adjusted there should be widespread support for such a program by national and international reinsurers.

**4.3. Key Roles for the Departmental Governments in Implementing the SAC Programs**

*Under the proposed Large-scale PPP Catastrophe Agricultural Insurance Program, the Departmental and Municipality Governments will play central roles in the implementation of the program.* Some of the potential roles are listed below:

1) Identification and Registration of Target Beneficiaries;
2) Provision of crop insurance awareness creation, education and training for the targeted farmers;
3) Support to Insurance Companies in the end of season area yield measurement exercise based on sample crop crops cuts, and the mid-season assessment of losses caused by idiosyncratic risks;
4) Contributing towards the financial costs of premium subsidies. In India the Federal and State Governments share the costs of premium subsidies on a 50:50 basis, while in Mexico under the CADENA Program Federal Government finances about 80% of the costs of premiums, and the State Governments fund the remaining 20% of premiums.
5) Monitoring and Evaluation of the SAC Program results and impacts.

**4.4. Key Roles for Private Commercial Insurers in supporting the Catastrophe Agricultural Insurance (SAC) program**

*International experience shows that the most sustainable agricultural insurance PPP programs are those where the private sector insurers are responsible for product design and rating, risk acceptance and underwriting decisions and also in coordinating loss assessment activities.* The potential roles of the insurance companies in the SAC initiative are highlighted in Figure 11.
To date the public and private insurance companies have not invested in developing agricultural insurance solutions for small-scale family farms. It is therefore very much hoped that if GoC agree to finance many of the support activities highlighted in Section 4.1 that the insurance companies will in turn respond by agreeing to invest in creating the necessary rural branch office infrastructure and systems and procedures to underwrite and settle claims on the large-scale catastrophe agricultural insurance (SAC) program for small family farms. A starting point would be to work with FASECOLDA to see if there is support to form a coinsurance pool to underwrite this risk.

Figure 11. Potential Roles of Public and Private Commercial Insurers in Supporting PPP Catastrophe Agricultural Insurance for Small Vulnerable Farmers in Colombia

It is recommended that GoC (through the Insurance Supervisory Authority) promote the formation of a suitable form of coinsurance (or pool) agreement by the interested insurance companies to underwrite the large-scale Catastrophe Agricultural Insurance PPP programs in Colombia. Under a PPP insurance initiative government usually adopts an annual tender to appoint an individual company to underwrite the business: contracts tend to be awarded on price alone and not based on service provision. Under such an approach where the appointed insured has a one-year contract there are few incentives for the Insurance Company to invest in developing operating systems and procedures (e.g. for farmer awareness and education; loss adjusting teams). The alternative approach is for government to promote a coinsurance agreement among the leading agricultural insurance companies. The advantages of coinsurance pools for agricultural insurance were highlighted in Section 4. In Colombia it is likely that in the short-term the interested insurers would not be willing to incorporate and capitalise a new specialist agricultural insurance pool company, but rather that they would enter into a coinsurance agreement and appoint a lead underwriter which would be responsible for negotiating terms with government, for issuing policies on its own paper and for implementing and managing the program on behalf of the coinsurers. Once experience has been gained and scalability and sustainability has been demonstrated, the coinsurers could then elect to form a new SAC Pool Company. Figure 12 shows an outline institutional framework for the SCA Program assuming a coinsurance agreement were to be adopted.

Figure 12. Institutional Framework for Large-Scale Catastrophe Agricultural Insurance in Colombia
Furthermore, the private insurers should be encouraged to continue developing private sector crop and livestock insurance products and programs for semi commercial and commercial farmers in parallel to the fully subsidised SAC Programs for subsistence farmers. Chapter 3 highlighted the fact that after 20 years, agricultural insurance penetration in Colombia remains very low. In the post-conflict period there appear to be major opportunities for the agricultural insurers to expand their activities in rural farming areas of Colombia.
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Annex 1. Colombia: Categories of Risk in Agriculture identified in 2017 Perceptions Survey

1. Eventos Climáticos Extremos.
   - Avenidas torrenciales
   - Deslizamientos
   - Exceso de Lluvia
   - Granizo
   - Heladas
   - Incendios
   - Inundaciones
   - NULL
   - Sequía
   - Vientos

10. Infraestructura y logística.
   - Fluctuaciones en el suministro de electricidad (irrigación, aireación granjas, refrigeración de lácteos, perecederos, etc)
   - Huelgas de controladores de puertos
   - Inadecuada infraestructura y logística del transporte
   - Interrupción de aeropuertos
   - Interrupción de vías fluviales y férreas
   - Interrupción en carreteras
   - NULL
   - Reducción repentina de capacidad de almacenamiento/infraestructura de almacenamiento

11. Políticas y programas públicos.
   - Comercio Internacional
   - Crédito
   - Crisis social: Conflicto armado/nuevas conflictividades en el marco del pos-acuerdo
   - Eventos climáticos extremos
   - Gestión de la Producción
   - Gestión de los insumos de producción y los recursos naturales
   - Infraestructura y logística
   - Marco regulatorio y políticas públicas
   - Mercado - Comercialización
   - NULL
   - Sanidad Animal
   - Sanidad Vegetal

12. Panorama general de los riesgos agropecuarios.
   - Comercio Internacional
   - Crédito
   - Crisis social: nuevas conflictividades en el pos-acuerdo
   - Eventos climáticos extremos
   - Exceso de Lluvia
   - Gestión de la Producción
   - Gestión de los insumos de producción y los recursos naturales
   - Infraestructura y logística
   - Marco regulatorio y políticas públicas
Mercado - Comercialización
NULL
Sanidad Animal
Sanidad Vegetal

2. Sanidad Animal.
Brucelosis y Tuberculosis
BSE (Vaca Loca)
Exceso de Lluvia
Fiebre Aftosa
Granizo
Gripe aviar
Heladas
Inundaciones
Newcastle
NULL
Peste Porcina
Secuencia
Vientos

3. Sanidad Vegetal.
Enfermedades
Nematodos
NULL
Plagas
Plantas Invasoras

4. Gestión de la producción.
Crisis social: abandono de tierras por violencia
Exceso de Lluvia
Falta de asistencia técnica
Falta de mano de obra
Falta o dificultad de acceso a insumos
Insumos inadecuados
Mano de obra no calificada
Mecanización inadecuada
Mecanización insuficiente
NULL
Secuencia
Tecnología inadecuada

5. Gestión de los insumos de producción y los recursos naturales.
Crisis social: Abandono de tierras, desuso o subutilización de tierras por conflicto armado
Exceso de Lluvia
Manejo inadecuado de fertilizantes y semilla
Manejo inadecuado de insumos pecuarios
Manejo inadecuado de pesticidas
Manejo inadecuado del agua
Manejo inadecuado del suelo
NULL

Caída de Precios internacionales
Caída de Precios nacionales
Cambios en las estrategias de promoción comercial
Cambios normativos y estándares internacionales
Exceso de Lluvia
Granizo
NULL
Retraso o falta de pago del precio mínimo
Sequía
Variación de impuestos, tasas y cargos
Volatileidad tasa de cambio

7. Crédito.
Cambios en las exigencias o reglamentación para obtención del crédito
Desembolso del crédito en periodo inadecuado
Exceso de Lluvia
Falta o insuficiencia de crédito
Fluctuación en las tasas de interés
NULL
Sequía

8. Comercio Internacional.
Aplicación inesperada de medidas de defensa comercial de las exportaciones (anti-dumping y salvaguardias)
Cambios en barreras arancelarias
Cambios en barreras no arancelarias (técnicas, sanitarias y fitosanitarias)
Crecimiento inesperado de la importación
Exceso de Lluvia
Falta de armonización entre normas sanitarias y fitosanitarias Colombianas y de otros países
Firma de acuerdos comerciales
NULL
Revaluación o devaluación de la moneda
Sequía

9. Marco Regulatorio y políticas públicas.
Cambios en el gobierno
Cambios en la interpretación de las reglas ambientales
Cambios en la interpretación de reglas sociales y laborales
Conflicto debido a insuficiente/inadecuada supervisión
Conflicto debido a Insuficiente/inadecuada/ indefinición del marco regulatorio
Conflicto debido a insuficiente/inadecuado marco regulatorio para determinados temas/sectores
Conflicto entre órganos de ejecución de políticas públicas
Crisis social: Conflicto armado/priorización de recursos, reformas o nuevas políticas y nuevas entidades de gobierno
Exceso de Lluvia
NULL
Sequía

13. [Blank] Other Risk identified by the respondents
Annex 2. Colombia CRED_EM DAT Database for Natural Disasters 1900 to 2017

Table A2.1. Top 10 Disasters by Total Number of Deaths

<table>
<thead>
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<th>Year</th>
<th>Disaster Type</th>
<th>No. Occurrence</th>
<th>Total deaths</th>
<th>Injured persons</th>
<th>Affected persons</th>
<th>Homeless persons</th>
<th>Total affected persons</th>
<th>Total damage (US$ 000)</th>
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<tr>
<td>1985</td>
<td>Volcanic activity</td>
<td>1</td>
<td>21,800</td>
<td>5,000</td>
<td>7,700</td>
<td>12,700</td>
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<tr>
<td>1999</td>
<td>Earthquake</td>
<td>1</td>
<td>1,186</td>
<td>8,563</td>
<td>745,000</td>
<td>452,370</td>
<td>1,205,933</td>
<td>1,857,366</td>
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<td>1949</td>
<td>Volcanic activity</td>
<td>1</td>
<td>1,000</td>
<td>7</td>
<td>266</td>
<td>276</td>
<td>7,000</td>
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<tr>
<td>1987</td>
<td>Landslide</td>
<td>2</td>
<td>653</td>
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<td>4,000</td>
<td>6,436</td>
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<tr>
<td>1979</td>
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<td>Earthquake</td>
<td>2</td>
<td>430</td>
<td>6</td>
<td>3,000</td>
<td>3,006</td>
<td>400</td>
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<tr>
<td>2010</td>
<td>Flood</td>
<td>3</td>
<td>418</td>
<td>463</td>
<td>2,796,097</td>
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<td>1,000,000</td>
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<td>1970</td>
<td>Flood</td>
<td>3</td>
<td>407</td>
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Source: http://www.emdat.be/database

Table A2.2. Damage Record by Type of Natural Event 1900-2017 (Values)

<table>
<thead>
<tr>
<th>Disaster Type</th>
<th>No. Occurrence</th>
<th>Total deaths</th>
<th>Injured persons</th>
<th>Affected persons</th>
<th>Homeless persons</th>
<th>Total affected persons</th>
<th>Total damage (US$ 000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flood</td>
<td>78</td>
<td>3,507</td>
<td>2,967</td>
<td>15,922,694</td>
<td>304,472</td>
<td>16,230,133</td>
<td>3,591,353</td>
</tr>
<tr>
<td>Landslide</td>
<td>42</td>
<td>3,372</td>
<td>3,862</td>
<td>65,759</td>
<td>6,363</td>
<td>75,984</td>
<td>2,400</td>
</tr>
<tr>
<td>Earthquake</td>
<td>25</td>
<td>3,593</td>
<td>12,332</td>
<td>922,675</td>
<td>525,312</td>
<td>1,460,319</td>
<td>2,313,666</td>
</tr>
<tr>
<td>Volcanic activity</td>
<td>11</td>
<td>22,826</td>
<td>5,013</td>
<td>51,951</td>
<td>0</td>
<td>56,964</td>
<td>1,000,000</td>
</tr>
<tr>
<td>Storm</td>
<td>9</td>
<td>49</td>
<td>258</td>
<td>132,094</td>
<td>8,063</td>
<td>140,415</td>
<td>53,050</td>
</tr>
<tr>
<td>Epidemic</td>
<td>5</td>
<td>503</td>
<td>12</td>
<td>41,543</td>
<td>0</td>
<td>41,555</td>
<td>0</td>
</tr>
<tr>
<td>Mass movement (dry)</td>
<td>3</td>
<td>247</td>
<td>36</td>
<td>2,250</td>
<td>125</td>
<td>2,411</td>
<td>0</td>
</tr>
<tr>
<td>Wildfire</td>
<td>3</td>
<td>31</td>
<td>0</td>
<td>200</td>
<td>0</td>
<td>200</td>
<td>0</td>
</tr>
<tr>
<td>Drought</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>100,000</td>
<td>0</td>
<td>100,000</td>
<td>0</td>
</tr>
<tr>
<td>Insect infestation</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>104,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>179</strong></td>
<td><strong>34,128</strong></td>
<td><strong>24,480</strong></td>
<td><strong>17,239,166</strong></td>
<td><strong>844,335</strong></td>
<td><strong>18,107,981</strong></td>
<td><strong>7,064,469</strong></td>
</tr>
</tbody>
</table>

Source: http://www.emdat.be/database
### Table A2.3. Damage Record by Type of Natural Event 1900-2017 (Percentages)

<table>
<thead>
<tr>
<th>Disaster Type</th>
<th>No. Occurrence</th>
<th>Total deaths</th>
<th>Injured persons</th>
<th>Affected persons</th>
<th>Homeless persons</th>
<th>Total affected persons</th>
<th>Total damage (US$ 000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flood</td>
<td>44%</td>
<td>10%</td>
<td>12%</td>
<td>92%</td>
<td>36%</td>
<td>90%</td>
<td>51%</td>
</tr>
<tr>
<td>Landslide</td>
<td>23%</td>
<td>10%</td>
<td>16%</td>
<td>0%</td>
<td>1%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Earthquake</td>
<td>14%</td>
<td>11%</td>
<td>50%</td>
<td>5%</td>
<td>62%</td>
<td>8%</td>
<td>33%</td>
</tr>
<tr>
<td>Volcanic activity</td>
<td>6%</td>
<td>67%</td>
<td>20%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>14%</td>
</tr>
<tr>
<td>Storm</td>
<td>5%</td>
<td>0%</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Epidemic</td>
<td>3%</td>
<td>1%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Mass movement (dry)</td>
<td>2%</td>
<td>1%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Wildfire</td>
<td>2%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Drought</td>
<td>1%</td>
<td>0%</td>
<td>0%</td>
<td>1%</td>
<td>0%</td>
<td>1%</td>
<td>0%</td>
</tr>
<tr>
<td>Insect infestation</td>
<td>1%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>1%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
<td><strong>100%</strong></td>
<td><strong>100%</strong></td>
<td><strong>100%</strong></td>
<td><strong>100%</strong></td>
<td><strong>100%</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>


### Table A2.4. Colombia: Analysis of Natural Event Damage Record by Decade (1900-2017)

<table>
<thead>
<tr>
<th>Decade</th>
<th>No. Occurrence</th>
<th>Total deaths</th>
<th>Injured persons</th>
<th>Affected persons</th>
<th>Homeless persons</th>
<th>Total affected persons</th>
<th>Total damage (US$ 000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1900 - 1909</td>
<td>1</td>
<td>400</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1910 - 1919</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1920 - 1929</td>
<td>1</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1930 - 1939</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1940 - 1949</td>
<td>1</td>
<td>1,000</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1950 - 1959</td>
<td>4</td>
<td>521</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1960 - 1969</td>
<td>5</td>
<td>340</td>
<td>200</td>
<td>41,020</td>
<td>63</td>
<td>41,283</td>
<td>650</td>
</tr>
<tr>
<td>1970 - 1979</td>
<td>21</td>
<td>2,534</td>
<td>2,836</td>
<td>5,192,000</td>
<td>107,100</td>
<td>5,301,936</td>
<td>167,750</td>
</tr>
<tr>
<td>1980 - 1989</td>
<td>23</td>
<td>23,710</td>
<td>9,576</td>
<td>571,400</td>
<td>500</td>
<td>581,476</td>
<td>1,468,400</td>
</tr>
<tr>
<td>1990 - 1999</td>
<td>41</td>
<td>2,558</td>
<td>9,355</td>
<td>1,301,650</td>
<td>631,847</td>
<td>1,942,852</td>
<td>1,967,669</td>
</tr>
<tr>
<td>2000 - 2009</td>
<td>48</td>
<td>1,334</td>
<td>1,391</td>
<td>5,519,643</td>
<td>53,353</td>
<td>5,574,387</td>
<td>20,000</td>
</tr>
<tr>
<td>2010 - 2017</td>
<td>34</td>
<td>1,631</td>
<td>1,122</td>
<td>4,613,453</td>
<td>11,472</td>
<td>4,626,047</td>
<td>3,440,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>179</strong></td>
<td><strong>34,128</strong></td>
<td><strong>24,480</strong></td>
<td><strong>17,239,166</strong></td>
<td><strong>844,335</strong></td>
<td><strong>18,107,981</strong></td>
<td><strong>7,064,469</strong></td>
</tr>
</tbody>
</table>

Annex 3. Colombia: Analysis of Agricultural Insurance Results 2010 to 2014

**Tabla A3.1. Número de pólizas por cultivo (2010 - 2014).**

<table>
<thead>
<tr>
<th>Cultivo</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algodón</td>
<td>532</td>
<td>48</td>
<td>67</td>
<td>279</td>
<td>211</td>
<td>1,137</td>
</tr>
<tr>
<td>Arroz</td>
<td>324</td>
<td>51</td>
<td>155</td>
<td>725</td>
<td>2,346</td>
<td>3,601</td>
</tr>
<tr>
<td>Banano</td>
<td>181</td>
<td>177</td>
<td>195</td>
<td>426</td>
<td>509</td>
<td>1,488</td>
</tr>
<tr>
<td>Caña de Azúcar</td>
<td>0</td>
<td>2,290</td>
<td>72</td>
<td>103</td>
<td>222</td>
<td>2,687</td>
</tr>
<tr>
<td>Maíz</td>
<td>2,009</td>
<td>1,925</td>
<td>1,721</td>
<td>1,265</td>
<td>2,738</td>
<td>9,658</td>
</tr>
<tr>
<td>Plantación Forestal</td>
<td>19</td>
<td>37</td>
<td>28</td>
<td>42</td>
<td>62</td>
<td>188</td>
</tr>
<tr>
<td>Tabaco</td>
<td>6,353</td>
<td>7,648</td>
<td>689</td>
<td>5,705</td>
<td>0</td>
<td>20,395</td>
</tr>
<tr>
<td>Total</td>
<td>9,418</td>
<td>12,176</td>
<td>2,927</td>
<td>8,545</td>
<td>6,088</td>
<td>39,154</td>
</tr>
</tbody>
</table>

**Tabla A3.2. Área asegurada por cultivo (2010 - 2014).**

<table>
<thead>
<tr>
<th>Cultivo</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algodón</td>
<td>3,771</td>
<td>838</td>
<td>463</td>
<td>2,029</td>
<td>2,294</td>
<td>9,395</td>
</tr>
<tr>
<td>Arroz</td>
<td>5,787</td>
<td>978</td>
<td>2,793</td>
<td>9,955</td>
<td>29,705</td>
<td>49,218</td>
</tr>
<tr>
<td>Banano</td>
<td>16,994</td>
<td>17,320</td>
<td>17,255</td>
<td>18,420</td>
<td>21,836</td>
<td>91,825</td>
</tr>
<tr>
<td>Caña de Azúcar</td>
<td>10,538</td>
<td>12,603</td>
<td>11,272</td>
<td>8,684</td>
<td>16,217</td>
<td>60,583</td>
</tr>
<tr>
<td>Maíz</td>
<td>10,745</td>
<td>13,665</td>
<td>11,722</td>
<td>15,315</td>
<td>44,869</td>
<td></td>
</tr>
<tr>
<td>Plantación Forestal</td>
<td>1,913</td>
<td>6,458</td>
<td>10,038</td>
<td>15,315</td>
<td>12,047</td>
<td></td>
</tr>
<tr>
<td>Tabaco</td>
<td>3,777</td>
<td>4,065</td>
<td>919</td>
<td>3,286</td>
<td>0</td>
<td>12,047</td>
</tr>
<tr>
<td>Total</td>
<td>42,987</td>
<td>53,862</td>
<td>55,343</td>
<td>66,754</td>
<td>100,238</td>
<td>319,183</td>
</tr>
</tbody>
</table>
### Tabla A3.3. Valor asegurada (millones de pesos) por cultivo (2010 - 2014).

<table>
<thead>
<tr>
<th>Cultivo</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algodón</td>
<td>14,014</td>
<td>2,703</td>
<td>1,812</td>
<td>8,923</td>
<td>9,959</td>
<td>37,411</td>
</tr>
<tr>
<td>Arroz</td>
<td>20,010</td>
<td>4,106</td>
<td>10,780</td>
<td>39,447</td>
<td>106,629</td>
<td>180,972</td>
</tr>
<tr>
<td>Banano</td>
<td>191,141</td>
<td>195,511</td>
<td>194,228</td>
<td>256,715</td>
<td>314,496</td>
<td>1,152,091</td>
</tr>
<tr>
<td>Caña de Azúcar</td>
<td>36,918</td>
<td>44,107</td>
<td>54,845</td>
<td>66,266</td>
<td>202,136</td>
<td>1,152,918</td>
</tr>
<tr>
<td>Maíz</td>
<td>34,266</td>
<td>47,124</td>
<td>39,151</td>
<td>32,556</td>
<td>68,182</td>
<td>221,279</td>
</tr>
<tr>
<td>Plantación Forestal</td>
<td>3,665</td>
<td>15,501</td>
<td>33,776</td>
<td>34,550</td>
<td>64,897</td>
<td>152,390</td>
</tr>
<tr>
<td>Tabaco</td>
<td>31,176</td>
<td>33,186</td>
<td>7,651</td>
<td>34,468</td>
<td>0</td>
<td>106,480</td>
</tr>
<tr>
<td>Total</td>
<td>294,271</td>
<td>335,049</td>
<td>331,504</td>
<td>461,504</td>
<td>630,430</td>
<td>2,052,758</td>
</tr>
</tbody>
</table>

### % del área total asegurado por cultivo (2010-14)

- Algodón: 3%
- Arroz: 15%
- Banano: 29%
- Caña de Azúcar: 16%
- Maíz: 19%
- Plantación Forestal: 14%
- Tabaco: 4%

### % de la suma asegurada total por cultivo (2010-14)

- Algodón: 2%
- Arroz: 9%
- Banano: 56%
- Caña de Azúcar: 11%
- Maíz: 10%
- Plantación Forestal: 7%
- Tabaco: 5%
Tabla A3.4. Valor de la prima (millones de pesos) por cultivo (2010 - 2014).

<table>
<thead>
<tr>
<th>Cultivo</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algodón</td>
<td>873</td>
<td>214</td>
<td>145</td>
<td>569</td>
<td>848</td>
<td>2,649</td>
</tr>
<tr>
<td>Arroz</td>
<td>1,382</td>
<td>319</td>
<td>712</td>
<td>3,106</td>
<td>8,893</td>
<td>14,412</td>
</tr>
<tr>
<td>Banano*</td>
<td>11,618</td>
<td>11,692</td>
<td>10,970</td>
<td>14,308</td>
<td>19,278</td>
<td>67,865</td>
</tr>
<tr>
<td>Caña de Azúcar</td>
<td>0</td>
<td>924</td>
<td>682</td>
<td>1,608</td>
<td>1,897</td>
<td>5,111</td>
</tr>
<tr>
<td>Maíz</td>
<td>2,046</td>
<td>2,864</td>
<td>2,300</td>
<td>1,948</td>
<td>5,171</td>
<td>14,329</td>
</tr>
<tr>
<td>Plantación Forestal</td>
<td>135</td>
<td>470</td>
<td>854</td>
<td>974</td>
<td>1,668</td>
<td>4,101</td>
</tr>
<tr>
<td>Tabaco</td>
<td>2,501</td>
<td>2,664</td>
<td>622</td>
<td>2,114</td>
<td>0</td>
<td>7,901</td>
</tr>
<tr>
<td>Total</td>
<td>18,555</td>
<td>19,147</td>
<td>16,286</td>
<td>24,625</td>
<td>37,754</td>
<td>116,368</td>
</tr>
</tbody>
</table>

% de la prima total por cultivo (2010-14)

- Algodón: 4%
- Arroz: 12%
- Banano*: 7%
- Caña de Azúcar: 58%
- Maíz: 4%
- Plantación Forestal: 2%
- Tabaco: 12%
Annex 4. International Experience with Large-Scale PPPs for Agricultural Insurance

Differences between Micro, Meso and Macro-level Applications of Index Insurance

Parametric or index insurance is a very flexible cover that can be offered at different levels of aggregation, starting at a micro-level where cover is retailed to individuals (e.g. farmers), through to meso-level applications to protect the financial exposure of regional aggregators such as input suppliers and agricultural lending banks and microfinance institutions (MFIs) and finally at a macro-level where governments are increasingly using index insurance as a risk transfer instrument as part of their national disaster risk financing programs and/or as large-scale social protection covers. Box A4.1. contains further information on the applications of Index Insurance at these three levels of aggregation.

Box A4.1. Applications of Parametric or Index Insurance at different levels of Aggregation

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

- **Meso level (indirect):** Policyholders are risk aggregators such as associations, cooperatives, mutual’s, credit unions or NGOs, whereby a (re)insurer makes payments to the risk aggregators, which then provide services to individuals.

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

Source: MCII 2016

The institutional and operational differences between a conventional micro-level policy purchased by an individual and a macro-level policy are illustrated below in Figure A4.1. Under a micro-level index policy, the individual is the policy holder and whom, for the payment of a pre-agreed up-front premium, receives a policy to protect him or her against a specific peril or perils stated in the policy and in the event the index is triggered he/she receives a payout from the Insurance company (micro-insurer). Under a macro-level policy, a state or national government is the Insured Policyholder and they are responsible for the payment of premium. In the event that the index is triggered, the government receives a lump sum payout which it can then use for whatever purposes it chooses. Macro-level programs have been designed to enable governments to effect post-disaster immediate emergency response activities at a regional level, to support cash or in kind transfer programs and to provide general budgetary support in the event of a natural disaster. A further option is for government and insurers to pre-agree who will be the beneficiaries and their individual sums insured and in the event of the policy being triggered for the payouts to be made directly to the individual beneficiaries.
Figure A4.1. Contractual Framework for Micro-level Index insurance for individual farmers versus Macro-level Government Disaster Risk Financing scheme

<table>
<thead>
<tr>
<th>Micro-level insurance program</th>
<th>Macro-level insurance program</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Insurer</strong></td>
<td><strong>Insurer</strong></td>
</tr>
<tr>
<td></td>
<td>Policies, premiums, claims</td>
</tr>
<tr>
<td><strong>Distributor</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Policies, premiums, claims</td>
</tr>
<tr>
<td><strong>Insured Policyholder is an individual Crop or Livestock Producer</strong></td>
<td><strong>Policyholder’s National or State Government</strong></td>
</tr>
<tr>
<td></td>
<td>Government sets the payout rules to Beneficiaries</td>
</tr>
<tr>
<td></td>
<td><strong>Beneficiaries (Vulnerable Crop or Livestock Producers)</strong></td>
</tr>
</tbody>
</table>

Source: Adapted by authors from W. Dick 2009

International experience with macro-level Index Insurance Programs for Small Farmers

The first Macro-level disaster weather index insurance program was launched in 2003 by Agrosemex, the Mexican Parastatal Reinsurer as a catastrophe drought protection cover for small subsistence farmers in Guanajuato state. Since then the Government of Mexico has invested massively in the development of macro-level index insurance programs for crops and livestock which are implemented jointly with the state governments as part of government's national disaster relief program for small vulnerable farmers and livestock producers. This program termed the CADENA now operates in all Mexico's 32 states and provides protection for several million crop and livestock producers. Further information on the Mexican program is provided below.

In Africa, the first macro-level rainfall deficit program was implemented in Ethiopia in 2006, followed by Malawi in 2009 with a rainfall deficit cover designed to protect against major drought losses in the national staple crop, maize, and most recently the African Risk Capacity (ARC) drought index program which was launched in 2014/15 in 4 African Countries. The Ethiopia program only operated for one year and was free of claims, while the Malawi program ran for 3 years with no payouts. In 2013/14 year 11, ARC made drought payouts valued at US$ 26.3 million in three of the four insured countries (Senegal, Mauritania and Niger); there was one payout to Malawi in 2015/16 and in 2016/17 seven countries subscribed to ARC which was free of claims.

In 2015/16 Kenya launched an innovative modified macro-level index insurance program for vulnerable pastoralists located in the ASAL regions of Kenya termed the Kenya Livestock Insurance Program, KLIP. The innovative feature of this program is that pastoralists are pre-registered as KLIP beneficiaries and program management assists them either to open bank accounts or mobile phone banking to enable payouts to be channeled directly to each beneficiaries account thereby speeding up the post-disaster response and reducing the potential for rent seeking in the distribution process.

There are two macro-level catastrophe windstorm index pool programs, the Caribbean Catastrophe Risk Insurance Facility, CCRIF and PCRAFI, the Pacific Catastrophe Risk Assessment and Financing.

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These two programs are not specific to agriculture but are examples of the use of macro-level index insurance for sovereign disaster risk financing. CCRIF was launched in 2007 to provide catastrophe tropical cyclone (and earthquake) sovereign risk financing to a number of Caribbean governments: by pooling risk, CCRIF can purchase reinsurance at much cheaper terms than if each government purchased cover separately. Currently 16 Caribbean governments are members of CCRIF and since 2014 CCRIF has extended its coverage to include Central American governments. CCRIF has recently added excess rainfall cover to the range of perils that governments can purchase. Over the past decade, CCRIF has made 22 payouts to 10 member government valued at US$ 69 million16.

To date these macro-level weather index insurance programs are showing considerable potential for funding government’s disaster risk response and/or financing social protection for the poorest sectors.

Mexico’s CADENA Catastrophe Climatic Insurance Programs for Resource Poor Farmers

Mexico is unique in having a national and state-level catastrophe climatic parametric insurance program for subsistence farmers called the Component for the Attention of Natural Disasters (CADENA) program. CADENA is designed to provide social safety net protection for the large numbers of small semi-subsistence rural farming households. The program was introduced in 2003 under a public-private partnership between the federal government (Ministries of Finance and Agriculture), local state governments, Mexican insurance companies and the national agricultural reinsurance company (Agroasemex) that provides both technical design and underwriting capacity on the program. (See Annex 5 for further details of the CADENA Program).

In Mexico government has used the CADENA ex-ante parametric crop and livestock insurance instruments to replace their traditional ex-post natural disaster compensation programs for the rural poor. Government’s rationale for using ex-ante insurance to replace the former ex-post compensation payments include: insurance brings a financial discipline to disaster response; it puts a price on risk and at the same time quantifies the values at risk; Government by paying an up-front premium can transfer the full financial liability from its balance sheet to insurance and international reinsurance markets in the knowledge it is fully protected in the event of catastrophe losses, rather than resorting to diverting budgets to meet these losses and or appeals for loans and humanitarian aid from international donors. Finally, there is evidence that insurance payouts can be made much more speedily post-event resulting in timely interventions at the individual beneficiary level.

The program is targeted at poor crop and livestock producers who are deemed to be too poor to purchase commercial agricultural insurance and who were formerly the beneficiaries of the direct natural disaster compensation programs operated by federal and state governments. The insurance payouts are designed to tide the farmer over until the next crop season and to enable them to purchase needed inputs. The state governments are responsible for identifying and registering subsistence crop and livestock farmers using criteria based on farm size for irrigated and non-irrigated holdings and number of livestock owned.

For crops, CADENA uses two types of index insurance policy (a) Weather Index Insurance (WII) based on ground weather stations and or satellite data, and (b) Area Yield Index Insurance (AYII) where the municipality forms the UAI and the index is based on historical municipality-yield data provided by the Ministry of Agriculture. The AYII program provides catastrophe yield shortfall cover only for yield loss that exceeds 70% of normal average yield and affected farmers receive a fixed level of compensation which is currently set at about US$ 100 per hectare for rain-fed crops and US$ 175 per hectare for tree crops and irrigated crops (see Box A4.2. and Annex 5 for further details).

16 Source: CCRIF SPC http://www.ccrif.org/content/about-us
The CADENA Program is underwritten by four insurance companies which submit seasonal bids to the individual States to provide Insurance cover. The program is underwritten by four companies, Agroasemex the national agricultural reinsurer and 3 private insurers including PROAGRO, which has opened an office in Colombia. The companies compete against each other to provide macro-level crop and livestock insurance covers to the individual State Governments which are the Insured.

The CADENA Premiums are fully funded by federal and state governments on a ratio of about 85% to 15% and over the period 2003 to 2011 the costs of premiums were about MXN 5.01 billion or US$ 375 million. CADENA beneficiaries do not make any contributions to the crop and livestock insurance premiums as they are deemed to be too poor to be able to afford cover.

In Mexico, the CADENA crop and livestock index macro-level index insurance programs have been massively scaled up by government over the last 13 years and currently reach about 2.5 million small vulnerable crop and livestock producers (about 56% of all eligible farmers) in 31 states of Mexico.

Evaluation results show that the CADENA program not only helps to put small farmers back in business after a disaster, but it reduces the need to sell productive assets and leads to higher sown area compared to non-beneficiaries. A recent study by de Janvry et al. (2016) shows that (i) CADENA payouts increase expenditures by about 27% and incomes by about 38% for beneficiaries and (ii) the benefits of the program exceed the costs under a wide range of estimates.
Box A4.2. México: CADENA. Tipos de pólizas de Seguro Indexados Catastróficos para Cultivos y Ganado

México: CADENA: Seguros Indexados de Coberturas Catastróficas para Cultivos y Ganado

El programa CADENA fue implementado en el 2003 con el objetivo de cubrir las pérdidas que incurriría el gobierno mexicano en caso de brindar asistencia a los productores que no tienen acceso a productos financieros y que se ven afectados por eventos meteorológicos extremos. El mecanismo de pago implementado en el programa CADENA se basa en la medición de diversos índices, cuyos valores se relacionan con las pérdidas registradas en zonas productivas específicas. Los índices seleccionados cubren una diversidad de cultivos anuales y perennes, y ganado vacuno. Los pagos generados a partir de estos productos son desembolsados al Gobierno Federal o a los gobiernos estatales adheridos, quienes luego lo distribuyen en sumas pre-definidas a los productores afectados. Para el caso de los cultivos perennes, el monto de compensación que recibe un productor hortícola y con infraestructura de riego es equivalente a US$149/Ha; mientras que un productor de secano y un productor ganadero recibe US$88/Ha y US$40/Unidad Ganadera, respectivamente (Arias et al. 2014).

Los Seguros Paramétricos para Cultivos basados en Índices Meteorológicos (WII, siglas en inglés) generalmente utilizan estaciones meteorológicas para asegurar cultivos contra las principales amenazas, como déficit de lluvias (sequías) o exceso de precipitaciones (inundaciones) y bajas temperaturas / heladas. Estos productos cubren cuatro cultivos: maíz, frijoles, sorgo y cebada, que en promedio representan entre el 85% y el 90% de las plantaciones de secano de los productores de bajos ingresos. Agroasamex, el reasegurador paraestatal especializado en el sector agropecuario, es la única compañía que ofrece productos de seguro paramétrico.

Los Seguros Indexados de Rendimiento de Área para cultivos usualmente operan a nivel municipal y se basan en muestreos de rendimientos en campo para establecer el rendimiento municipal promedio y, si corresponde, el monto de las pérdidas de rendimiento. Estos seguros son productos multi-rriesgo que buscan complementar la demanda insatisfecha por los WII, dada la limitada cobertura de las estaciones meteorológicas, y dados los cultivos y amenazas excluidas, tales como huracán, granizo y terremotos. Estos productos son suscriptos tanto por el sector privado de seguros comerciales como por Agroasamex.

Los Seguros Indexados de Pasturas basados en Sensores Remotos cubren los gastos de alimentación suplementaria del ganado originado en la escasez de tierras para pastoreo debido a eventos hidrometeorológicos. Estos productos utilizan mediciones del vigor de la pastura mediante el Índice de Vegetación Normalizado (NDVI, siglas en inglés) para activar pagos compensatorios. Al igual que con los WII, Agroasamex es la única empresa que ofrece este tipo de coberturas.

Los Seguros Tradicionales de Ganado aseguran el ganado vacuno y caprino contra sequías que provocan tanto la pérdida de pasturas como una pérdida extraordinaria en el peso del ganado asegurado, utilizando índices de sanidad animal regionales.

Fuente: Autores, en base a SAGARPA 2012.
Annex 5. Mexico: CADENA Catastrophe Index Insurance for Small Farmers

**CADENA as a National Safety Net Program for poor farmers**

*Mexico is unique in having a national and state-level catastrophe climatic parametric insurance program (Seguro Catastrófico Agropecuario or SAC)* which is specifically designed to provide social safety net protection for the large numbers of small semi-subistence rural farming households that are below the threshold of insurability by the commercial sector.

*In 2003 Mexico was the first country in the world to recognise the potential of using macro-level catastrophe climatic agricultural index insurance products to finance a national social safety net program for small subsistence farmers and livestock producers for whom commercial crop insurance is not necessarily an appropriate or cost-effective mechanism and to replace traditional ad-hoc post disaster relief schemes by formal parametric crop and livestock insurance solutions at a state level.*

In 1995 the federal and state governments of Mexico introduced an ex-post national natural disaster scheme under the FONDEN program, which was designed to provide financial compensation to small rural farming families who were not eligible for private crop and livestock insurance. Between 1995 and 2003, the federal government and state governments paid out US$212 million and US$74 million, respectively, in direct support payments to small farmers under the FONDEN program. In 2003 as part of the FAPRACC (Fund for the Care of Rural Population Affected by Weather Contingencies), government contracted Agroasemex the national agricultural reinsurer to substitute the ex post disaster compensation programs with an ex ante macro-level index insurance for catastrophic climatic perils (Agroasemex 2007).

*In 2003, Agroasemex designed the World's first macro-level drought index insurance cover for rain-fed cereals grown in Guanajuato state and since then has expanded its range of parametric crop and livestock parametric catastrophe insurance products into nearly all Mexican states.* Since 2004 the private insurance companies have also actively provided traditional non-parametric catastrophe crop and livestock insurance covers to the state governments. In 2008 FAPRACC was replaced by the PACC program which operated for three years before being superseded in 2011 by the CADENA program. Today the CADENA program contains two main components: (i) the Catastrophe Agricultural Insurance (SAC) programs for farmers, livestock producers, aquaculture farmers and fishermen and (ii) in states where SAC is not provided, the continued direct support (Apoyo directo) compensation payments to farmers for climatic disasters.

*Since inception in 2003 the CADENA-SAC program has expanded hugely such that in 2011 approximately 8 million hectares of crops were insured in 27 states with over 2.5 million insured farmers (beneficiaries), representing about 56% of this target group (4.5 million subsistence smallholders farming 16.5 million hectares). In addition, over 4.2 million head of animals were insured throughout the country under the catastrophe livestock program in 2011. Overall the CADENA crop and livestock insurance programs in 2011 covered 2,362 municipalities in 30 out of Mexico’s 32 states with Total Premium Income of more than MXN 1.5 billion and Total Sum Insured (TSI) of 12 billion (see Figure A5.1.) (World Bank 2012; Arias et al 2014).*

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17 Fund for Natural Disasters (*Fondo de Destastres Naturales*)

18 Mexico has 31 states plus 1 District Federal and a total of 2,445 municipalities
Figure A5.1. Evolution of the CADENA Program between 2003 and 2011 (Insured crop area in hectares and number of insured livestock)

World Bank 2013 based on SAGARPA data.

For governments there are several key advantages of using an ex-ante macro-level insurance product to finance natural disaster payments including: (1) for the payment of a pre-agreed premium, the maximum liability can be quantified in advance and transferred out of the fiscal budget to local and international insurance and reinsurance markets, (2) insurance payouts under an index program can be made very rapidly to State Governments (and to farmers where there’s an ex-ante farmer registry), as there is no need for in-field damage assessment on weather index programs and a reduced need for in-field assessment on area-yield-based index programs, and (3) insurance brings transparency and standardisation of payout rules to disaster compensation payments.

The CADENA Program is funded by the Federal and State-level governments and is underwritten by the national reinsurer, Agroasemex and several private sector insurance companies. The CADENA program is administered by the Secretariat of Agriculture, Livestock, Rural Development, Fisheries and Food (SAGARPA). The state-level governments separately purchase macro-level crop and livestock index insurance to finance their catastrophe climatic disaster programs for poor farmers in their states. The costs of the program (including most importantly premium financing) are shared on a ratio of about 90% federal government and 10% state-level governments. A system of competitive annual tendering is used each year to appoint insurers to underwrite the program.

CADENA Insurance Products and Eligibility Criteria

The CADENA offers two types of crop macro-level index insurance programs: (1) Catastrophic Parametric or Weather Index Insurance (WII) policies which typically use ground-based weather stations to insure crops against key perils such as rainfall deficit (drought) or excess rain and other catastrophe climatic perils such as hurricane wind speeds, low temperature/freeze and floods, and (2) Area-based Yield Index Insurance(AYII) policies which usually operate at a municipality or agrarian nucleus or ejido level and involve actual in-field sampling of crop yields to establish the actual average municipality yield and if applicable the amount of yield loss. These latter policies are designed to insure against catastrophe yield loss at the municipality or locality level: for each insured crop, the Insured Yield is set at 30% of the municipality average yield using SAGARPA historical production and yield data – as such the products respond to catastrophe crop losses which exceed 70% of expected production (Table A5.1).
For livestock, CADENA also offers two products, a livestock loss of pasture/grazing policy which is based on satellite imagery - Normalised Difference Vegetative Index (NDVI) - and a traditional livestock cover against loss of forage (Table A5.1).

Table A5.1. CADENA Crop and Livestock Insurance Products and Programs

<table>
<thead>
<tr>
<th>No</th>
<th>Type of Cadena Catastrophe Insurance Program</th>
<th>Basis of Insurance and Indemnity</th>
<th>Insured Perils</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Parametric Crop Weather Index Insurance (Seguro Agrícola de Índices Climáticos - SAIC)</td>
<td>Weather Indexes measured at ground stations</td>
<td>Drought, excess rain, flood, hurricane wind storm</td>
</tr>
<tr>
<td>2</td>
<td>Crop Area Yield Index Insurance (Seguro Agrícola de Índices de Producción - SAIP)</td>
<td>Area-Yields measured by in-field loss assessment</td>
<td>Comprehensive Multiple-peril</td>
</tr>
<tr>
<td>3</td>
<td>Livestock-Pasture NDVI (Seguro Pecuario de Índices de Vegetación - SPIV)</td>
<td>Satellite measured NDVI Index</td>
<td>All perils which reduce pasture growth (mainly drought)</td>
</tr>
<tr>
<td>4</td>
<td>Traditional Livestock (Seguro Pecuario Catastrófico – SPC)</td>
<td>Decreased forage and extraordinary weight loss in animals</td>
<td>Drought</td>
</tr>
</tbody>
</table>

World Bank 2013

Mexico applies strict eligibility criteria to define poor farmers who are eligible for free protection under the CADENA crop and livestock insurance programs. For farmers the criteria are based on farm size limits and for livestock producers on the maximum number of Livestock Units owned. These criteria apply both for CADENA Direct Support Payments and Catastrophe Agricultural Insurance (SAC). The CADENA also carries fixed sums insured/compensation payments which are applied throughout the country: for rainfed annual crops the 2012 payout was a fixed value of MXN 1,300/Ha or about US$ 100/Ha and for tree fruit a higher value of MXN 2,200/ha or about $175/Ha. The insurance value for livestock was MXN 600 per or US$ 45 per Livestock Unit (Table A5.2). These compensation amounts are small, but are designed to tide the small farmer over until the next season.

19 These are SAGARPA’s classifications of the CADENA Crop and livestock insurance programs.
In the event of a triggered payout on the CADENA Macro-Level Crop and livestock insurance programs this payment is made to the State Government as the Insured, or in the case where SAGARPA purchases cover SAGARPA. It is then the responsibility of the State-level governments and SAGARPA to distribute the benefits to the farmers in the affected areas.

There are two systems for disbursing insurance CADENA claims payments. The first method is where the state government purchases aggregate cover for a particular crop in a municipality, but does not pre-register the eligible farmers (beneficiaries): in the event of a loss being triggered the State government receives a lump sum payout and then uses in-field assessment to establish which farmers have incurred losses and to then distribute the payout accordingly to the affected farmers. The main drawback of this two-stage method of distributing payouts is that it is very time consuming to conduct farm-level loss assessment. The second method involves the a priori registration using the PROCAMPO lists of the targeted beneficiaries in each municipality and establishment of the sum insured for each named farmer. In the event of payout being triggered on the policy, each registered beneficiary receives a direct payment in accordance with his/her insured area of the crop (number of insured animals). The second method is more transparent and timely payments can be made to each beneficiary. SAGARPA is actively promoting the registration of CADENA beneficiaries in each State and Municipality and is then conducting seasonal monitoring surveys to ensure farmers are receiving their correct payouts in a timely fashion.

Cadena Premiums and Claims and Costs and Benefits

Since 2003 the Costs of the CADENA Agricultural Insurance Premium subsidies has been MXN 5.01 billion (about US$ 375 million) of which SAGARPA (Federal Government) has subsidised 86% of the costs of premiums and the state governments have subsidised 14% of the premiums. Benefitting
farmers do not make any contributions towards the costs of the CADENA insurance programs (Figure A5.2).

**Figure A5.2. CADENA Cost of Premium Subsidies to State and Federal Governments (MXN 000)**

![Figure A5.2. CADENA Cost of Premium Subsidies to State and Federal Governments (MXN 000)](chart)

Source: World Bank 2013 based on SAGARPA data

**The CADENA program has experienced two major loss years** namely in 2009 which was the second worst drought year in 60 years with a loss ratio of 118% and again in 2011 which was both a very severe drought year and a major freeze year (1 in 50-year return period) when the loss ratio was 129%. Over the 9-year period, total claims payouts have amounted to MXN 4.1 billion. The fact that the program has been able to sustain such severe loss years is due to the actuarial basis of rating and the high premium rates charged by the insurers averaging 11.9% over the 9-years of operations. The long term average loss ratio at end of 2011 was running at 82.1% which represents a break-even position after deduction of operating expenses and underwriting margins. (Table A5.3.)

**Table A5.3. CADENA Consolidated Agricultural Insurance Results 2003-2011 (MXN 000)**

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Sum Insured (MXN 000)</th>
<th>Total Premium (MXN 000)</th>
<th>Average Premium Rate (%)</th>
<th>Total Claims (MXN 000)</th>
<th>Loss Ratio %</th>
<th>Loss Cost %</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>34,445</td>
<td>3,438</td>
<td>10.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
<tr>
<td>2004</td>
<td>229,134</td>
<td>25,896</td>
<td>11.30%</td>
<td>1,001</td>
<td>3.90%</td>
<td>0.40%</td>
</tr>
<tr>
<td>2005</td>
<td>906,866</td>
<td>124,327</td>
<td>13.70%</td>
<td>110,329</td>
<td>88.70%</td>
<td>12.20%</td>
</tr>
<tr>
<td>2006</td>
<td>1,667,406</td>
<td>200,875</td>
<td>12.00%</td>
<td>52,941</td>
<td>26.40%</td>
<td>3.20%</td>
</tr>
<tr>
<td>2007</td>
<td>2,106,128</td>
<td>238,624</td>
<td>11.30%</td>
<td>104,093</td>
<td>43.60%</td>
<td>4.90%</td>
</tr>
<tr>
<td>2008</td>
<td>7,617,721</td>
<td>839,488</td>
<td>11.00%</td>
<td>311,118</td>
<td>37.10%</td>
<td>4.10%</td>
</tr>
<tr>
<td>2009</td>
<td>8,477,013</td>
<td>917,748</td>
<td>10.80%</td>
<td>1,079,160</td>
<td>117.60%</td>
<td>12.70%</td>
</tr>
<tr>
<td>2010</td>
<td>9,025,091</td>
<td>1,136,499</td>
<td>12.60%</td>
<td>488,000</td>
<td>42.90%</td>
<td>5.40%</td>
</tr>
<tr>
<td>2011</td>
<td>12,039,010</td>
<td>1,523,137</td>
<td>12.70%</td>
<td>1,966,190</td>
<td>129.10%</td>
<td>16.30%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>42,102,815</strong></td>
<td><strong>5,010,031</strong></td>
<td><strong>11.90%</strong></td>
<td><strong>4,112,833</strong></td>
<td><strong>82.10%</strong></td>
<td><strong>9.80%</strong></td>
</tr>
</tbody>
</table>

Source: World Bank 2013 based on SAGARPA data

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20 SAGARPA 30 October 2012
Over the same period, the CADENA program has paid out a similar amount or MXN 4.04 billion in direct compensation payments to those resource poor farmers who are not yet included under the CADENA catastrophe index insurance programs. (Table A5.4).

Table A5.4. Cost of Direct Compensation Payments (MXN)

<table>
<thead>
<tr>
<th>Year</th>
<th>Federal Govt (MXN)</th>
<th>Federal Govt (%)</th>
<th>State Govt. (MXN)</th>
<th>State Govt. (%)</th>
<th>TOTAL (MXN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>73,765,783</td>
<td>70%</td>
<td>31,591,733</td>
<td>30%</td>
<td>105,357,516</td>
</tr>
<tr>
<td>2004</td>
<td>195,308,915</td>
<td>70%</td>
<td>83,679,029</td>
<td>30%</td>
<td>278,987,944</td>
</tr>
<tr>
<td>2005</td>
<td>529,104,634</td>
<td>70%</td>
<td>227,002,198</td>
<td>30%</td>
<td>756,106,832</td>
</tr>
<tr>
<td>2006</td>
<td>301,407,030</td>
<td>70%</td>
<td>129,176,036</td>
<td>30%</td>
<td>430,583,066</td>
</tr>
<tr>
<td>2007</td>
<td>242,269,883</td>
<td>70%</td>
<td>103,849,063</td>
<td>30%</td>
<td>346,118,946</td>
</tr>
<tr>
<td>2008</td>
<td>87,531,603</td>
<td>60%</td>
<td>58,017,640</td>
<td>40%</td>
<td>145,549,243</td>
</tr>
<tr>
<td>2009</td>
<td>113,993,830</td>
<td>50%</td>
<td>113,993,830</td>
<td>50%</td>
<td>227,987,660</td>
</tr>
<tr>
<td>2010</td>
<td>80,697,614</td>
<td>50%</td>
<td>80,697,614</td>
<td>50%</td>
<td>161,395,228</td>
</tr>
<tr>
<td>2011</td>
<td>792,113,066</td>
<td>50%</td>
<td>792,113,066</td>
<td>50%</td>
<td>1,584,226,132</td>
</tr>
<tr>
<td>TOTAL 2003-2011</td>
<td>2,416,192,358</td>
<td>60%</td>
<td>1,620,120,209</td>
<td>40%</td>
<td>4,036,312,567</td>
</tr>
<tr>
<td>Annual Av.</td>
<td>268,465,818</td>
<td>180,013,357</td>
<td>448,479,174</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


In a recent study de Janvry et al 2016 have conducted an analysis of the costs and benefits of the CADENA Programme at Municipality level. The authors state:

"We estimate a total benefit of 2.15 M MXN per municipality, which is multiplied by the number of payouts we observe (998) to obtain a total benefit of MXN 2.12 Billion. Given the uncertainty in our estimates, we follow the same procedure using the 5% confidence interval for our ß income and obtain a range of 359.40 M to 3.88 B MXN for the estimated benefits. This compares to a program cost of 2.35 B MXN. We conclude that our estimates for the impact of CADENA are too imprecise definitely to determine whether the program is cost-effective. However, for a significant range of estimates, the benefits exceed the costs. Moreover, this exercise accounts only for a portion of the benefits of the CADENA program since we are not able to causally identify the risk management effect" (p13).

Opportunity Costs of Catastrophe Insurance vs Direct Compensation Payments

A key advantage to Federal and State governments of purchasing CADENA catastrophe insurance is the ability to leverage much higher levels of financial protection against unforeseen climatic contingencies that can be achieved through budgetary allocations alone. Over the past 9 years, government has expended a total of MXN 9.1 billion on a combination of direct support payments to small farmers and insurance premium payments to the insurance sector, in return for total liability (TSI) protection valued at MXN 42.1 billion. In the most recent underwriting year 2011, agricultural crop and livestock insurance premiums amounted to MXN 1.52 billion against a TSI of MXN 12.0 billion and insurance payouts of MXN 1.97 billion. Government expended a further MXN 1.58 in direct support payments or a total financial outlay for government of MXN 3.5 billion. Had 2011 been an even more severe loss year, the CADENA insurance programs would have afforded government protection up to MXN 12 billion. (Figure A5.3).
Another way of analyzing the cost-effectiveness of the CADENA Agricultural Insurance Programs is to assume that no insurance program was in place and to calculate the benefits in terms of direct support payments that could have been made using the saved premium costs. This analysis has been conducted for the crop insurance programs. The results of the analysis are presented in Figure A5.4. The blue line shows the actual insured area rising to 8.03 million Ha in 2011 for a premium cost of MEX 1.33 billion. The red line shows that had no insurance been in place, the MEX 1.33 billion in saved premiums could have been used in 2011 to fund direct compensation payments in 1.17 million Ha or only 15% of the actual insured area. Over the full period 2003 to 2011, the saved insurance premiums could only have compensated an average of 14% of the actual insured area.

Source: World Bank 2013

CADENA Welfare Impacts

There have been several studies to measure the impacts of the CADENA programme on vulnerable farmers. Agricultural insurance has a direct effect of making payouts in the event of crop failure or death of livestock, which can help smooth consumption or ensure sufficient resources for production in subsequent seasons. The risk reduction that this entails can have indirect effects on economic outcomes by altering farmers' investment decisions. Fuchs and Wolff (2010) found that the CADENA
increased small farmers maize yields and rural per capita expenditure and income. Richie (2015) found that CADENA did increase the sown area of maize in the year after a payout, but did not lead to significant increases in agricultural income.

A recent welfare study found that moderate income poverty was reduced by 1.78 percentage points (pp) due to CADENA weather index insurance (WII), but in contrast, income inequality (Gini coefficient) increased marginally and WII had no effect on reducing extreme poverty. The study could not conclude whether extreme poverty remains unaffected because many of the extreme poor are not eligible under CADENA rules of operation; or whether this result came from ineffective targeting. It also is plausible that CADENA WII exacerbates income inequality (Arias et al 2014).

In a separate study, de Janvry el al 2016 have analysed the effects of the CADENA insurance payouts on ex-post investment decisions and coping mechanisms. They conclude that their analysis provides suggestive evidence that index insurance has the possibility of improving welfare for rural households by providing resources to invest in the subsequent planting season, which in turn results in more land sowed. The payments may also prevent households from resorting to costly coping mechanisms, such as reducing consumption, as evidenced by the result for household expenditures. Lastly, there appears to be some interaction between formal insurance payments and remittances that reduces the burden of private transfers for relief assumed by migrants. While the cost of insurance appears to be high relative to the payouts, the benefits exceed the costs for a substantial range of outcomes.

The above finding that CADENA enables resource poor farmers to return to production are confirmed by the Autonomous University of Chapingo 2009 study which showed that nearly 100% of surveyed beneficiaries had continued to remain in agricultural production following the catastrophe event due to the CADENA payouts they had received. Overall 75% of beneficiaries reinvested their payouts in their crop or livestock activities. An additional 22 percent used the payouts to settle debts (cited by Arias et al 2014)

Fuchs and Wolff (2011) reporting on the Mexican experience, highlight the potential unintended consequences of the large scale weather index insurance (WII) programs under CADENA. WII creates disincentives to invest in other non-insured crops leading to potential overspecialization and monoculture. WII further generates disincentives to invest in irrigation systems because farmers are insured only as long as production takes place on non-irrigated land. Finally, in case of catastrophic events food prices can inflate with indemnity payments at the expense of the uninsured poor.

Key Operational Issues and challenges for CADENA

The Autonomous University of Chapingo 2009 study identifies some key operational issues and challenges for the CADENA Program.

From an operational and implementation viewpoint one of the main areas requiring improvement on CADENA is in the timeliness of payouts reaching the targeted beneficiaries: CADENA first makes payouts to the state governments whom are then responsible for distributing the payouts to affected farmers and this process requires speeding up. the average time taken post-event for beneficiaries to receive their CADENA payouts was 89 days. Overall, 62.1 percent of surveyed farmers received their payouts between 3 and 6 months after the event. However, a significant 37.9 percent of payouts were between 6 and 9 months after the event. Delays of greater than 6 months to affect payouts from a parametric weather insurance program are excessive. It is very important that government should seek ways to reduce the time for the payouts to reach the beneficiaries to no more than 90 days for all CADENA Programs in all States.

The study showed that while farmers benefiting from CADENA payouts fell strictly within the farmer size eligibility criteria, about a third of all livestock beneficiaries owned more livestock than the maximum permitted limit. To benefit from CADENA, in 2009 the eligibility criteria for farmers were: up to 20 ha of rainfed annual crops and up to 5 ha of perennial tree crops; and for livestock owners,
up to 30 livestock units. The survey results showed that, for crops, 100 percent of the beneficiaries from the direct aid payouts and SAC insurance payouts complied with these criteria. However, for livestock, only 65 percent of the surveyed beneficiaries complied with the eligibility criteria. In other words, more than one-third of the benefitting livestock producers owned more animals than the maximum permitted to be eligible for CADENA assistance.

**Surveyed beneficiaries noted that the value of the CADENA payouts were inadequate to cover the costs of their investments in their agricultural enterprises.** Overall, 60 percent of respondents (and as high as 72.2 percent of crop producers) noted that the payouts covered less than 25 percent of the amounts that they had invested up to the time of loss (an improvement on the 70.2 percent of respondents in 2008). Overall, only 14.2 percent replied that the payouts exceeded 50 percent of their investment. Beneficiaries clearly identified a need for higher compensation payout levels. SAGARPA is trying to address this issue by increasing the payout levels over time.
Annex 6. Options for the Design of Catastrophe Agricultural Insurance in Colombia

Drawing on international experience, the feasibility study considered three possible parametric or index options for the design of the underlying Catastrophe Agricultural Insurance Product (or policy) namely:

1) **Weather Index Insurance (WII) Cover using ground-based meteorological weather stations (Seguro de Índice Climático basado en Estaciones Meteorológicas).**

Data that is normally collected by weather stations includes daily rainfall, minimum and maximum temperatures, relative humidity and sometimes windspeed, evapotranspiration and sunshine hours. WII covers typically provide insurance against too much or too little rainfall as proxies for excess rain and drought and excess temperature and low temperature (as a measure for frost damage in crops). Typically a minimum of 20 to 25 years uninterrupted daily data is required to construct a weather index. One weather station is typically considered to be representative of the weather conditions (e.g. rainfall recorded) in a radius of 10km to 15km of the station, but this is highly influenced by topography: therefore, a high density of weather stations is required to operate such a WII cover using ground-based weather stations.

The feasibility study concluded that the density of ground based weather stations in Colombia is currently too low to be able to support a national catastrophe Agricultural Insurance program for small farmers. The consultants conducted a detailed analysis for all weather stations under the jurisdiction of the national meteorological agency the Institute of Hydrology, Meteorology and Environmental Studies (Instituto de Hidrología, Meteorología y Estudios Ambientales- IDEAM), but concluded that the density of weather stations with the required time series daily rainfall data, minimum and maximum daily temperatures was inadequate to support such a WII Program. (World Bank 2017a).

2) **Area Yield Index Insurance (AYII) (Seguro de Rendimiento de área).**

An alternative approach is to design and Area-Yield Index Insurance or AYII Policy. The key feature of an AYII product is that it does not indemnify crop yield losses at the individual farmer or field level. Rather, an AYII product makes indemnity payments to farmers according to yield loss or shortfall against an average area yield (the index) in a defined geographical area (e.g. a municipality), as opposed to settling losses on individual farmers' fields. This means that individual farmers cannot influence the yield outcome, for example by purchasing cover only for fields in low lying areas which are subject to flooding and water logging (anti-selection) or by applying sub-optimal levels of husbandry and pest and disease and weed control (moral hazard) in the expectation of then claiming the yield loss on their crop insurance policy.

An illustrative example of a conventional AYII policy is illustrated in Figure 9 for maize in a municipality X. In this case the historical average yield of maize is 2,500 Kg/Acre and insurers agree to provide an insured yield coverage level of 80% of average or 2,500 Kg/Acre. All farmers located in Municipality X are provided with the 2,500 Kg/Acre yield shortfall guarantee. Two actual harvest yield scenarios are presented in the figure - (1) a year with good weather conditions where actual average yield in municipality X is 2,800 Kg/Acre or well above both the insured yield and the average yield and no payout is due and (2) a poor crop year when the average yield of maize is only 1,000 Kg/Acre and therefore all farmers are compensated at a fixed rate of shortfall of 1,000 Kg/Acre times their actual acreage.
Figure A6.1. Illustrative Example of an AYII Contract for Maize grown in Village X

Source: Authors

To operate an AYII cover it is necessary to have (a) historical crop-area production and yield data for a minimum of 15 years or more and (b) an accurate, and timely methodology for estimating actual average area yield at the time of harvest for each insured crop. The costs of operating AYII are much lower than for a MPCI Policy, especially because individual farmer pre-inspections and in-field crop loss assessment are not required, and this offers the potential to market this product at lower premium costs to small and medium sized farmers.

A detailed analysis was conducted of MADR historical crop yield data for major cereal and other crops at municipality level but concluded that the maximum of 9-years’ time-series was inadequate to construct such an area yield index. The MADR 9-year municipality-level crop area (sown area, harvested area) production and average yield data was analysed both on a sown area and harvested area yield basis, but in many cases the level of year to year yield variability was deemed implausibly low for rain-fed crops. Furthermore, the yield series was considered too short to adequately reflect past major yield loss years such as the 1997/8 Nino/Nina. For this reason, a conventional AYII cover could not be recommended for Colombia.

3) Modelled Damage Insurance (Seguro de Pérdidas Modeladas).

Parametric agricultural insurance is increasingly using synthetic or modelled satellite weather data (rainfall, temperature, evapotranspiration) and combining this with modelled crop yield data to construct indexes. The major advantage of satellite weather data is that free historical data can be accessed for 20 to 30 years or more and then updated on a real time basis: such data is also available at very high levels of resolution and this data can be combined with ground-weather station data. Similarly, in the case of crop yield modelling, there are now several well tried and tested models that are internationally used in crop insurance index design.

For the purposes of the Catastrophe Agricultural Insurance (SAC) product in Colombia the consultants recommend the design of a modified Area-Yield Index (AYII) cover using modelled crop yields. The yield model used was Simulation Model of the Ecological Potential of Crops (Modelo de Simulación del Potencial Ecológico de los Cultivos -MSPEC) which uses key variables of rainfall, minimum and maximum temperature to simulate crop yields for defined satellite grid areas, in this case at a resolution of 8 km x 8 km grids. MSPEC was used to generate synthetic yields in the selected departments and for the selected crops for up to 37 historical years. Full details of the area yield simulation methodology are presented in World Bank 2017a.
The contract design for the Catastrophe Agricultural Insurance (SAC) product for Colombia which is based on simulated area yields is illustrated below for a theoretic maize crop in one 6 km x 6 km pixel (defined as the Unit Area of Insurance or UAI) in a selected Department. (Figure A6.2). The modelled average yield is 2,000 Kg/Hectare. As this is a catastrophe product for small family farmers, it is proposed that payouts would be triggered when the actual average yield of insured maize in the selected UAI falls short of 50% (1,000 Kg/Ha) of the modelled average yield /Ha or even as low as 30% (600 Kg/Ha). The actual average yield will be measured in the UAI at the time of harvest using an area-yield sampling methodology developed for the CADENA program in Mexico and detailed in the Technical Report (World Banks 2017a).

The difference to a conventional AYII program is that if actual yield falls below the insured yield threshold (for example the Insured Yield is 1,000 Kg/Ha, 50% and actual yield is 950Kg/Ha or below the payout trigger) this automatically triggers a 100% compensation payout, or in insurance terms this is treated as a Constructive Total Loss (CTL). All protected farmers in the UAI would therefore receive the same payout for a 50% of yield CTL payout per hectare.

Figure A6.2. Proposed Modelled Area Yield SAC Policy for Small Farmers in Colombia

<table>
<thead>
<tr>
<th>Modelled maize Yield (2000 Kg/Ha)</th>
<th>Catastrophe Yield Shortfall Cover 50% of Average</th>
<th>Catastrophe Yield Shortfall Cover 30% of Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000 Kg/Ha</td>
<td>2000 Kg/Ha</td>
<td>100% 2000 Kg/Ha</td>
</tr>
<tr>
<td>1000 Kg/Ha</td>
<td>Payout</td>
<td>50%</td>
</tr>
<tr>
<td>600 Kg/Ha</td>
<td>Payout</td>
<td>30%</td>
</tr>
</tbody>
</table>

Source: Authors

A further feature of the Proposed Policy is that in the case of idiosyncratic or localised losses due to hail, frost or other perils, individual farmers incurring losses would receive an adjustment on their own plots and a payout based on the actual amount of damage to their own crop. This is a feature of the CADENA AYII Programs in Mexico and is designed to reduce the problem of basis risk namely situations where the actual area yield average is not triggered, but individual farmers have incurred severe localised losses on their own plots. This feature of the proposed cover has important operational and logistical implications not least in the costs of establishing field teams of crop loss adjusters to measure damage on individual farmer’s fields.

The international experience shows that Pools have been adopted in 14% of the countries surveyed under the 2008 World Bank study (Mahul & Stutley 2010). Some of the features of these Pool schemes are shown in Box A7.1. Since this study, Ghana established an agricultural insurance coinsurance pool program in 2011 which is supported by 19 non-life insurance company and is now in its third year of operations and in 2015 Kenya has launched large scale coinsurance pools for crop and livestock insurance.

In several countries, governments have actively promoted the formation of agricultural co-insurance pools with largest being the Agroseguro, a pool program formed in 1980 in Spain. Since 2000, coinsurance pools have also been formed in Chile21, Turkey and China. Under several of the new crop weather index insurance (WII) initiatives, coinsurance pools have been formed in countries like Malawi and Thailand and in the case of livestock, the Mongolia livestock mortality index program. The potential benefits of adopting a pool structure for agricultural insurance in Kenya are reviewed below.

In Africa, the best-known example of a pool scheme is the Malawi Pool. In 2005, nine Malawi-registered non-life insurance companies formed a coinsurance pool under the umbrella of the Insurance Association of Malawi to underwrite a new crop WBII program (Mahul & Stutley 2010). Subsequent to the completion of this study, both Senegal and Ghana and Kenya have established PPP's for agricultural insurance based on Pool programs.

Box A7.1. Major Pool Schemes for Agricultural Insurance

<table>
<thead>
<tr>
<th>Country</th>
<th>Years</th>
<th>Scheme Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>Since 2005</td>
<td>Mendoza Province Fruits &amp; Vineyard Hail Crop Insurance Scheme is led by Sancor and La Segunda, under a pool coinsurance arrangement with several other local private commercial insurance companies. Crop insurance market in Argentina is active and competitive.</td>
</tr>
<tr>
<td>Austria</td>
<td>1947</td>
<td>Austrian Hail Insurance Company, a mutual insurer with 17 founding companies, is the sole provider of crop hail insurance.</td>
</tr>
<tr>
<td>China</td>
<td>Since 2006</td>
<td>Two agricultural insurance coinsurance pool schemes are led by the People’s Insurance Company of China (PICC), one in Zhejiang Province (crops, livestock, forestry, and aquaculture), the other in Hainan Province (crops, forestry, and livestock). PICC acts as the scheme administrator and loss adjuster on behalf of coinsurers.</td>
</tr>
<tr>
<td>Malawi</td>
<td>Since 2006</td>
<td>Weather-based crop insurance underwritten by a pool of domestic insurance companies, coordinated by the association of insurers, is being piloted.</td>
</tr>
<tr>
<td>Mongolia</td>
<td>Since 2006</td>
<td>Four private insurers offer livestock index mortality insurance through the Livestock Indemnity Pool, a public-private coinsurance pool.</td>
</tr>
<tr>
<td>Philippines</td>
<td>Since 1978</td>
<td>A public-private coinsurance pool for livestock insurance is underwritten by the Government Service Insurance System (GSIS) and the Philippine Livestock Management Services Corporation (PLMSC), which has 14 participating coinsurers. There is one other crop and livestock insurer in the Philippines (PICC).</td>
</tr>
<tr>
<td>Spain</td>
<td>Since 1980</td>
<td>Agroseguro, the largest public-private agricultural coinsurance pool in the world, is a specialist agricultural managing underwriting company formed by coinsurers to implement the Spanish national agricultural insurance scheme on their behalf. In 2008, Agroseguro is comprised of 28 private insurance company shareholders, six mutual insurer members and the national reinsurer, Consorcio de Compensacion de Seguros. The largest shareholder and coinsurer is Mapfre Insurance Company, with a 30 percent share in the pool.</td>
</tr>
</tbody>
</table>

21 The Chilean Crop Insurance Pool has now been disbanded and the 2 main insurers operate independently.
are no other agricultural insurance schemes in Spain, although some voluntary forestry and aquaculture insurance is written outside the national pool scheme.

Turkey (since 2006): Tarsim Agricultural Insurance Pool is a specialist insurance company formed by 16 private commercial companies, each with a 6.25 percent share in the company. Tarsim underwrites crop and livestock on behalf of coinsurers. No other companies offer agricultural insurance in Turkey.

Ukraine (since 2000): Two crop coinsurance pool schemes are in operation. A large number of competing companies offer crop and livestock insurance.

Source: Mahul & Stutley 2010

Rationale for Forming Agricultural Insurance Pools

For an insurance company wishing to develop an agricultural crop or livestock insurance capability, the start-up costs are often prohibitively high including: (i) recruitment of specialist underwriters and claims adjusters, (ii) the costs of data access and in conducting risk mapping and risk modelling (iii) in the design and rating of products (iv) in creating operating systems and procedures including for indemnity-based products, field-based inspection and loss assessment systems and procedures (v) recruitment and training of field staff in these procedures. Conversely, where insurance companies elect to form a Pool, economies of scale can be gained in sharing these start-up costs and the normal administration and operating (A&O) costs. There are also major potential cost savings for a Pool in purchasing reinsurance protection on a pooled portfolio because of the much higher spread of risk and diversification of the portfolio than if each reinsures their own separate and smaller portfolios. Pools also offer the potential to maintain common underwriting standards and to avoid situations of rate cutting in soft markets.

Where governments are actively trying to promote and implement a national agricultural insurance policy through the private insurance sector under a PPP agreement, there are major potential advantages for both parties of dealing with a single Pool organization rather than a large number of individual insurance companies. It is obviously much easier for a government to establish a 3 - 5-year strategy and plan for agricultural insurance where it is negotiating with a single entity. Equally, it is easier for government to prioritize and allocate funds to data enhancement and product research and development where it is dealing with a single entity which has agreed with these R&D priorities rather than a series of companies, some of which, may not agree on the R&D priorities. Furthermore, it is much easier to agree on education and training programs and to distribute and administer premium subsidies through a single Pool company rather than several or possibly many individual companies.

The main drawback of Pools is that they are often monopoly insurers and there is therefore reduced or no competition on pricing. Box A7.2. has more information on the advantages and drawbacks of Pools.

Box A7.2. Benefits and Limitations of Coinsurance Pool Arrangements

<table>
<thead>
<tr>
<th>BENEFITS</th>
</tr>
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<tbody>
<tr>
<td>Economies of scale through operating as a single entity with shared (pooled) administration and operating functions leading to costs savings due to:</td>
</tr>
<tr>
<td>* Reduced staffing requirements (fixed costs);</td>
</tr>
<tr>
<td>* Shared costs of product research and development, actuarial and rating;</td>
</tr>
</tbody>
</table>

22To a certain extent these start-up and A&O costs can be reduced under an index insurance program where there is no need for pre-inspections or in-field loss assessment. However, often companies have to invest in upgrading weather station recoding instrumentation and equipment and this represents a very significant start-up cost.
* Reduced costs of underwriting and claims control and loss adjustment.

Cost advantages in purchasing common account (pooled) reinsurance protection rather than each company trying to place its own reinsurance program. Advantages due to:
* Stronger negotiating position with reinsurers;
* Larger and more balanced portfolio and better spread of risk;
* Reduced costs of reinsurance due to pooled risk exposure;
* Reduced transaction costs (reinsurance brokerage, etc).

No competition on rates in a soft market and ability to maintain technically set rates. Most pools operate as the sole insurance provider or monopoly (e.g. Austria, Senegal, Spain, Turkey), and there is therefore no competition on pricing.

Ability to maintain underwriting and loss adjustment standards. Under a pool monopoly arrangement, the pool manager can ensure that common and high standards are maintained in the underwriting of crop and livestock insurance and in the adjusting of claims. Where companies are competing against each other for standard crop insurance business, there is often a problem of varying loss adjustment standards between companies.

Advantages of coordinating Government Support to a Pool under a Public Private Partnership: It is much easier for governments under PPP arrangements to coordinate national agricultural insurance policy and planning and specific support functions (e.g. provision of premium subsidies, research and development, education and training) to a single insurance entity (Pool) than it is to try dealing with individual insurance companies, each which may have very different priorities for agricultural insurance.

LIMITATIONS

A Pool may act as the sole agricultural insurer, resulting in lack of competition in the market in terms of the:
* Range of products and services offered by the monopoly pool underwriter;
* Restrictions on the range of perils which are insured;
* Restrictions on the regions where agricultural insurance is offered and/or the type of farmer insured;
* Lack of competitiveness in premium rates charged by the pool.

Source: Mahul & Stutley 2010

In the sections below, examples of successful agricultural insurance pools from Spain and Turkey are reviewed along with recent experience with Pools in Africa which include Malawi, Senegal and Ghana. It is important to note that not all agricultural insurance Pools programs have been a success both in Kenya and internationally, and at the end of the section, some of these failed programs are also briefly reviewed.

Case Study 1: Agroseguro Pool, Spain

Prior to 1980, there was very limited agricultural insurance provision in Spain.

In 1980, the Government enacted legislation to create a national agricultural insurance program, termed the Combined Agricultural Insurance (Seguros Agrarios Combinados) program, a public private partnership underwritten by AGROSEGURO- a Private Coinsurance Pool with a mandate to provide subsidized agricultural insurance to all of Spain’s regions and farmers on a voluntary basis.

Today, AGROSEGURO is Europe’s largest and most comprehensive national agricultural insurance program underwriting over 200 different crop, livestock, aquaculture and forestry programs and generating total commercial premiums of Euro 676 million in 2012.

The Key forms of Government Support to Agricultural Insurance in Spain are:
• Insurance Legislation.
• Subsidies on Agriculture Insurance Premiums paid by Farmers/Herders.
• Co-insurance and Reinsurance through the National Catastrophe Reinsurance Company or Consorcio de Compensación de Seguro (CCS).
• Assistance to data collection and insurance product research and development

The Key Parties Involved in the implementation of the Spanish Agricultural Insurance PPP are shown in Figure A7.1 and include:

• **National Administrator:** ENESA (The National Agricultural Insurance Agency or La Entidad Estatal de Seguros Agrarios) coordinates the system and manages resources for subsidizing insurance premiums.

• **Ministry of Agriculture Food and Environment.** Responsible for data coordination and information collection for new product research and development in conjunction with Agroseguro's insurance specialists.

• **Pool Co-insurers Companies:** There are currently 28 co-insurers in the Agroseguro pool, which include both private and mutual insurance companies such as, - Mapfre Insurance and Reinsurance Company (Spain’s largest insurance company), and the Spanish public sector catastrophe reinsurer, Consorcio de Compensación de Seguros. The largest shareholder in the pool is Mapfre, with a 212% shareholding of 20%; the smallest co-insurer has less than a 1 percent share in the pool. Size of shareholding is therefore not a barrier to participation. Each company’s share of annual agricultural insurance premiums and liability is determined according to its percentage share in the pool during the underwriting year. Participation in the pool is completely voluntary and insurance companies are permitted to join and leave the pool after completion of an underwriting campaign (year). In order to maintain continuity, companies agree to join the pool for a three-year period.

• **Managing Underwriter:** AGROSEGURO, which is owned by the 28 shareholders / co-insurers, has been appointed by the co-insurers to underwrite, adjust, and settle claims on their collective behalves. Agroseguro started with a very small team of agricultural underwriters, claims managers, loss assessors, and office support staff; today it has grown into Europe’s largest agricultural insurance management company, underwriting more than 260,000 agricultural insurance policies and a further 30,000 livestock, forestry, and aquaculture policies generating total commercial premiums of EURO 676 million in 2012. Agroseguro has a full-time complement of about 75 permanent staff based in its headquarters in Madrid and an equal number based in each of the 14 autonomous regions. It has a general management unit, a legal department, and regional branches as well as core operational departments responsible for (a) product research and development, (b) production and communication (underwriting), (c) claims administration and loss assessment, (d) administration and accounting, and (e) organization and information technology systems. As such, it functions as a very professional commercial managing company on behalf of its co-insurers. Agroseguro’s internal A&O costs are financed out of earned premiums on the agricultural insurance business it writes on behalf of the pool. Over the past five years, its internal A&O expenses have amounted to 3.5 percent of total earned premiums (Agroseguro 2012).

• **Consorcio de Compensación de Seguro (CCS).** The national (state) catastrophe reinsurer providing reinsurance to Agroseguro pool co-insurers.
- **International Commercial Reinsurers**: Providers of (i) stop loss reinsurance to pool reinsurers on their viable line retentions and (ii) multi-year catastrophe stop loss to CCS.

**Figure A7.1. AGROSEGURO Spain: Institutional Framework**

Source: OECD 2011

ENESA in conjunction with the Ministry of Agriculture, Food and Environment (MAFE) is responsible for drawing up a three-year rolling agricultural insurance plan in consultation with the state governments, producer organizations and AGROSEGURO. ENESA is also responsible for drafting the annual implementation plan setting out the premium subsidy levels that will apply to each product line and program in the current year and the agreed budget from government for premium subsidies. For 2013, the approved state budget for agricultural insurance premium subsidies was € 205 million (MAFE 2013).

Under the Spanish model, premium subsidies are used as a policy instrument to promote the widest possible voluntary uptake and adoption of agricultural insurance by farmers and to replace ad hoc ex-post natural disaster relief compensation payments by a comprehensive national agricultural insurance program. To reinforce the point, Spanish farmers are not eligible for disaster payments for perils for which insurance is offered. For non-covered perils, *ad hoc* disaster payments are available, but only if the producer has already purchased agricultural insurance for covered perils.

The costs to government of premium subsidies are high as shown in Figure A7.2. Over the past 33 years (1980 to 2012), the total cost of premium subsidy support by federal and autonomous state governments amounted to € 5.98 billion or 56% of the total costs of premiums while farmers paid the remaining 44% of total premium earnings. In 2012, the total premium income amounted to € 728.3 million and state financed premiums were € 393 million (54% of total).
Government is responsible for fixing premium subsidy levels. A system of differential premium subsidies applies which provides different levels of premium subsidy for each category of crops and livestock and the type of insurance product (named peril etc.) and additional subsidies are provided for collectively purchased policies through associations, for target groups of farmers including young farmers, and for the contracting of multi-crop policies or multi-year covers.

In 2012 AGROSEGURO underwrote almost 485,000 crop and livestock policies with total premium volume of € 728 million. The year 2012 was a very severe year for frosts, drought and hail and total claims amounted to € 800 million equivalent to a loss ratio of 118.5% (Agroseguro 2013).

AGROSEGURO currently underwrites about 200 viable and experimental crops, livestock, and marine aquaculture lines, and forestry insurance covering a wide range of crop types including cereals, oilseeds, horticultural crops, leaf and fibres, tree fruits and vines, and livestock types. The company offers comprehensive range of single-peril hail, named-peril and multi-peril crop insurance policies. The company only underwrites two index insurance covers: one for bees and the other a livestock NDVI pasture-drought index policy. In 2012, the company retained a national network of 397 crop loss adjusters and 123 livestock veterinary inspectors.

AGROSEGURO has traditionally purchased stop loss reinsurance protection from the national catastrophe reinsurer, CCS. There are different reinsurance agreements in place for the different insurance lines of A, B and C according to the perils insured and their degree of catastrophe loss potential. The reinsurance protection provided by CCS has been a major factor in the financial viability of the Agroseguro Pool program over the past 33 years. Traditionally, CCS has purchased multi-year Stop Loss Retrocession protection on its liability. The individual pool coinsurers have also been permitted to purchase additional stop loss reinsurance protection on their retentions from international reinsurers.

**Case Study 2: Tarsim Pool, Turkey**

The Turkish Agricultural Insurance Pool, Tarsim, was established by Law No 5365 in 2005. The law covers the establishment of the Pool, the risks to be insured by the Pool, the Pool’s income and
expenses, government support in the form of premium subsidies and excess of loss reinsurance support, insurance contracts, the contracting of reinsurance and the principle duties of the pool operating company and the co-insuring members. Additional legislation which governs Tarsim’s operations is set out on the Regulation of the Application of the Agricultural Insurance (No 26172, 18 May 2006) and the Agricultural Insurance Pool Operating Procedures and the Principles of the Agricultural Insurance Regulations (No 26172, 18 May 2006).

Prior to the formation of the Tarsim Pool in Turkey in 2005 only 0.5% of agricultural areas in Turkey were insured (Bora 2010). A number of private insurance companies provided limited crop and greenhouse insurance mainly against hail and livestock insurance was poorly developed. The agricultural insurance market was fragmented, the system operated with limited data on which to design and rate products and programs, there was inadequate actuarial expertise, a lack of transparency and under-funded research, coordination and monitoring. At the time, government did not support agricultural insurance but rather provided limited ex-post ad hoc disaster relief to crop and livestock producers after a catastrophic loss event. The Tarsim PPP initiative was promoted to overcome these constraints and to create a modern national agricultural insurance capability (Bora 2010). Turkey elected to model its new system closely on the Spanish Pool structure with centralized underwriting claims handling and reinsurance purchasing because of the potential benefits of such a system (See Box A7.3 for further details).

**Box A7.3. Aims of the TARSIM Pool**

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<thead>
<tr>
<th>Aims of the TARSIM Pool</th>
</tr>
</thead>
<tbody>
<tr>
<td>To contribute to the development and generalization of agricultural insurance.</td>
</tr>
<tr>
<td>To provide standard insurance contracts covering the risks falling within the scope of the Act.</td>
</tr>
<tr>
<td>To centralize and standardize loss adjustment activities.</td>
</tr>
<tr>
<td>To have claims processed quickly and paid fairly by a central entity.</td>
</tr>
<tr>
<td>To lay down procedures and principles for the operation of agricultural insurance.</td>
</tr>
<tr>
<td>To provide insurance coverage for catastrophe risks like drought, frost, etc. that could overwhelm an individual insurance company.</td>
</tr>
<tr>
<td>To expand reinsurance capacity and coverage by introducing incentives for participation in reinsurance.</td>
</tr>
<tr>
<td>To make effective, joint use of insurance companies’ information, human and financial resources.</td>
</tr>
<tr>
<td>To make effective use of Government subsidies and the Government’s Catastrophe Stop Loss protection.</td>
</tr>
<tr>
<td>To prevent unfair price competition.</td>
</tr>
<tr>
<td>To encourage participation in insurance.</td>
</tr>
</tbody>
</table>

Source: Bora 2010

Tarsim’s Operating Company is a joint stock company owned by the 24 insurance companies that participated in the Agricultural Insurance Pool in 2012, each with an equal share (approximately 5%). As in Spain, the role of each Pool insurance company is two-fold; to market Tarsim’s standard policies at approved rates to Turkish crop, greenhouse, livestock, poultry and aquaculture producers and to provide insurance capacity to the Pool. The Pool Operating Company is responsible for all underwriting and claims management and IT systems and procedures. Tarsim reports to a Management Board comprised of two representatives from the Ministry of Agriculture; two representatives from the Under Secretariat of the Treasury and one member from each of the
Insurance and Reinsurance Companies of Turkey, the Union of Chambers of Agriculture and from Tarsim (the Operating Company). (Figure A7.3).

Figure A7.3. Turkey Institutional Framework of the Tarsim Agricultural Insurance Pool

Source: Tarsim Annual Report 2012

Under the public-private partnership for agricultural insurance, the Turkish government provides Tarsim with 50% premium subsidies on all classes of agricultural insurance save for crop policies which also include cover against frost in which case, the subsidy level is higher at 66%. (Tarsim 2013). In addition, the government provides catastrophe excess of loss (stop loss) protection to Tarsim. Other benefits include subsidies on Tarsim’s administration and operating expenses and loss adjustment costs and agricultural insurance premiums which are exempt from sales tax (Mahul & Stutley 2012). Tarsim is responsible for deciding its risk retention and reinsurance strategy. The law permits Tarsim to retrocede business back to the Pool insurers and/or to reinsure through the local reinsurer MilliRe and international reinsurers (Figure A7.4).

Figure A7.5. Tarsim Agricultural Insurance Pool: Risk Transfer Mechanisms

Source: SwissRe: Sigma No1/2013
Since the formation of Tarsim the company has standardized all agricultural insurance policies and tariffs and increased their range of product lines as well as making a major investment in a web-based centralized national insurance application, underwriting and claims administration system. In addition, the Pool Operator has established a national crop and livestock farm inspection and loss assessment capability which can draw on 536 qualified and registered crop inspectors and 568 livestock inspectors (Altinozluu 2010).

Since the formation of Tarsim there has been a major expansion in the demand by farmers for agricultural insurance in Turkey. This demand has also been stimulated under the close public-private partnership by the provision by government of a minimum 50% premium subsidy on the costs of all agricultural insurance policies. In the five years that Tarsim has been operational, the number of policy sales has increased from 218,938 to 744,093 (an increase of 240%) and premium income has increased from TL 47 million to TL 273 million (a 482% increase) (Figure A7.5). Over this period Turkey has grown to be the third largest agricultural insurance market in Europe by premium volume.

**Figure A7.5. Tarsim: Growth in Number of Policy Sales, Total Sum Insured and Premium Income 2007 to 2012**

![chart](chart.png)

Source: TARSIM 2012 Annual Report
### Annex 8: Countries with premium subsidies for crop insurance

<table>
<thead>
<tr>
<th>Countries that provide no premium subsidy</th>
<th>Countries that provide premium subsidy</th>
<th>Type of premium subsidy</th>
<th>Fixed subsidy (percent)</th>
<th>Variable subsidy (percent)</th>
<th>Special subsidy for small and marginal farmers</th>
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<tbody>
<tr>
<td><strong>High-Income Countries</strong></td>
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<td>Germany</td>
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<td>Cyprus</td>
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<td></td>
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<td>Japan</td>
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<td><strong>Upper middle-income countries</strong></td>
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<td>Costa Rica</td>
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<td>Panama</td>
<td>Kazakhstan</td>
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<tr>
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<td>Countries that provide no premium subsidy</td>
<td>Countries that provide premium subsidy</td>
<td>Type of premium subsidy</td>
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<td>Variable subsidy (percent)</td>
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<td>India</td>
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</table>

**Low-income countries**

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<thead>
<tr>
<th>Ethiopia</th>
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</table>

Source: Mahul and Stutley, 2010, p. 188f