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BAHIA STATE, BRAZIL

AGRICULTURAL SECTOR RISK ASSESSMENT

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BAHIA STATE AGRICULTURE SECTOR RISK ANALYSIS

Volume 1: Risk Assessment
Volume 2: Risk Management Strategy

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ABBREVIATIONS AND ACCRONYMS

2-ME	2-mercaptoethanol Test	-
ABPA	Brazilian Association of Animal Protein	*Associação Brasileira de Proteína Animal*
ABCS	Brazilian Association of Producers of Swine Breeders	*Associação Brasileira de Criadores de Suínos*
ABIEC	Brazilian Association of Meat Exporting Industries	*Associação Brasileira das Indústrias Exportadoras de Carne*
ABRAPA	Brazilian Association of Cotton Growers	*Associação Brasileira dos Produtores de Algodão*
ACIS	Agroclimatic Information System	-
ADAB	Agency for Agricultural Defense of Bahia	*Agência Estadual de Defesa Agropecuária da Bahia*
ADAB	Bahia Agency for Agricultural and Livestock Defense	*Agência Estadual de Defesa Agropecuária da Bahia*
ADAB	Agency for Agricultural/Livestock Defense	*Agência de Defesa Agropecuária da Bahia*
AGF	Federal Government Acquisitions	*Aquisições do Governo Federal*
AGRITEMPO	Agrometeorological Monitoring System	*Sistema de Monitoramento Agrometeorológico*
AIBA	Association of Growers and Irrigators of Bahia	*Associação dos Agricultores e Irrigantes da Bahia*
AIS	Agricultural Innovation System	-
ANA	National Water Agency	*Agência Nacional de Águas*
ANATER	Technical Assistance and Rural Extension National Agency	*Agência Nacional de Assistência Técnica e Extensão Rural*
ANVISA	National Health Surveillance Agency	*Agencia Nacional de Vigilância Sanitária*
APHIS	Animal and Plant Health Inspection Service	-
ARM	Agriculture Risk Management	-
ARP	Pest Risk Analysis	*Análise de Risco de Pragas*
ASA	Articulation for the Semi-arid	*Articulação do Semi-Arido*
ATER	Technical Assistance and Rural Extension	*Assistência Técnica e Extensão Rural*
BA	Bahia State	-
BACEN	Central Bank of Brazil	*Banco Central do Brasil*
BE	Drought Benefit	*Bolsa Estiagem*
BR-3	Medium Risk of Foot and Mouth Disease	*Risco Medio de Febre Aftosa*
BSE	Bovine Spongiform Encephalopatitis	*Encefalopatite Bovina Espongiforme*
Bt	Bacillus thuringiensis	-
C	Centigrade	-

CAR	Regional Development and Action Company of Bahia	*Companhia de Desenvolvimento e Ação Regional*
CDA	Coordination for Agrarian Development	*Coordenação de Desenvolvimento Agrário*
CDAF	Direct Purchase from Family Agriculture	*Compra Direta da Agricultura Familiar*
CDS	Purchase with Immediate Donation	*Compra com Doação Simultânea*
CE	Ceara State	-
CEASA	Supply Center	*Centro de Abastecimento*
CEASA-BA	Bahia State Water Supply Company	*Empresa Baiana de Abastecimento*
CEPEC	Research Centre for Cacao	*Centro de Pesquisas do Cacau*
CEPLAC	Executive Planning Commission of the Cacao Cultivation	*Comissão Executiva do Planejamento da Lavoura Cacaueira*
CFO	Origin Phytosanitary Certification	*Certificado Fitossanitário de Origem*
CHESF	Hydroelectric Company of São Francisco	*Companhia Hidro Elétrica do São Francisco*
CNA	Brazilian Confederation of Agriculture and Livestock	*Confederação da Agricultura e Pecuária do Brasil*
CODEVASF	Company for the Development of the São Francisco and Parnaíba Valleys	*Companhia de Desenvolvimento dos Vales do São Francisco e do Parnaíba*
CONAB	National Supply Company	*Companhia Nacional de Abastecimento*
COSALFA	South American Commission for the Figth Against Foot-and-Mouth Disease	*Comisión Sudamericana de Lucha contra la Fiebre Aftosa*
CPR-ESTOQUE	Support for the Formation of Stocks	*Cédula de Produto Rural - Estoque*
CsCMV	Cassava Common Mosaic Virus	*Vírus do Mosaico Comum da Mandioca*
CSF	Classical Swine Fever	*Peste Suína Clássica*
CSVMC	Cassava Vain Mosaic Virus	*Vírus do Mosaico das Nervuras da Mandioca*
CVC	Citrus Variegated Chlorosis	*Clorose Variegada dos Citrus*
DAP	PRONAF Capability Statement	*Declaração de Aptidão ao PRONAF*
DBMS	Database Management System	-
EBDA	Agriculture Development Company of Bahia	*Empresa Baiana de Desenvolvimento Agrícola S.A.*
EMATER	Company for Technical Assistance and Rural Extension	*Empresa de Assistência Técnica e Extensão Rural*
EMATER-BA	Bahia Technical Assistance and Rural Extension Company	*Empresa de Assistência Técnica e Extensão Rural da Bahia*
EMBRAPA	Brazilian Company for Agriculture and Livestock Research	*Empresa Brasileira de Pesquisa Agropecuária*
ENSO	El Niño Southern Oscillation	-

EPABA	Agriculture Research Company of Bahia	*Empresa de Pesquisa Agropecuária da Bahia*
FAEB	Agriculture and Livestock Federation of Bahia	*Federação da Agricultura e Pecuária do Estado da Bahia*
FAO	Food and Agriculture Organization	-
FETAG-BA	Federation of Rural Workers of Bahia	*Federação dos Trabalhadores na Agricultura do Estado da Bahia*
FGS	Garantia Safra Fund	*Fundo Garantia Safra*
FMD	Foot and Mouth Disease	*Febre Aftosa*
FNDE	National Fund for the Development of Education	*Fundo Nacional de Desenvolvimento da Educação*
FNE	Constitutional Fund for Financing of the Northeast	*Fundo Constitucional de Financiamento do Nordeste*
FUNCEME	State of Ceara Meteorology and Water Foundation	*Fundação Cearense de Meteorologia e Recursos Hídricos*
FUNCEP	State Fund for Poverty Combat and Eradication	*Fundo Estadual de Combate e Erradicação à Pobreza*
GAP	Good Agricultural Practices	-
GDP	Gross Domestic Product	-
GPV	Gross Production Value	-
GS	Garantia Safra Program	*Programa Garantia Safra*
ha	Hectare	-
HDI	Human Development Index	-
HLB	Huanglongbing	-
HPAI	Highly Pathogenic Avian Influenza	-
HPL	Huanglongbing	-
IADB	Inter-american Development Bank	-
IBGE	Brazilian Institute of Geography and Statistics	*Instituto Brasileiro de Geografia e Estatística*
IBGE	Brazilian Institute of Geography and Statistics	*Instituto Brasileiro de Geografia e Estatística*
ICMS	Tax on Circulation of Goods and Services between States and/or Municipalitions and Communications	*Imposto sobre Operações Relativas a Circulação de Mercadorias e sobre Prestações de Serviços de Transporte Interestadual, Intermunicipal e de Comunicação*
IFAD	International Fund for Agricultural Development	-
IICA	Inter-american Institute for Agriculture Cooperation	*Instituto Interamericano de Cooperação para a Agricultura*
INEMA	Institute for the Environment and Water Resources	*Instituto do Meio Ambiente e Recursos Hídricos*
INMET	National Institute of Meteorology	*Instituto Nacional de Meteorologia*
INPE/CPTEC	National Institute for Space Research	*Instituto Nacional de Pesquisas Espaciais*

INSA	National Institute for the Semi-Arid	*Instituto Nacional do Semi-Árido*
INSS	National Institute for Social Security	*Instituto Nacional do Seguro Social*
IPCC	Intergovernmental Panel on Climate Change	-
IPEA	Institute for Applied Economic Research	*Instituto de Pesquisa Econômica Aplicada*
IPM	Integrated Pest Management	-
IRPAA	Regional Institute for Small Adequate Agriculture	*Instituto Regional da Pequena Agropecuária Apropriada*
ITZC	Inter-tropical Convergence Zone	-
km	Kilometer	-
MAPA	Ministry of Agriculture, Livestock and Supply	*Ministério da Agricultura, Pecuaria e Abastecimento*
MCTI	Ministry of Science, Technology, and Innovation	*Ministério de Ciência, Tecnologia e Inovação*
MDA	Ministry of Agrarian Development	*Ministerio do Desenvolvimento Agrário*
MDS	Ministry of Social Development and Fight Against Hunger	*Ministério do Desenvolvimento Social e Combate à Fome*
MF	Ministry of Finance	*Ministério da Fazenda*
MI	Ministry of National Integration	*Ministério de Integração Nacional*
MIMR	Multifrequency Imaging Microwave Radiometer	-
mm	Millimeters	-
MPOG	Ministry of Planning, Budget and Management	*Ministério do Planejamento, Orçamento e Gestão*
NCDV	Newcastle Disease Virus	-
NGOs	Non-Governmental Organizations	-
NYSE	The New York Stock Exchange	-
OIE	World Organization for Animal Health	*Organização Internacional de Saúde Animal*
OIE/PVS	World Organization for Animal Health / Performance of Veterinary Services	-
PAA	National Program for Acquisition of Food from Family Farmers	*Programa de Aquisição de Alimentos*
PANAFTOSA	Pan American Foot-and-Mouth Disease Center	*Centro Panamericano de Fiebre Aftosa*
PB	Paraiba State	-
PEA	State Plan for Desertifigation Combat and Mitigation of Drought Impacts	*Plano Estadual de Combate à Desertificação e Mitigação dos Efeitos da Seca*
PEATER	Technical Assistance and Agricultural Extension State Policy for Family Agriculture	*Política Estadual de Assistência Técnica e Extensão Rural para a Agricultura Familiar*
PEP	Premium for Product Outflow	*Prêmio para Escoamento de Produto*

PEPRO	Premium for Product Equalization	*Prêmio Equalizador do Produto*
PGPAF	Minimum Price Guarantee Policy	*Programa de Garantia Preços para a Agricultura Familiar*
PGPM	Policy for Minimum Price Guarantee	*Política de Garantia de Preços Mínimos*
PNAE	National School Feeding Program	*Programa Nacional de Alimentação Escolar*
PNCEBT	National Program for Control, Eradication and Prevention of Brucellosis and Tuberculosis	*Programa Nacional de Controle e Erradicação de Brucelose e Tuberculose.*
PNCRH	National Program for Prevention and Control of Rabies of Herbivores and other Encephalopaties	*Programa Nacional para a Prevenção da Raiva de Herbívoros e outras Encefalopatias*
PNCT	National Program for Control and Eradication of Brucellosis and Tuberculosis	*Programa Nacional de Controle da Tuberculose*
PNEFA	National Program for Control, Eradication, and Prevention of Foot and Mouth Disease	*Programa Nacional de Controle, Erradicacao e Prevencao da Febre Aftosa*
PNSA	National Avian Health Program	*Programa Nacional de Saúde Aviária*
PNSAA	National Program of Health of Aquatic Animals	*Programa Nacional de Saúde dos Animais Aquáticos*
PNSAp	National Program for Bee Health	*Programa Nacional de Sanidade Apícola*
PNSCO	National Health Program Goats and Sheep	*Programa Nacional de Saúde de Ovinos e Caprinos*
PNSE	National Equidae Health Program	*Programa Nacional de Sanidade Equidea*
PNSS	National Program of Swine Health	*Programa Nacional de Saúde Suína*
PROAGRO / PROAGRO TRADICIONAL	Agriculture and Livestock Activity Guarantee Program	*Programa de Garantia da Atividade Agropecuária*
PROAGRO MAIS	Agriculture and livestock Activity Guarantee Program for the Family Farmers	*Programa de Garantia da Atividade Agropecuária da Agricultura Familiar*
PROATER	Technical Assistance and Agricultural Extension State Program for Family Agriculture	*Programa Estadual de Assistência Técnica e Extensão Rural para a Agricultura Familiar*
PRONAF	National Program for Family Agriculture Strengthening	*Programa Nacional de Fortalecimento da Agricultura Familiar*
PROP	Risk Premium for Product Acquisition through Options Market	*Prêmio de Risco para Aquisição de Produto Agrícola oriundo de Contrato Privado de Opção de Venda*
PSR	Rural Insurance Premium Subsidy Program	*Programa de Subvenção ao Prêmio do Seguro Rural*
RBT	Rose-Bengal Test	-
RD&I	Research, Development and Innovation	-

RENIVA	Network of Multiplication and Transfer of Cassava Manivas-seed with Genetic and Phytosanitary Quality	*Rede de Multiplicação e Transferência de Manivas-semente de Mandioca com qualidade Genética e Fitossanitária*
RR	Roundup Ready	-
SDA	National Secretary for Agriculture and Livestock Health	*Secretaria Nacional de Defesa Agropecuária*
SDS	Secretariat for Public Safety in the State of Bahia	*Secretaria da Segurança Pública do Estado da Bahia*
SEAF	Insurance for Family Farming	*Seguro da Agricultura Familiar*
SEAGRI	State Secretariat of Agriculture, Livestock, Irrigation, Agrarian Reform and Aquaculture	*Secretaria de Agricultura, Pecuária, Irrigação, Reforma Agraria, Pesca e Aquicultura*
SEBRAE	Brazilian Micro and Small Business Support Service	*Serviço Brasileiro de Apoio às Micro e Pequenas Empresas*
SEDES	Secretariat for Social Development and Fight Against Poverty	*Secretaria de Desenvolvimento Social e Combate à Pobreza*
SEDIR	State Secretariat of Development and Regional Integration	*Secretaria de Desenvolvimento e Integração Regional*
SEFAZ	Bahia State Treasury	*Secretaria da Fazenda do Estado da Bahia*
SEI	Superintendence of Social and Economic Studies	*Superintendência de Estudos Sociais e Econômicos*
SEMA	Bahia State Secretariat for the Environment	*Secretaria do Meio Ambiente*
SEPLAN	Bahia State Secretariat of Planning	*Secretaria do Planejamento do Estado da Bahia*
SIE	State Inspection Service	Serviço de Inspecção Estadual
SIF	Federal Inspection Service	Serviço de Inspecção Federal
SISBI	Brazilian System for Inspection of Animal Origin Products	*Sistema Brasileiro de Inspeção de Produtos de Origem Animal*
SLP	Sea Level Pressure	-
SPA	Superintendence of Politics in Agribussiness	*Superintendência de Política do Agronegócio*
SPEI	Standardized Precipitation Evapotranspiration Index	-
SPI	Standardized Precipitation Index	-
SPS	Sanitary and Phytosanitary System	-
SST	Sea Surface Temperature	-
SUAF	Family Agriculture Superintendence	*Superintendencia de Agricultura Familiar*
SUASA	Unified System of Agricultural Health and Food Safety	*Sistema Unificado de Atenção à Sanidade Agropecuária*
SUDENE	Superintendency for Development of the Northeast	*Superintendência do Desenvolvimento do Nordeste*
SUSEP	Superintendency for Private Insurance	*Superintendência de Seguros Privados*

TA	Technical Assistance	-
UESB	State University of the Southwest of Bahia	*Universidade Estadual do Sudoeste da Bahia*
UFBA	Federal University of Bahia	*Universidade Federal da Bahia*
UFLA	Federal University of Lavras	*Universidade Federal de Lavras*
UFRB	Federal University of the Recôncavo of Bahia	*Universidade Federal do Recôncavo da Bahia*
UFV	Federal University of Viçosa	*Universidade Federal de Viçosa*
UNEB	University of the State of Bahia	*Universidade do Estado da Bahia*
USAID	United States Agency for International Development	-
USDA	United States Department of Agriculture	*Departamento de Agricultura dos Estados Unidos*
USP/ESALQ	University of São Paulo	*Universidade de São Paulo*
VEP	Product Outflow Value	*Valor de Escoamento de Produto*
WHO	World Health Organization	-
ZARC	Agricultural Climate Risk Zoning	*Zoneamento Agrícola de Risco Climático*

EXECUTIVE SUMMARY

1. **The present study is part of an effort by the World Bank and the State of Bahia to assess Agriculture Sector Risks as a contribution to the strategic economic development and poverty reduction agenda of the State Government.** It is composed of two phases: an Agricultural Sector Risk Identification and Prioritization (Volume I) and a Risk Management Strategy and Action Plan (Volume II). The study was conducted in close collaboration with the Regional Development and Action Company of Bahia (CAR) and the Secretariat of Agriculture of Bahia (SEAGRI). In the immediate term the study provides practical elements for the implementation of the Bahia Sustainable Rural Development Project – named Bahia Produtiva, which is currently implemented by CAR and is financed by a World Bank loan (8415-BR).

2. **Risks in Bahia's agricultural sector are highly concentrated in soybean, maize, cotton, cacao, fruits, vegetables and beans.** The aggregated gross output value of these crops, which are important both for household food security and for the sustainability of commercial farming, accounts for 84% of total gross output value of State agriculture and 82% of the total estimated annual losses. The following productive systems aggregate the above crops and are targeted under the Risk Management Strategy: agro-industrial commercial agriculture in the Western region of the State (Cerrado); commercial fruit subsector; commercial horticulture subsector; family agriculture; and, livestock production chains.

3. **There are a number of relatively frequent (1 in 3, 1 in 5 and 1 in 10 year occurrence probability) risks that have moderate expected impact. These risks are climate (drought), pest and diseases and price volatility.** The realization of those risks have no high or critical impact because of the many government interventions that are in place to produce innovations, cope with drought and support crop prices, although their management can be greatly improved. But there are a few risks that still having occasional occurrence likelihood (1 in 10 years), could cause high/catastrophic damage, as already occurred in the past -fruit and cacao diseases, severe drought, and exotic livestock diseases-, and therefore require strong mitigation and coping preparation efforts.

4. For the **agro-industrial supply chains** in the West of the State the most **important risks are extreme dry climatic conditions and resistant pests and weeds due to intensive use of chemical products**. The **commercial fruit** subsector's greatest risks are the **exotic diseases and the severe droughts**. The **horticulture supply chain** in turn faces **high price volatility and is exposed to some aggressive pests and diseases**. For **family agriculture** the main risks are **severe drought, irregular precipitation and price volatility** of some crops like cassava. The **livestock value chain** is always subject to **outbreak of exotic diseases in addition to other diseases**, and is seriously exposed to the severe droughts.

5. **Approximately R$ 186 million (equivalent to US$ 105 million at 2010 exchange rate) or 1.9% of the State's agricultural GDP, was estimated as the value of the average annual production loss** of Bahia's agricultural sector as a result of unmanaged production risks[1] in the last 20 years.

[1] Estimated as anual yield drop greater than 33% of standard deviation.in a 20 years period.

6. **Average figures tend to conceal the actual catastrophic impact that some shocks have at the time that they occur.** For instance, during the 2002 and 2003 droughts, the worst in the period 1990-2010 for Bahia's agriculture, the losses amounted to R$ 398 million and R$ 390 million respectively, that is more than double the annual average. More recently, in 2006 and 2009, the estimated production losses amounted to R$ 238 million and R$ 263 million, respectively.

7. **Further, the losses with respect to average agricultural production values tend to concentrate in specific crops and specific actors along the supply chain.** The risk exposure is to a great extent a function of the supply chain governance and the stakeholders' capability and opportunities for risk management. In the period 1999-2003 the losses were highly concentrated in cacao: 48%, 62%, 46%, 44% and 20% of the total losses, respectively. During the very bad years of 2002, 2003, 2006 and 2009, the losses were particularly significant in soybean: 29%, 36%, 35% and 29% of the total losses, respectively. Whereas other years the drought conditions affected more seriously the fruit and vegetable production, like in the period 1996-2000, where the losses of papaya fruit alone accounted for 18%-22% of the total production losses in Bahia. As regards the subsistence crops of family agriculture, particularly beans, the years of 1995-1996, 2001-2004 and 2010 were particularly bad. In 2004 losses in beans were estimated to be R$ 66 million or 38% of the total agricultural production losses in the state. In occasions, the realized risks derive in longer term processes of production downturns (cacao) or recurrent production drops (cassava) or periods of production depression.

8. **Although livestock production is greatly exposed to sanitary risks, Bahia has not suffered catastrophic animal or plant health events in recent years.** The outbreak of an exotic disease (e.g. FMD or BSE) would trigger the elimination of animals, quarantine and disinfection, the loss of external markets, etc. as occurred during the 2005 FMD outbreak in Mato Grosso do Sul and Paraná. The outbreak had great impact on exports and prices of beef, poultry and pork, which only recovered after the lifting of the import bans by Russia (the main importing country) twenty eight months later.

9. **Looking at risks from the combined perspective of their impact potential (moderate to critical) and management possibility (none to very high), severe drought and *moniliase* disease in cacao appear as the risks with the most critical potential impact and minimum risk management.** Therefore, they require medium to long-term investment and strong preparation to cope. Other diseases such as *sigatoka negra* (banana) and *cochonilha rosada* (grapes and mangoes) also have minimum risk management capacity but with a lower damaging potential. Weeds resistant to herbicides (for crops like cotton, maize, soybean) present a potential high impact in the West of Bahia and one that requires an integrated pest management approach.

10. **Considering output value as a measure of aggregated impact of risks in Bahia as a whole, the greatest challenges are drought, aggressive pests and diseases and weeds resistant to herbicides in Western Bahia**, taking into account the proportionally large economic size of that region. If focusing on family agriculture, which has a small participation in State agriculture output value but is significant in social terms, irregular rainfall and drought appear as the only major risk. In effect, most family farmers live in the *Sertão* (Semi-arid) region where a destructive recurrent drought scenario dominates. Family farmers do not consider phytosanitary risks important in relation to the great weather related risks. Market risks are also minor because of their relatively small participation in commercialization of agriculture products and because of federal procurement and price support programs.

11. **Based on the above analysis and other considerations, the first phase of the assessment identified the following risk management intervention areas to address the priority risks:** (i) strengthening State rural extension and technical assistance system including both production and marketing aspects; (ii) review and reinforce State animal and plant health sanitary system; and (iii) develop an integrated agroclimatic information system. After analyzing a number of programs and projects that are already addressing some of the identified risks along the above solution areas, came up some gaps and complementary actions. As a result, the following are the strategic lines identified during the agriculture risk management assessment – ARM (second phase):

I. Agroclimatic Information System:

- Development of a Weather Database Integrated System for the state of Bahia;
- Strengthening the State Drought Committee in order to make actions more proactive and less reactive;
- Professional training of the extension workers that participate in the claim adjustment in the Garantia Safra order to reduce moral hazard and technical issues.

II. Sanitary and Phytosanitary System

- Implementation of a wide area Integrated Pest Management (IPM) for the Cerrado of Western Bahia;
- Actions to delay or avoid the introduction of exotic pests;
- Enhance and expand the RENIVA (network of multiplication and transfer of propagating materials of cassava with genetic and phytosanitary quality program);
- Evaluate and improve animal health programs.

III. Supply Chain Coordination

- Identify, support and expand actual farm to market experiences and business opportunities for family farmers in Bahia;
- Capacity building on business development among associated small scale farmers.

IV. Agricultural Innovation System

- Improve the coordination of the Agriculture Innovation System for agriculture risk management of family farmers;
- Improve efficiency of the Agricultural Innovation System for family agriculture risk management - strengthen the research sub-system;
- Improve efficiency of the Agricultural Innovation System for family agriculture risk management - strengthen the Technical Assistance and Rural Extension (ATER - *Assistência Técnica e Extensão Rural*) Sub-system for family farmers;
- Improve efficiency of the Agricultural Innovation System for family agriculture risk management;
- Scale-up of successful programs and projects for family farmers.

12. **The proposed action plan (detailed in the text) reflects the strategic lines and includes some basic details on who, when and how much is required for the implementation of the actions proposed.** The cost of the entire ARM action plan has been estimated at a total of US$ 129,522,000 over 5 years, with a strong concentration of activities within the first two years. Out of this total, US$ 5,622,000 would correspond to studies, training and pre-investment, US$ 38.900,000 to program investments, and US$ 85,000,000 are estimated for covering staff costs associated to the EBDA reform. The summary break down by category of intervention is as follows:

Category of intervention	Total Cost (US$)	Execution of field programs (US$)	Payments to EBDA staff (US$)	Studies, training and pre-investment (US$)
Weather Information System	3,581,000			3,581,000
Sanitary and Phytosanitary System	746,000			746,000
Supply Chain Coordination	230,000			230,000
Agricultural Innovation System	124,965,000	38,900,000	85,000,000	1,065,000
Total Action Plan	129,522,000	38,900,000	85,000,000	5,622,000

13. Finally, the following are some short term actions that can be undertaken by CAR/Bahia Produtiva:

- Expand the citrus seedling production program, financing individual cages environments.
- Strengthening family farmer farm-to-market relation through greater farmer organization to facilitate technical assistance and marketing services and facilitate increased participation in institutional markets like PAA and PNAE, having *Bahia Produtiva* as a focal point to develop supply chain coordination and supply/demand planning.
- Conduct a survey on potential technical assistance providers in the State, as well as explore other non-public technical assistance modalities.
- Conduct a survey to gather information regarding rural households organized in Community Associations.

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INTRODUCTION AND CONTEXT

1. The present Agriculture Sector Risk Assessment study is part of an effort by the World Bank and the State of Bahia to assess agricultural risks that have significant impact in terms of economic and social losses and propose an appropriate strategy and action plan. The study is a contribution to the strategic economic development and poverty reduction agenda of the State Government. In the immediate term it seeks to provide practical elements for the implementation of the Bahia Sustainable Rural Development Project – named *Bahia Produtiva*, which is currently financed by a World Bank loan (8415-BR). The World Bank conducted the study in close collaboration with the Regional Development and Action Company of Bahia (CAR) and the Secretariat of Agriculture of Bahia (SEAGRI).

2. Brazil has developed a portfolio of agricultural risk management solutions (activities and instruments like *Garantia Safra*, several EMBRAPA[2] research programs, Price Guarantee programs, etc.) that involve issues such as drought, pest and diseases and procurement and price support of basic foodstuff. These solutions have regional and nationwide coverage and their implementation require the participation of many state and federal institutions. However, there is still room, and need, for strengthening the risk management capacity of the public and private sector, especially through improving policy and program coordination, taking advantage of synergies and strengthening the support services to the most vulnerable farmers.

3. The rapid risk assessment methodology developed by the World Bank to assess risks and risk management involves several phases. The First Phase – the Risk Assessment – (Volume 1) provides a diagnosis of the primary risks in the entire agricultural sector. Risks are classified based on the probability of occurrence and expected impact, from which emerge the prioritized risks for the sector and a list of potential management strategies. Then, those solutions are confronted with the existing programs and projects that somehow address the agricultural risks, and a set of solutions that fill gaps in current risk management is proposed.

4. This First Phase serves as the basis for planning the Second Phase of the risk assessment methodology, which focuses on the development of a Risk Management Strategy and Action Plan. The Second Phase (Volume 2) aims to develop an Agriculture Risk Management Strategy by deepening the analysis into the risk management solutions and risk management capacity assessment along the lines of the above priority risk solution areas. Work under this Second Phase also includes the assessments of current Agriculture Risk Management (ARM) practices to identify the main gaps which warrant attention to better mitigate, transfer, and/or cope with agricultural risks.

[2] Empresa Brasileira de Pesquisa Agropecuária - Brazilian Company for Agriculture and Livestock Research

5. The Action Plan can be executed in the medium-term to mitigate, transfer, and cope the risks in the sector. The specific solutions are developed in depth with stakeholders in response to the first phase's characterization of risks.

6. Figure 1 provides an overview of the full process of the World Bank's risk assessment methodology.

Figure 1: Agriculture Sector Risk Management Process Flow

7. The analysis was conducted in close collaboration with the team of Project Bahia Produtiva under Companhia de Desenvolvimento e Ação Regional (CAR - Regional Development and Action Company of Bahia). Expert interviews, in combination with the analysis of primary and secondary data and literature provided the basis for this Risk Assessment and Risk Management Strategy. The work included consultations with state and federal government and academic stakeholders, as well as interviews with various stakeholders of the major supply chains including farmers organizations and private sector companies.

8. This report presents the findings and conclusions of the First and Second phases of the Agriculture Sector Risk Assessment for the State of Bahia.

9. Volume 1 includes the following chapters. Chapter 1: Agricultural System characterizes the recent performance of the agriculture sector, including agro-climatic and market conditions. It also identifies the productive systems used for the risk analysis. Chapter 2: Agriculture Sector Risks describes the main risks in the agricultural sector, capturing market, production, and enabling environment risks along the value chains involved in the selected productive system typologies. Chapter 3: Adverse Impact of Agricultural Risk presents the estimations of the aggregate impacts of unmanaged agricultural risk on agricultural losses and production volatility. Chapter 4: Stakeholders Assessment identifies risk profiles for different

stakeholders, underlying the different types of risk impacts, and then highlights a vulnerability framework. Finally, Chapter 5: Risk Prioritization and Management presents a prioritization of risks and proposes a preliminary set of priority risk management measures. A short list of potential solution actions are offered as the starting point for a more in-depth solution analysis for the second phase of the risk assessment.

10. Volume 2 comprises four chapters. Chapter 1: Summary of Agriculture Risk Management Strategy present an introductory chapter summarizing the conclusions so far and advancing the results of the Risk Management Assessment. Chapter 2: Bahia Agriculture Risk Management Framework provides a brief discussion on the agricultural risk profile and risk management options of Bahia and an inventory of current programs, projects and policies that in different ways address the main agricultural risks. In addition, the chapter presents an overview of the key agricultural sector features relevant to understanding the ARM strategy. Chapter 3: Proposed ARM Strategy presents the ARM strategy, including concrete risk management actions. Chapter 4: ARM Action Plan incorporates detailed information on the proposed actions by aggregated strategic line. It includes information on the estimated cost of the actions, the responsible institution and the timeframe. Moreover, a second table provides a short-term calendar of actions by institution.

VOLUME 1: RISK ASSESSMENT

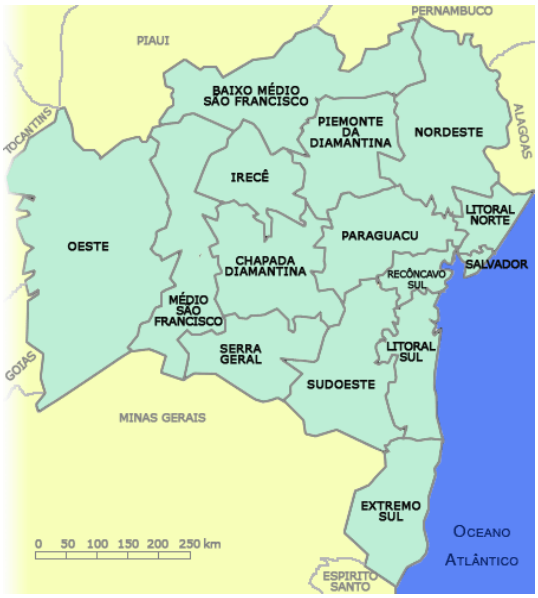
CHAPTER 1: AGRICULTURAL SYSTEM

Agriculture Sector Overview and Performance

11. Located in the Northeast Region, the State of Bahia occupies an area of 564,830.86 km² and has 14.7 million inhabitants, representing 7.7% of the total population of Brazil and 27.2% of the population of the Northeast. Thirty percent of the Bahia's population lives in the rural areas, and this percentage is higher than the average in the Northeast Region.[3] There are 417 municipalities; but 379 have up to 50,000 inhabitants or 90% of total.

12. The state of Bahia is bordered to the west by the States of Tocantins and Goias, to the east by the States of Sergipe and Alagoas and the Atlantic Ocean, to the south by Minas Gerais and Espirito Santo and to the north by Piaui and Pernambuco (the map, in Figure 2 below, shows the different regions in the state of Bahia).

Figure 2: Map of Regions of Bahia



Source: State Government of Bahia

13. Until the first half of the twentieth century Bahia remained as an immense territory of reserve, and partially filled with low level of economic activity. From the 1970s, the region was marked by a new cycle of development. Nowadays Bahia has great significance from the economic point of view and it is the largest economy of the Northeast region and the eighth largest economy in the country. According to IBGE data for 2011, Bahia accounts for 4% of the country's GDP and its agricultural sector accounts for 5.4% of the national agricultural sector.

14. Along with a relevant production of grains and livestock, the state of Bahia counts on a diversified industrial sector and is one of the main touristic destinations in Brazil. However, the State´s GDP is composed mostly by the services sector, 66% of the total. In the services sector, the main activities are public administration, trade, real estate and transports. The agriculture and livestock sector represents 7.4% of the State's economy (2011).[4]

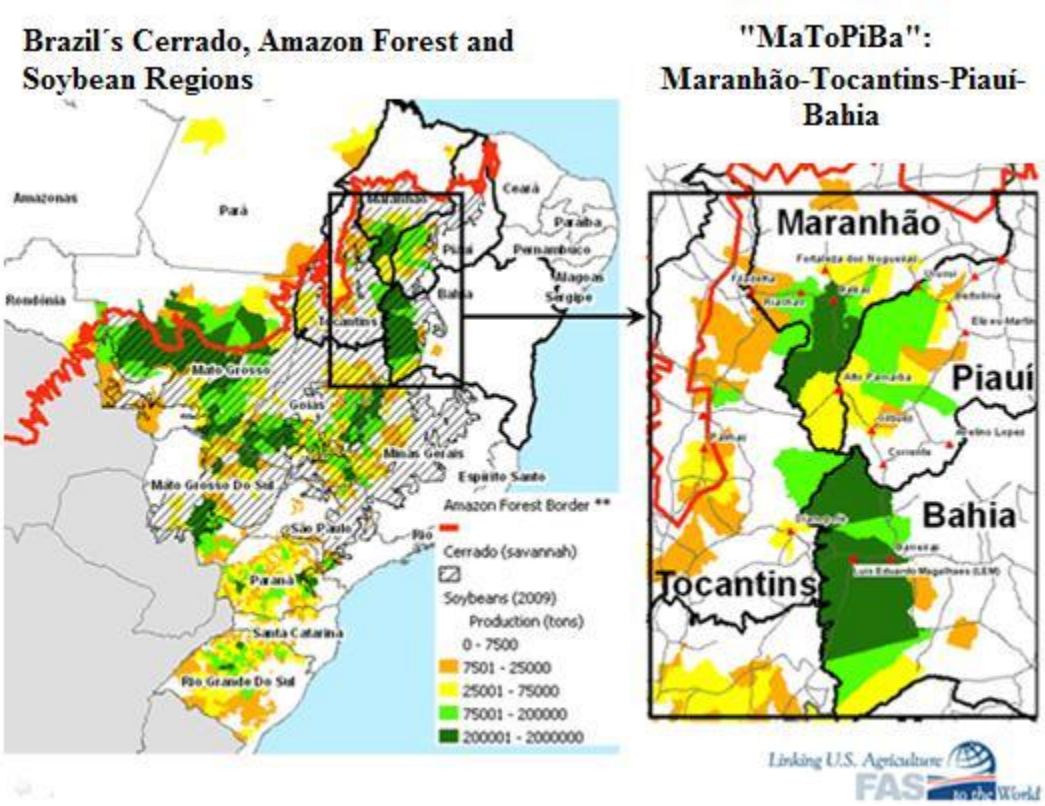
15. Because of the different agroecological and climatic zones that are present in Bahia (see next section), agriculture is diversified. Bahia is the greatest Brazilian producer of cocoa and the second producer of cotton, and is also an important producer of fruits such as banana and papaya fruit as well as

[3] Indicadores Sociais dos Estados Brasileiros – Social Indicators for Brazilian States: IPEA 2012.
[4] Data from IBGE (Instituto Brasileiro de Geografia e Estatística - Brazilian Institute of Geography and Statistics).

horticultural products. Bahia is also an important producer of soybean and, in 2011, produced more than 3 million tons and exported near 1 billion dollars of it. The most relevant export items are oil, soybeans and cotton. There are 350,000 hectares under irrigation in Bahia and there is potential for much more. Livestock is very important for the economy of Bahia. The livestock population accounts nowadays for 11 million cattle; 2.7 million goats; 3.9 million sheep; 1.6 million swine, and 1.1 million horses (IBGE).

16. The main large scale commercial agriculture area in Bahia is the Western Cerrado region, which was opened in the late 1970s and early-to-mid 1980s helped by government incentives. Farmers who moved to the region received cheap credit and others assistances. Most of these farmers were coming from the southern states of Rio Grande do Sul and Parana. With a population of about 500,000, nowadays the region encompasses an area of 10,500 square kilometers. The dominant crop in terms of area is soybeans, followed by cotton, maize, and grass seed. Soybean production increased during the past 20-years from around 200,000 tons in 1990 to more than 3 million tons in 2010. Together with the states of Maranhão, Tocantins and Piaui, well known as *Matopiba*, the Eastern Cerrado of Bahia forms a new agricultural frontier. *Matopiba* accounts for 12.2 million tons of grains and oilseeds crop in 2011/12 or 8% of the total national (Figure 3).

Figure 3: Map of Soy Production



Source: Amazon Forest World Wildlife Fund Ecoregions; Foreign Agricultural Service, U.S. Department of Agriculture. IGBE = 2009 Soybean Production

17. Agriculture in Bahia is currently performing well. While the overall economy of Bahia grew by 2% during the first quarter of 2014, as compared with the same period of 2013, the agricultural sector grew by 17%, with special highlight of cotton (35%), soybean (36%) and maize (50%)[5], harvested on the Cerrado region. However, there was a large fall in the production of cassava (26%) cultivated on the Semiarid and sugar cane (-12%) on the coastal region, hit by drought. And as Bahia's Semiarid is the largest in the Northeast and is extensively populated by poor rural families, drought conditions have a great impact on the rural poor.

Agro-Climatic Conditions

18. In general, it is known that several phenomena have a strong influence on the rainfall pattern within the Northeast region of Brazil. One is the Southern Oscillation of El Niño (ENSO), which is a global phenomenon that may cause severe droughts or excess of rainfall conditions depending on its intensity. In general, the hottest (coldest) phase of ENSO is related with years with below normal (above normal) rainfall conditions. However, the Northeast of Brazil has experienced severe drought events that are not necessarily related to the ENSO, but to the influence of different atmospheric systems that cause rain in this region.[6] Others are the Sea Surface Temperature (SST) in the Atlantic Ocean, Easterly Winds, the Sea Level Pressure (SLP); the Inter-tropical Convergence Zone (ITZC) -this is one of the most important factors that determine how generous or deficient the rainfall conditions perform in the northern areas of the northeast of Brazil;[7] Cold Fronts, which are recorded between November and January (the cold fronts are organized bands of cloud that are created in the areas where it confluence a mass of cold air with a mass of hot air); and the Upper Tropospheric Cyclonic Vortices that are originated in the Atlantic Ocean between November and March and move from east to west more often between January and February. In addition, the effects of sea breeze also influence the rainfall conditions: continental areas record rainfall values as low as 300 mm compared to the coast, which has around 1,400 mm annually. The sea breeze, which may affect up to 100 Km inland, is generated because of the difference in temperature values recorded between the sea surface (low temperature) and the mainland (high temperature).

19. There are four major climate regions: (i) The Western Savana is reported in the interior and it experiences a rainfall regime of 1,000 mm/year in summer and a seasonal drought during winter; (ii) the Hyper-humid region records around 2,000 mm/year and 23°C of mean temperature. This type of climate is experienced in the *Reconcavo* and the southern coastal areas; (iii) the hot semi-arid climate where the rainfall regimes decrease from the north to the east of Bahia. The annual rainfall regime ranges between 500 mm to 700 mm per year with high spatial and temporal volatility; and (iv) the Tropical Savanna which covers the regions of Chapada Diamantina and Espinhaço. Temperature values ranges between 18° and 21°C.

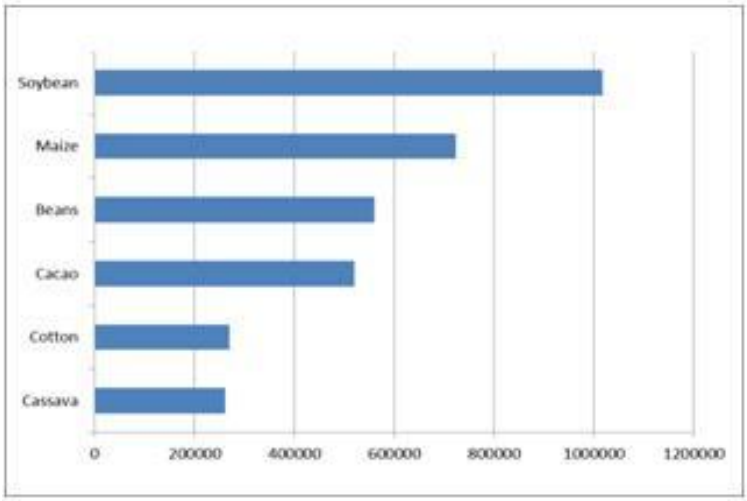
[5] Superintendência de Estudos Econômicos da Bahia (SEI).
[6] Alves and Repelli, 1992, cited by de Almeida and Júnior, 2012.
[7] In general, the ITZC traditional moves to the North between August-October, to the South of the Atlantic basin between February-April; nevertheless, its position as well as its intensity is conditioned upon the SST.

20. In the semi-arid and in the southern part of Bahia, the main rainfall season is registered between November and January. Because of its geographic position, the rainfall regime during this period of the year is associated with the penetration of the frontal systems, the position of the ITZC and the Upper Tropospheric Cyclonic Vortices, the anomalies on the SST, and the rainfall variability reported in the Amazonas rain forest. In contrast, the main rainfall season in the coast of Bahia is recorded between April and June, due to the influence of sea breeze and the Trade Winds.

Production and Market Trends

21. Soybean is the crop with largest area and higher total production, followed by maize, beans and cacao (Figure 4).

Figure 4: Planted Area (he) by Crop, 2010



Source: IBGE

22. Yields of main crops have followed different trends during the last twenty years (as seen in Figure 5, following page).[8] Large scale market oriented crops (soybean, maize and cotton) have increased yields systematically. This long term trend is attributed to the significant infrastructure investments in the Western region of Bahia and the very relevant EMBRAPA research achievements to adapt new varieties and other cultural practices to the Cerrado agricultural conditions. Papaya fruit, another clearly market oriented product, has also shown consistent yield increase in the referred period.

23. Beans, on the other hand, a crop both cultivated for family consumption by smallholders and commercially in large farms, are showing a steady trend. A rather similar picture can be observed with respect to banana, which is an important food security crop in specific locations. Cassava yields, in turn, are very variable between years with no evident trend to increase.

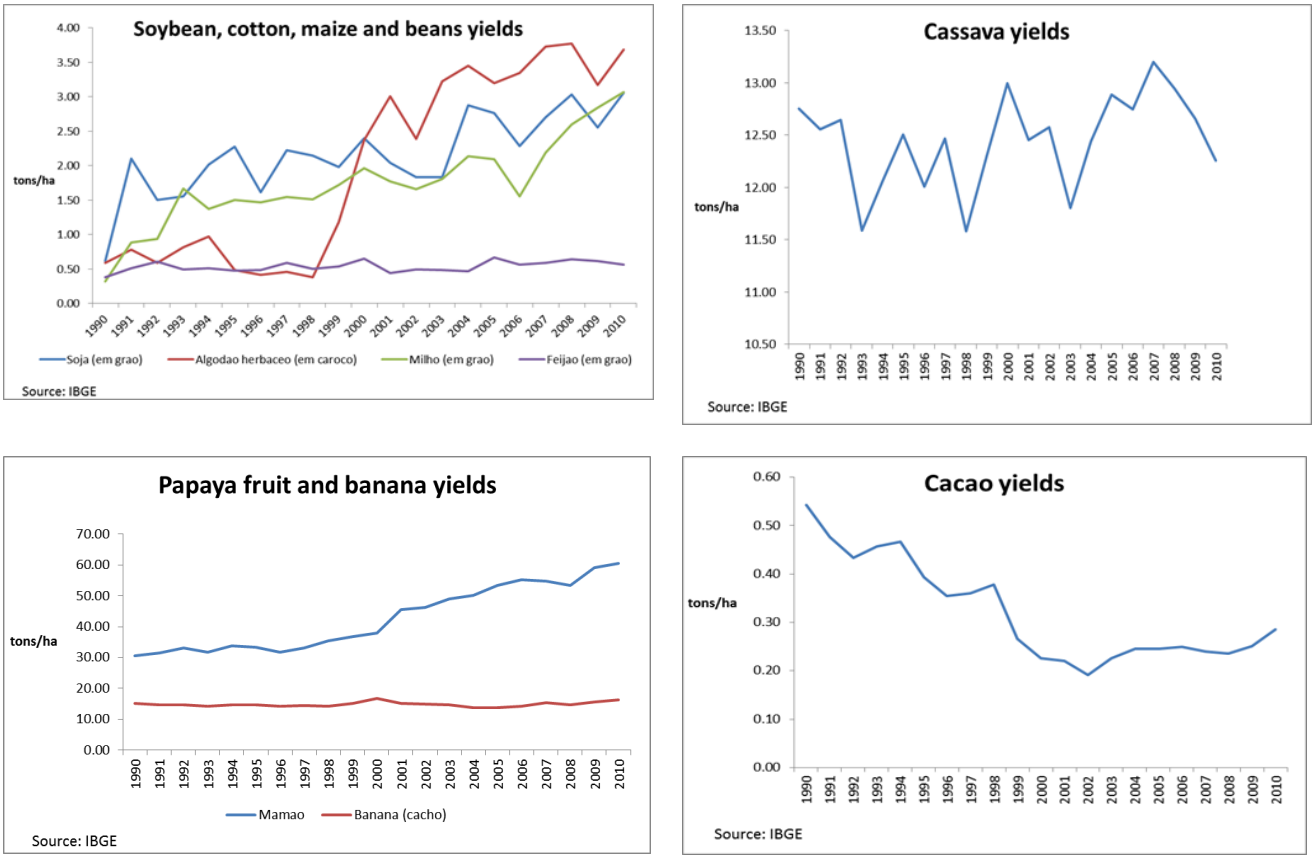
[8] EMBRAPA is responsible for many of the positive results through the work of its research units, such as Cruz das Almas and Petrolina.

24. Cacao yields have decreased during the 1990s and early 2000s and stabilized afterwards. The reason was a pest attack that decimated the cacao fields (see Chapter 2 for further discussion).

25. Livestock stock has also followed different trends depending on the categories. Except for bovines, that has seen the stock increased significantly from just over 6 million to the 11 million in 2008, the other categories of livestock have remained about the same over the time (Figure 6, on following page).

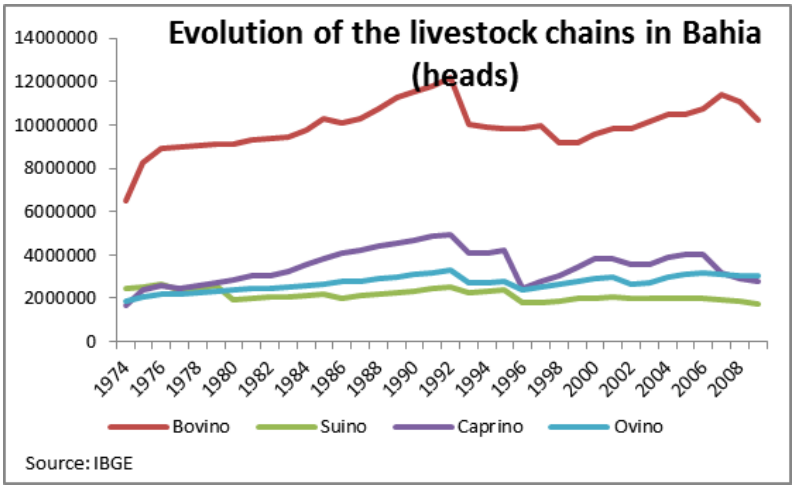
26. The drop in the stock of bovines and goats in the period 1992-1995 is explained by a serious drought affecting Bahia.

Figure 5: Yields by crop, 1990 to 2010



Source: IBGE.

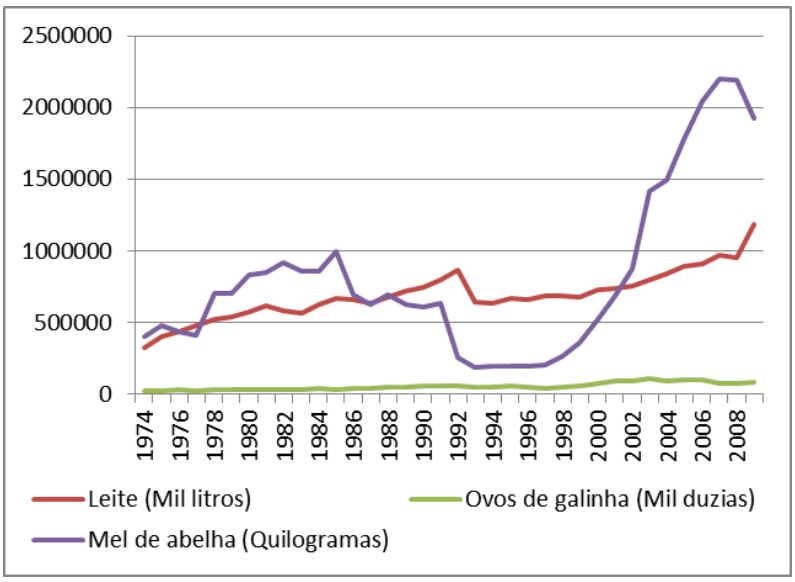
Figure 6: Evolution of Livestock Chains in Bahia (heads), 1974 to 2010



Source: IBGE

27. Figure 7 shows the evolution of production of selected livestock products. It is remarkable the pronounced increase in the production of honey during most of the 2000s.

Figure 7: Evolution of the production of milk (liters), honey (kg) and eggs (thousand dozens)



Source: IBGE

28. In regards to market trends, some crops, like cotton and soybean, are marked by intense price volatility, which is connected to the international market volatility. Inter-annual price variation of fruits is very sensible to domestic supply and demand variations. These issues are further discussed in Chapter 3 within each supply chain market risk assessments section.

CHAPTER 2: AGRICULTURE SECTOR RISKS

29. Agriculture is inherently variable as producers may incur moderate losses every year due to sub-optimal climatic conditions at different times in the production cycle or to other production related factors. For the purpose of this report, production risks refer to the more severe and unpredictable adverse events that occur beyond these smaller events. They are measured as per yield reductions with respect to the linear trend line greater than 33% of the standard deviation (see details in Chapter 4). Also modest departures from expected prices may cause moderate losses that are not considered risks but unexpected significant price drops is an important risk affecting all actors along the supply chain. The price variations are measured by the coefficient of inter-annual price variations.

30. The state of Bahia has suffered from very severe droughts in the past. Not surprisingly droughts are mentioned by stakeholders as the most damaging production risk for all crops and livestock. Severe droughts should be differentiated from the recurrent (seasonal) droughts in the Semi-arid, which given its predictability they can be regarded as a constraint. However, lack of preparedness has determined that even those seasonally predictable droughts are faced as an emergency. In addition, unpredicted erratic rainfall is a frequent risk but of moderate or low impact. The damaging impact of pests and diseases is significant when they are not properly mitigated. They have been particularly devastating when new pests/diseases arrived and the state technology support services were not prepared to respond adequately (e.g. cacao). Livestock sanitary risks are relevant and are a very important threat if outbreaks of exotic diseases occur. Price volatility of family agriculture crops, like maize, is high but the impact on family agriculture farmers is limited because of the Government's purchasing and price support programs. Export crops, mostly soybean, have their domestic prices largely determined by the prices in the international market.

31. Risks are highly concentrated in a few crops that account for 84% of the total production value of the state agriculture and 82% of the total estimated annual losses due to realized production risks in the last 20 years (see detailed calculation in Chapter 4): soybean, maize, cotton, cacao, fruits, vegetables and beans. They are particularly important both for family food security and for the sustainability of commercial farming. Table 1 shows the relative importance of the main crops in Bahia in terms of contribution to the State agricultural production value.

32. The following productive systems aggregate the above crops and represent the dominant technological models in Bahia, and were chosen for the present risk management analysis: (i) Agro-industrial commercial agriculture in the West of the State (Cerrado); (ii) Commercial fruit subsector; (iii) Commercial horticulture subsector; (iv) Family agriculture; and, (v) Livestock production chains. This analytical structure was discussed and agreed with the mission's counterpart at CAR/Bahia *Produtiva*.

Table 1: Gross Production Value (GPV) of Main Crops and Indicative Losses Attributed to Risk Events, Percentage of Total State Agriculture

	% GPV 2010	% Indicative Annual Average Losses in Value Terms
Soybean	15.6%	14.8%
Cotton	9.0%	9.6%
Papaya fruit	7.8%	7.2%
Cacao	7.4%	17.8%
Maize	7.4%	5.1%
Banana	5.8%	2.9%
Beans	5.4%	8.5%
Cassava	5.3%	2.2%
Coffee	5.3%	6.9%
Passion Fruit - *Maracuja*	3.8%	0.6%
Sugar cane	3.5%	1.2%
Oranges	2.8%	1.7%
Onion	2.4%	1.4%
Tomato	2.3%	2.1%

Source: IBGE

This section presents findings regarding the production, market and enabling environment risks for selected supply chains covering the referred major production systems in the state of Bahia. The impact of the adverse events on the different stakeholders is discussed in Chapter 4.

Agro-industrial Commercial Agriculture in the West of Bahia

Profile of Main Supply Chains

33. The West of Bahia is characterized as a typical Cerrado region, with vast flat areas, conducive to mechanization, but with low fertility soils, thus requiring high investment capital and intensive use of modern technology. The climate consists of a rainy season (October to April) and a dry season (May to September), the rainy season may come up with dry interstices, even in the rainy season. Unlike the Semi-arid region of Bahia, the West is characterized by favorable edaphoclimatic conditions to rain-fed or irrigated production of grains.

34. The region has reached the highest levels of agricultural production within the state, boosted by large-scale grain crops, such as soybeans, maize, and cotton. It has a well-developed agro-industry complex, which is composed by large farms, agribusiness and trading companies for export. Smallholders are also present in the region producing beans, maize and cassava. Most of commercial producers use no-tillage and integrated productive systems, rotating the main cultures (soybeans and cotton) with maize and, more recently, beans. The introduction of those technologies in the region was important to increase productivity, management of soils, and pest control.

35. The regional agribusiness dynamics attracted several input distributors, providing farmers with chemicals, fertilizers, and agricultural machinery. The main input suppliers are large transnational trading

companies. Most of soybean and cotton crops are processed locally or exported. Maize, rice, and beans are almost exclusively sold on local spot markets but, given seasonal shortages on the international market, part of the maize is exported once in a while.

36. In 2013, exports of soybeans reached the amount of 1,578 million tons, bringing in revenue of US$ 844 million. A volume corresponding to 59% was shipped to China, followed by the Netherlands and Spain, with 8.3% and 8.2%, respectively. Also in 2013, about 46% of the cotton produced in Western Bahia was shipped abroad. The major clients are Asian countries. Maize produced in Western Bahia, which is mainly for domestic supply and, particularly, for filling the needs of the Northeast, has recently begun to work its way into the international scenario. In two years, 10% of the crop has been exported.

Production risks – Climate.

37. The Western region is susceptible to periods of severe drought and occasional breakout of pests and diseases. Over the last three years the region has been affected by extreme dry conditions. For instance, production of cotton and soybeans were affected by the drought and the spread of Helicoverpa armigera pest in 2012. Cotton and soybeans productions were reduced by 27% and 15% from crop season 2011-2012 to 2012-2013, respectively. SEAGRI estimated a loss of nearly US$ 1 billion for producers of 9 municipalities. During this crop season, the soybean productivity in the West of Bahia decreased 16% compared to the yields reported during the previous year (57 bags/hectare) and 10% compared to the historical average yield (52 bags/hectare).

38. In the case of maize, whose high yield depends on adequate precipitation, temperature and solar radiation, crop losses were estimated to be up to 15% during the 2013-2014 crop seasons as a result of the prolonged dry spell that affected the entire country. In Bahia, the absence of precipitation was registered during the grain filling stage and there was also an increase in the production costs due to an outbreak of caterpillars.

39. The cotton production losses registered in Bahia during the 2011-2012 crop season ranged between 15% and 70% due to the combined effect of drought and the attack of H. armigera. In addition, there were inadequate weather conditions to sow beans in western Bahia forcing the local authorities to source themselves of beans from other states (Minas Gerais and Paraná).

Production risks – Pests and diseases.

40. As a general rule, the attack of pests (diseases, insects, nematodes) in the West region, is relatively stable between years, with possible augmentation under certain climatic conditions, like for instance fungal diseases, or the most severe attack of caterpillars (such as the newly introduced species *H. armigera*) reported as being more aggressive on drier years[9].

[9] The biology of pests is highly dependent on environmental conditions, especially temperature and humidity. For example, in years of higher moisture increases the risk of more severe attacks from fungal diseases such as the soybean rust. Fungi that act as biological control agents of insect pests are also favored in wet years.

41. An important feature of the dominant production system in the region is the intensive use of the available arable land, represented by crop succession in the same growing season, like soybean/maize or soybean/cotton later followed by beans. This condition created the opportunity for an evolution and adaptation of some major pests, especially insects, nematodes and weeds, which became generic pests of the whole production system, losing their previous status of a unique pest of a single crop. It is specially the case for caterpillars, bugs or whiteflies, which have lost their specificity and became polyphagous and widely adapted pests.

42. Among the insect pests, the main phytosanitary risks associated with these crops are the caterpillar *falsa medideira* and the *caterpillar helicoverpa* (soybean and cotton) and *lagarta da espiga* (maize), which have low impact. As insect pests of moderate impact may be cited the *percevejo marrom* (soybean), the *bicudo do algodoeiro* (cotton), and the *mosca branca*, that despite being polyphagous, cause greater losses in beans where it acts as a vector of viruses. Among the diseases, *antracnose* and *cancro da haste* (soybean) besides *mancha de ramulose* (cotton) cause minor damage, while larger impacts are associated with *ferrugem da soja* (soybeans), nematodes (soybean and cotton) and *mosaic dourado* (beans).

43. As a rule, the pests of this production system are under satisfactory management, imposing predictable although high costs for its control. The control is performed by different techniques, such as chemical, biological, cultural or genetic control. In the latter case, there are varieties which incorporate a toxin expressed by the bacterium *Bacillus thuringiensis* in plant tissues of maize, soybeans and cotton (called Bt varieties), being highly effective against major caterpillars pests. The largest perceived risk is the loss of effectiveness of this technology, due to non-compliance of the requirements for using this advanced technique, by part of the growers, as it is the case of using a refuge consisting of a susceptible variety, in order to reduce the risk of developing resistance to the treat.

44. To help controlling the major weeds, RR (Roundup Ready) varieties were developed, possessing a gene conferring resistance to the herbicide glyphosate. When a grower uses a RR variety (cotton, soybean or maize), the herbicide sprayed all over the crop kills the weeds, but do not affect the crop itself. The risk associated with the use of this technology is the development of resistant weeds, which makes more difficult their control, increasing competition with crop and causing reduced productivity. The risk of developing glyphosate-resistant weeds is recent, but its importance will increase in the coming years, with major financial impact. There is also the risk of maize becoming a "weed" on soybean fields, due to the emergency of voluntary plants from seeds falling to the soil during maize harvest. As the maize is as resistant to glyphosate as soybeans, spraying glyphosate over the field will not result in controlling the voluntary maize plants, which will compete with soybeans and reduce its yield.

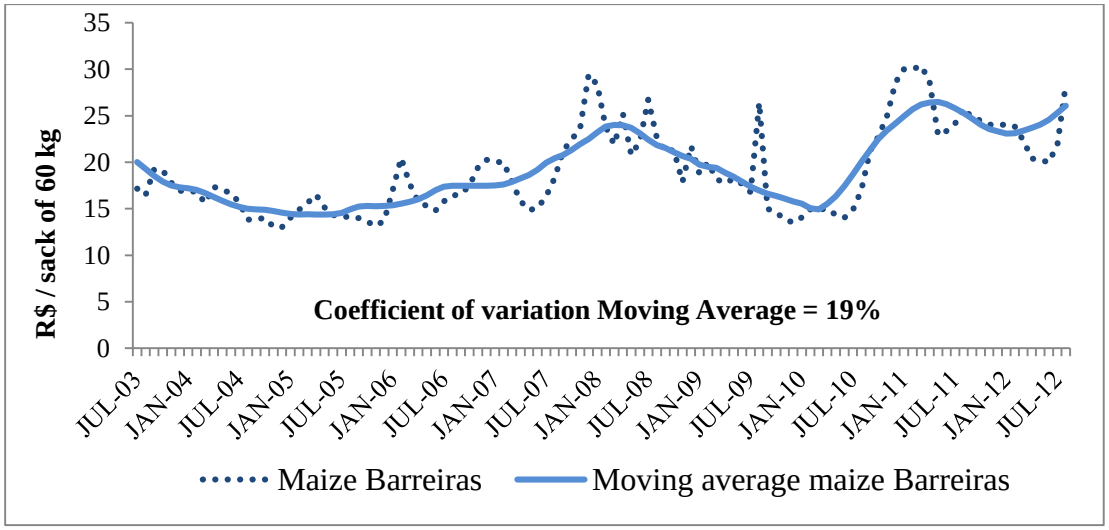
Price risks

45. As an export crop soybean, is traded via the global companies present in the region, modulated by the Chicago market prices. It is estimated by the farmers' association that about 75%-80% of soybean output is sold future before or at the moment of sowing. Prices of cotton are also set following the international market (NYSE), and futures covers 70-80% of the local production. The prices of soybean

and cotton tend to have some adjustment over the international prices according to the domestic demand, but the variation is not more than 10% the international reference price. About 70% of the total volume produce in Western Bahia is exported and the remaining 30% is sold in the domestic market. According to the information obtained from the farmers' organization, the relations between farmers and their cooperatives and the industry (ginners) are fluid and the contracts are honored. Therefore, price volatility of both crops, soybean and cotton, in Bahia, is strongly connected to the volatility in the international market and farmers in the West of Bahia have access to hedging market instruments.

46. Maize produced in Bahia, in turn, is mostly a product for the domestic market and is also included in the Minimum Price Guarantee Policy (it is estimated that only 8%-12% is exported). Different from soybean and cotton, maize is traded spot and the destination is greatly for the poultry industry. The price volatility is mainly connected to the supply-demand forces though being Bahia a surplus state, maize farmers are usually benefited by the CONAB's guarantee policy auctions what results in relatively low price volatility. Figure 8 below shows the actual price series of maize at *Barreiras* (central town of the Western region of Bahia) for the period July 2003- August 2012 and the seasonally adjusted series. The coefficient of variation of the price moving average is 19%, what is not very high but is strongly influenced by the price drop in 2010 following a bumper harvest of maize nationwide.

Figure 8: Maize Price, actual and moving average, Jul-03 to Jul-12



Source: SEAGRI.

47. Input price variation is another source of risk. Both domestic forces and exchange rate have an influence in the price of inputs (agro-chemicals, etc.) that have great incidence of commercial farming in the West of Bahia. This risk was clearly mentioned by the stakeholders interviewed though the mission could not obtain decisive data to support the statements received.

Commercial Fruit-culture

Overview of Subsector and Profile of Main Supply Chains

48. There are different fruit clusters in the state of Bahia: the irrigated fruit district, located in the *Médio São Francisco* Basin; the Reconcavo and the North Coast regions, dominated by citrus fruit growing; the cacao and papaya production in southern Bahia; and the production of coffee and fruit in the highlands of central and southwestern Bahia. A brief explanation on the production patterns of each major fruit subsector is included below.

49. Bahia is the second largest producer of banana in Brazil, according to IBGE data for 2012. Banana is mainly produced in the South region (*Extremo Sul Baiano*) as well as in the Southwest (*Centro Sul Baiano* and *Bom Jesus da Lapa*), and the South Coast (*Ilhéus-Itabuna*), the culture developed in consortium with cocoa for the latter region (see Figure 1: Map, in Chapter 1). In the Vale do São Francisco region, cultivation evolved as secondary option in irrigation projects. Those producing regions are mainly composed by small and medium producers, with the properties areas ranging from 5 to 20 hectares, and part of the production is organized through producer associations. Those organizations present structured production chains that are integrated to the agro-industrial chains.

50. Although 16 banana cultivars have been identified in the producing regions, 43% of plantings are banana Prata and Prata-anã, 23% of banana Pacovan, and 34% of other varieties. All banana produced in the state is marketed "in natura" to regional and national markets. The state of Bahia does not access international markets. Due to deficiencies in transportation logistics and post-harvesting operations, producers were unable to fulfill international standards to export. But in turn, banana is an important element in the diet, not only for its high nutritional value but also for its low cost, along with being easy to produce and quite adapted to several agroecological conditions.

51. The Bahia state is a large producer of papaya fruit and together with Espírito Santo and Ceará states, it represents 83% of national production. Bahia is the second exporter of papaya fruit after Espírito Santo State. The main commercial production regions are located in the West and Extreme south of Bahia (see Figure 1: Map, in Chapter 1). The main papaya cultivars produced in the State are *Solo, Formosa*, and *Havaí*, being the latter variety designated to international markets.

52. The post-harvesting in the West region is highly sophisticated. Most producers have packing houses and some producer have electronic tracking for classification and standardization of fruits to meet the internal and the external markets. On the other hand, the Extreme south region lacks infrastructure to capture a larger share of exports. Today, the region has only 3 packing houses of small scale. Most of Bahia's production is commercialized 'in natura' to supply the internal market. The supply centers throughout Brazil, *Centrais de Abastecimento* (CEASAs), are the main channels of distribution. Small producers without packing houses sell their products directly to intermediate buyers or to the very local market.

53. Bahia is the largest producer of mango in Brazil, followed by São Paulo and Pernambuco states. In Bahia, mango production takes place in several regions of the State including: *Baixo* Médio São Francisco, Médio São Francisco, Serra Geral, and Extremo Oeste (see Figure 1: Map, in Chapter 1). Production in Bahia began through extensive and spontaneously planting. The introduction of technologies, in particular irrigation, enabled a qualitative change of the product, which made it suitable for export. The region of Baixo Médio São Francisco, the largest production region, is characterized by large commercial companies, with high level of infrastructure and technologies to meet internal and external market standards and by small producers, with lower level of infrastructure and capital, assisted by CODEVASF projects (*Companhia de Desenvolvimento do Vale do São Franscisco e Parnaíba*).

54. Most mango production in Bahia is commercialized to the CEASAs on the main urban centers in the Southeast and South regions of Brazil. Usually, the purchase method used by the domestic market is based on fix prices, determined by supply/demand conditions of the week.

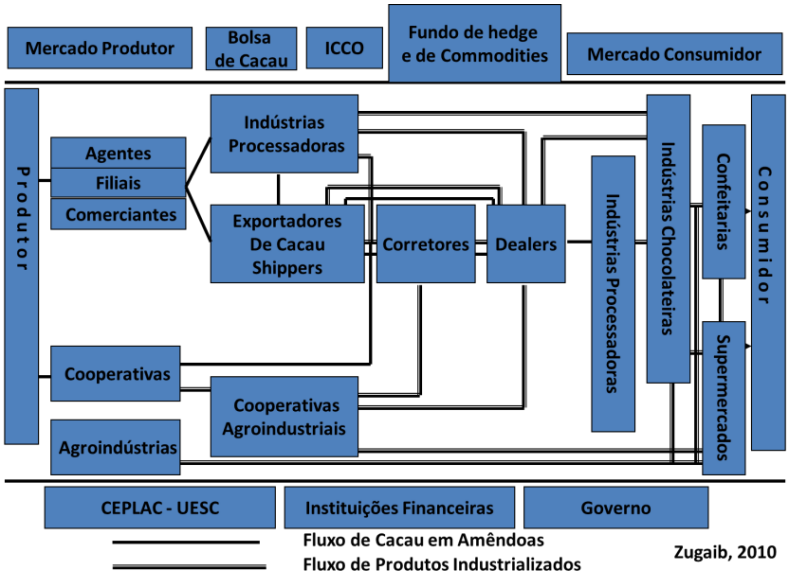
55. Citrus. In 2012 Bahia ranked as the second largest producer of orange and the third of lime in Brazil. The predominant producing regions in Bahia are the West (*Extremo Oeste*), South (*Extremo Sul*), North (*Vale do São Francisco*), and Semi-arid (*Paraguaçu*). From the total planted area in Bahia, nearly 22% is exploited by small holders with less than 5 hectares. Although, small holders play an important role, the majority of citrus production is concentrated in the hands of few commercial producers.

56. Most of Bahia's production supplies the domestic market of in natura orange and is sold to juice industries. The commercialization of oranges, both in Brazil and in Bahia is organized according to a main stream that surrounds the producer, intermediates, and local wholesaler, and final distribution to consumption by merchants, supermarkets, retail shops. The variety of Tahiti lime is the most exported fresh citrus fruit, especially for the European market.

57. The cacao-producing region of Bahia is composed of 92 municipalities, being Ilhéus and Itabuna the main centers. This region accounts for 87% of the national production of cocoa in Brazil. The vast majority of this production is exported to countries like Japan, the Russian Federation, Switzerland and the United States; half of this is sold as processed products (chocolate, vegetable fat, chocolate liquor, cocoa powder and butter) and the rest is exported as cocoa beans. Brazil is also an importer of cocoa beans, since 1989 when a fungal disease called witches-broom blighted local plantations (Text Box 1). This fungus devastated Bahia leaving 200,000 people unemployed and causing social unrest and great damage to the state's economy. For the 20 years following the pest entry, the region struggled to recover and has not fully recovered yet.

58. Figure 9, on following page, explains the cacao supply chain in Bahia today.

Figure 9: Cacao Supply Chain Mapping



Source: CEPLAC

Production Risks - Climate

59. In large parts of Bahia's territory, the annual volume of rainfall is insufficient to supply the water needs of fruit plantations. The uneven distribution of rainfall facilitates the occurrence of long periods of water deficit in the soil and consequent water stress of plants, generating falls in production and affecting the quality and commercial value of the fruits. This represents a serious risk to producers.

60. The drought conditions experienced in 2012 in Bahia affected the irrigated fruit plantations. The lack of water for human consumption forced the local authorities to prohibit the use of water for commercial purposes. As a result, citrus irrigated plantations were induced to sever water stress, a situation that negatively affected the sector. Pineapple producers also reported losses. In addition, the agricultural activities planned for 2013 were delayed because the crop season extended beyond the originally planned.

61. Coffee production in Paloalto region declined 30% to 50% of the one registered during the previous crop season, whereas the Cerrado region was the less affected with only 9% losses compared to the 2010-2011 crop season. The 2012 drought event was registered at a regional level and it covered also the more humid climatic municipalities (Ipiaú, Ubata, Ibirataia, Itagibá, DárioMeira, Jitaúna, Gongogi), and other climatic transition regions. The reduction of precipitation values registered on these areas compared to historical levels caused moderate to severe yield reduction on cocoa plantations.

62. Due to the restrictions on water use for irrigation, over 4,000 hectares of mango trees died in the Serra Geral region. According to the Empresa Baiana de Desenvolvimento Agrícola (EBDA), this represented a profit loss of R$120 million to producers and over 7,000 mango pickers lost their jobs in 2013.

63. In the case of papaya, the decrease on precipitation values caused a rapid ripening of papaya fruits in 2010; for this reason, the offer exceeded the demand therefore the farm gate prices fell sharply.

Production risks - Pests and diseases.

64. In the irrigated region of the middle São Francisco, where there is no water restriction, fruit farming is essentially commercial driven, partially export-oriented, using the most modern technology. This pole produces grapes, mangoes and bananas, with frequent occurrence of insect pests like *cochonilhas* (grape, mango) and fungal diseases (grape). Modern control techniques, which include biological and cultural control and the use of pesticides are common practices, resulting in losses of lower mounts. However, the costs to control *fruit flies* (grape) generate moderate impact level to this crop.

65. The fruit production in the Reconcavo and the North Coast region is dominated by species of citrus, especially orange and lemon, also with the cultivation of pineapple. There is sufficient rain precipitation in this region, so there is no need to supplementary irrigation. Smallholders predominate in this region, including family farmers, whose production targets mostly the local surrounding market supply, besides closer larger cities like Salvador. Citrus plantations are often attacked by fruit flies specially the *mosca negra dos citrus* and viral diseases, with low impact on production. Other diseases of citrus as the CVC (*clorose variegada dos citrus*) are less frequent but cause moderate impacts. In this region, the main pest risk for pineapple production is the *fusariose*, a widely spread disease with moderate impact.

66. In southern Bahia there are two specific poles. The first is the cocoa region, centered on the axis Itabuna - Ilhéus, concentrating all cocoa production in the state. The entry of the disease *vassoura de bruxa*, 25 years ago, caused a severe economic and social disaster (see Text Box 1), and led to the reorganization of the entire cocoa production, currently dominated by small farms and agrarian reform settlements. The main phytosanitary risks of the crop are the *vassoura de bruxa* and *podridão parda*, responsible for moderate impacts due to their frequent appearance on the farms. The extreme south of Bahia as well as the Southwestern region is important centers for the production of papaya, partially directed for export. The dominant system is entrepreneurial though there are several smallholders producing papaya for the domestic market. The dominant production chain is comprised of medium and large producers, using modern techniques for the sake of monitoring and control of the pests. The main risks to papaya production are the viruses, appropriately managed by monitoring their vectors and using cultural practices. These viruses are of frequent occurrence but with low impact due to the mitigation practices used by growers through monitoring and controlling their vector by means of cultural practices, including the use of insecticides. When those practices are not fully accomplished, as happened in the 2013 season, almost 30% of the papaya plants in southern Bahia had to be roughed and destroyed, as they were contaminated by the virus that causes the mosaic disease.

67. Coffee is produced in the central highlands of Bahia. The main problem of the coffee plantation is the *broca do café*, which occurs frequently, causing moderate impacts, and being adequately controlled with the use of pesticides.

68. Quarantine pests are threats that should be considered as having much importance for the fruit production in Bahia, represented by exotic diseases such as citrus greening (also known as *Huanglongbing* - HLB), the black sigatoka of banana, and the pink mealybug which attacks mango and grape. These pests are already present in other regions of Brazil, but have not been recorded in these cultures in Bahia. The eventuality of the introduction in Bahia will result in high adverse impacts to fruit production. In this context, the exotic pest of major importance is the moniliasis of cocoa, not yet registered in Brazil. Its eventual introduction into the Bahia cocoa region is ranked as a very serious threat by CEPLAC (Executive Planning Commission for the Cocoa Crop) technicians, who are responsible for research and technical assistance regarding cocoa plantations. According to these technicians, in the case of entry of this disease in the coming years, the impact will be far greater than that observed with the *vassoura de bruxa* (see Text Box 1). The reason is that currently the cocoa production occurs on small farms and agrarian reform settlements, whose owners do not have a financial condition to withstand the impact of the entry of an aggressive disease expected to cause very great harm, requiring not only more sophisticated technological tools, but also will represent loss of production and higher production costs.

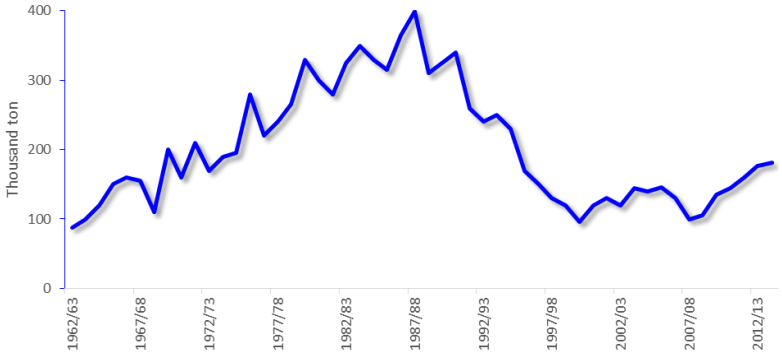
Text Box 1: Cacao Crisis - A Lesson to be Learned?

The cultivation of cacao in Brazil started in the late XVIIIth century as part of the incentive of the Portuguese Crown to diversify the economy of its Brazilian Colony, heavily dependent on sugar exports. The first cacao plantation in Ilhéus, state of Bahia was performed in 1820 by Swiss and German producers. Exports began in 1835 and, since that date, its economic importance to the state of Bahia continuously expanded until very recently. In the first half of the twentieth century, cacao was the most important export product of Bahia and was the major financial source supporting the development of the state.

Historically grown on farms considered as large properties for the type of operation, cacao constituted the economic backing of a large region in Southern Bahia, with the axis Itabuna - Ilhéus being the most representative of the wealth and progress derived from cacao cultivation. Despite its role in the regional economy, the cacao farming, its producers and the product itself were always associated with fluctuations, of moderate to high intensity, mainly due to a financial nature, resulting from the volatility of production, prices and international market.

In specific moments of acute crisis, to support a crop of vital importance, the Government created the Instituto do Cacau (1931) and later (1957), the CEPLAC (Executive Planning Commission of the Cacao Cultivation), linked to the Ministry of Agriculture (MAPA), whose mission is " to promote the competitiveness and sustainability of agriculture, agro-forestry and agro-industrial development of the cacao growing regions." The Research Centre for Cacao (CEPEC), part of CEPLAC, began its operations in 1964. As observed in the chart below, the establishment of CEPEC promoted a continuous growing on cacao production in Bahia and in 1985, Bahia produced nearly 400,000 tons of cacao. Unfortunately, this virtuous cycle was abruptly stopped in 1989, with the entry of the witches' broom disease – caused by the fungus *Moniliophthora perniciosa*- (*vassoura-de-bruxa*) and the cacao cultivation faced the greatest crisis of its history. About 10 years after the entry of the disease, Bahia

reached the all-time lowest cacao production, under 100,000 tones, over 75% reduction as compared to the 1977/88 production record.



Source: CEPLAC

The productive crisis had, not only economic consequences, such as loss of the export market and the resulting need for importing cacao to keep active the associated agro-industry: the fall in production bankrupted most producers already indebted, unable to cope with such a serious disease problem and the cost for controlling it. Therefore, the whole region has been beset by innumerous social problems that caused worrying seizures in certain moments.

Twenty five years after the introduction of the pest, backed by a new land and productive organization structure, and in the midst of another technological cycle captained by CEPEC, cacao production gradually engaged a sustained recovery. Meanwhile, CEPEC researchers strongly casts an alert, as another disease - the moniliasis of cacao, caused by the fungus *Moniliophthora roreri* - has a devastation potential to cacao farming, even more intense than the one caused by the witches' broom. The moniliasis has been recorded a long time ago in countries close to the northwestern border of Brazil, a sign of imminent risk to cross the border and be detected in the country.

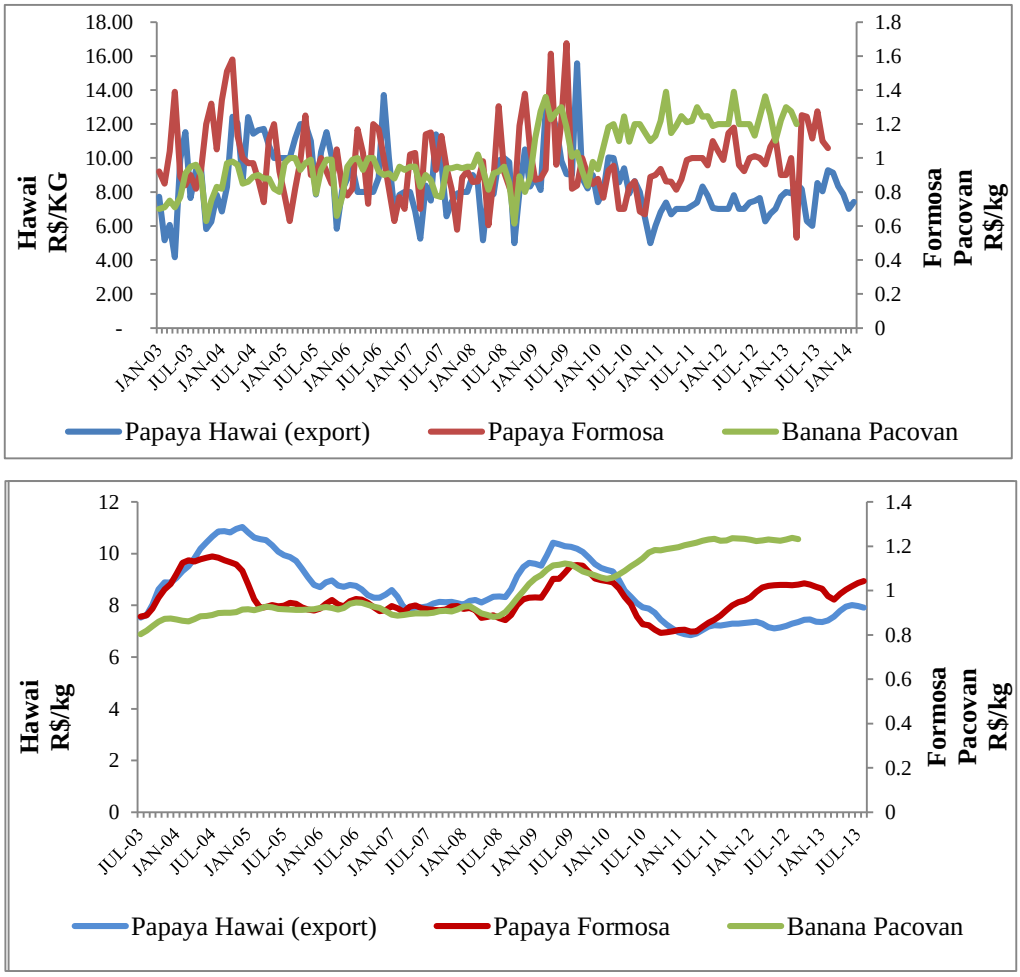
CEPEC scientists did not limit to warning, but are pleading for stronger action to prepare the background for an event seen as almost inevitable in a long-term scenario. Their scientific proposal includes several studies of biology, ecology, epidemiology, biological control and genetic resistance. These studies must necessarily be conducted in countries where the fungus is already widely distributed. However, the difficulties faced over the past few years show that the lesson of the entry of witches' witch, without adequate preparation of the production chain to face it, was not learned. Instead of encouragement, support and facilities to prevent another disaster of even greater proportions than the last - and with even greater social impact, since, currently, most cacao farmers are smallholders and settlers - scientists have found barriers and difficulties of all kinds to develop their studies abroad.

CEPLAC believes that urgent actions must be taken by the Government regarding the preparedness for an eventual introduction of the moniliasis, which is configured as inevitable. Surely, the cost of preventing and be prepared just in case of this disease is to be introduced, will be far less than the cost of a new and profound economic and social crisis in cacao farming.

Price risk.

69. Papaya fruit and banana are among the fruits that are most largely produced and traded in Bahia. They are both traded at the wholesale market in Salvador, CEASA: the mission visited CEASA to hold discussions with key traders. As a result of these conversations and the analysis of price data provided by SEAGRI, it was possible to carry out some analysis. However, since no information was available on the volumes traded at CEASA, the team could not analyze how strong is the relationship between volume traded and inter-annual price variation. But, thanks to the long monthly price series made available by the SEAGRI's *Superintendência de Política do Agronegócio* - SPA(2003-2013) the mission could analyze the seasonal behavior of prices. Figure 10 below shows the actual monthly prices and the seasonally adjusted series.

Figure 10: Actual and Seasonally Adjusted Monthly Price Series, first and second graphs respectively



Source: SEAGRI.

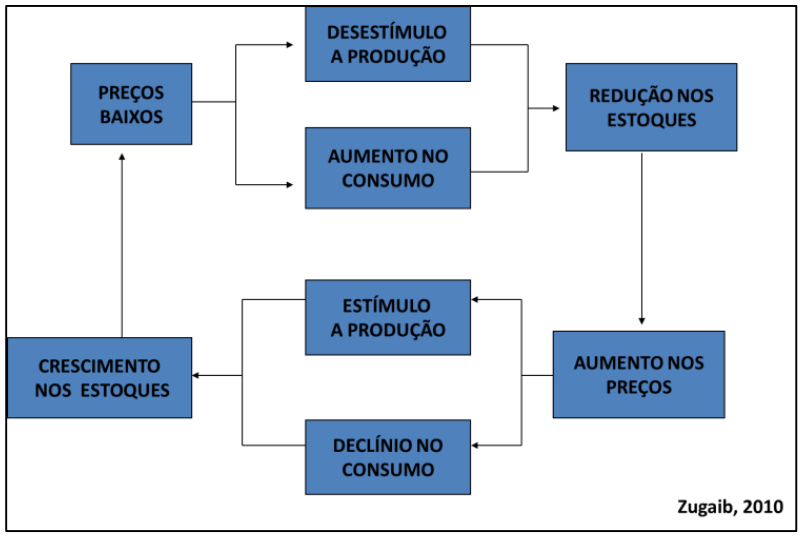
70. The coefficient of variation (Table 2 below) is relatively low for both the actual and the seasonally adjusted series, what denotes relatively low inter-annual price volatility and is a good indication of reasonably well-coordinated supply chain.

Table 2: Coefficient of Variation

	Actual price series	Seasonally adjusted prices
Banana Pacovan	18%	14%
Papaya Formosa	21%	9%
Papaya Hawai	23%	14%

71. As for cacao, the domestic price is strongly influenced by the behavior of the international market. In effect, Brazil's share in cacao world production is 4%-6% during 2000s. The international price is formed around a stock-production-consumption cycle as illustrated in Figure 11 bellow prepared by CEPLAC (Comissão Executiva do Plano da Lavoura Cacaueira).

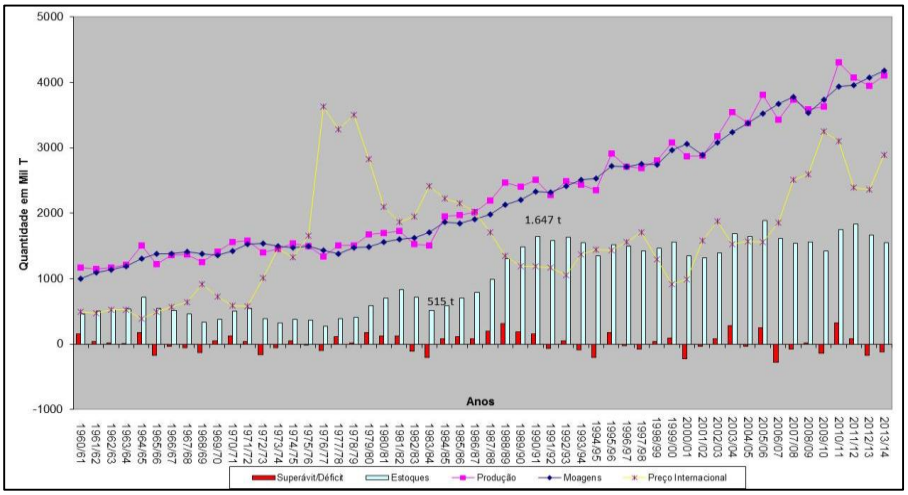
Figure 11: Cacao Price Cycle - Stock; Production; Consumption



Source: CEPLAC

72. The next chart (Figure 12) shows a long term data series of world cacao production, processing, surplus/deficit, stocks and prices. It is evident the relationship between the level of stocks and the prices after 1990s. There is a strong concentration of cacao transportation and processing as well as in chocolate production (36% of chocolate world sales are controlled by six transnational companies as for 2011). Price are somehow determined by oligopolistic forces that control production and trade in the producer countries and consumer markets.

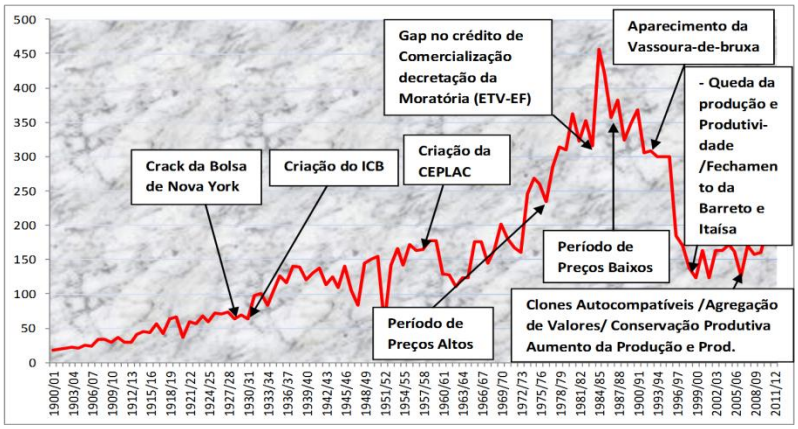
Figure 12: Cacao Price-Stock Relationship, World Market



Source: CEPLAC

73. The Brazilian producers complain about the utilization of the drawback[10] import mechanism for the chocolate and other final product producers as depressing the domestic prices. In addition, there have been a number of events that tended to have an impact on prices and add uncertainties to the already volatile world market (Figure 13).

Figure 13: Events that Impacted Price



Source: CEPLAC

74. The Federal Government has decided to prioritize the valorization of cacao in the Northeast in order to assist the farmers. In effect, cacao was included in the Price Guarantee Policy (PGPMP) –see Text Box 1- for the second year in a row. For the 2014/15 season, the price was fixed at R$ 5.59/kg in the Northeast region and Espírito Santo, with an increase of 11% above the previous season.

[10] Drawback is an incentive for processing plants that produce for export, through which they can import inputs duty free for the transformation into products that will then be exported.

Commercial Horticulture

Overview of Subsector.

75. Horticultural production is spread all over the State with production clusters in *Chapada Diamantina* and *Irecê* regions. The bulk of production is concentrated in few species, such as potato, onion, and tomato. However, Bahia is not highly ranked on vegetable production in Brazil, except for onions, being the second producing state in Brazil. Horticultural production is basically a small scale crop cultivated by commercial and family agriculture farmers. Increases in productivity over the years were driven by the adoption of new technologies: production of seedlings in trays with substrate; expanding the use of hybrid seeds; mechanized planting and harvesting; ferti-irrigation; introduction of modernized inputs and equipment; mulching; screens, and GPS and new agronomic practices: hydroponics and organic productions.

76. Small farmers commercialize their products direct to local consumers and through middlemen who commercialize in supply centers (CEASAs). Commercial producers channel their products to supermarkets chains or large scale intermediate buyers.

Production risks – Climate.

77. Production of horticultural crops is highly susceptible to weather events. For instance, the 2012 drought event caused a sharp increase in the prices of horticultural products due to the reduction of crop yields and the less availability of products that met market quality requirements. According to the Superintendence of Social and Economic Studies (SEI) around 90% of the total production of onion in Bahia state was under the risk of suffering from production losses because of that drought. In addition, the cost of replanting some crops such as lettuce increased almost double due to the scarcity of seedlings. The occurrence of drought events usually comes with high temperatures. The above might be counterproductive for tomato production because it accelerates crop maturity, thus tomato harvesting window concentrates in less time around the affected areas.

Production risks – Pests and diseases.

78. Tomato was largely cultivated in the irrigated districts of the Medio São Francisco Basin, but the development of resistance of the pest *traça do tomateiro* to the insecticides used for its control largely increased the production costs and growers changed to other crops. Presently tomatoes are cultivated in the coastal region where the major risks are nematodes and a fungal disease (*requeima*), of low impact although of high probability of appearance. The insect pests *traça do tomateiro* and *mosca branca* are also frequent and causes moderate impacts, along with diseases caused by virus. Control of the fungal diseases and insect pests are made by specific pesticides.

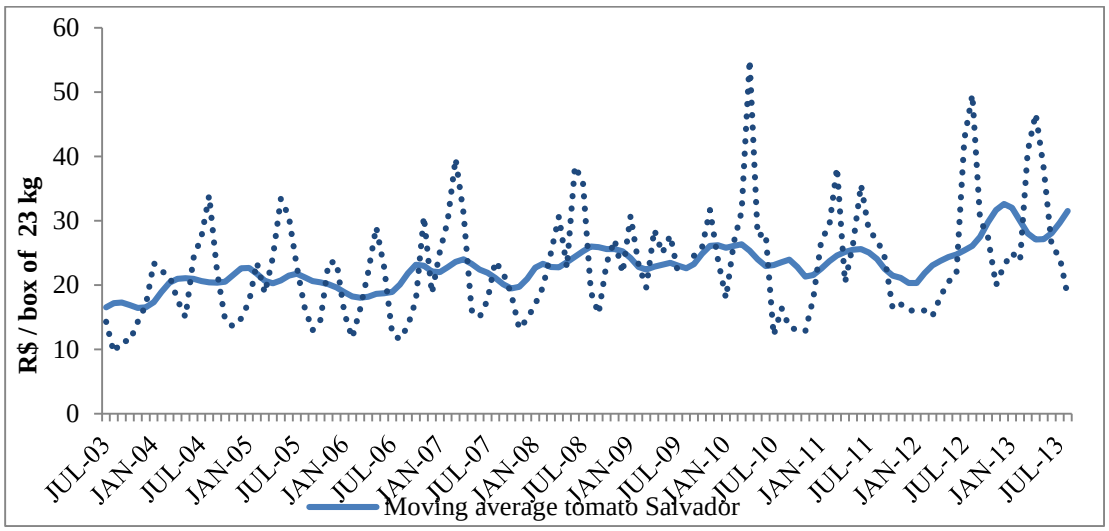
79. Onions are grown largely on the farms close to the borders of the Sobradinho Lake, on the Medio Sao Francisco Basin, being irrigated along its growing cycle. The crop is frequently attacked by nematodes and fungal diseases like *mildio* and *mancha púrpura*, which are adequately managed by fungicide spraying.

80. Potato is a temperate to cold weather crop and is grown only on the highlands of *Chapada Diamantina*. The major pests for this crop are fungal diseases (*requeima*) and nematodes, along with several viruses, which are frequently observed, but origins low impact. Nematodes, which attacks directly the potato are also frequent and results in moderate impacts. Pesticides are commonly used to control these pests

Price volatility.

81. The seasonally adjusted prices for tomato (the only product for which it was possible to obtain a long series of prices) are as volatile as those of banana (Figure 14). However, it is the opinion of several traders interviewed at the CEASA wholesale market of Salvador that the vegetable supply chains are poorly organized and therefore less commercially reliable and subject to supply instability. Domestic traders tend to import vegetables as much as it is possible. This lack of marketing coordination may be causing the observed high intra-annual price variability, which is shown in the large difference between the coefficient of variation of the actual price series and the moving average series, 38% and 14% respectively.

Figure 14: Tomato Price, Ceasa Salvador - actual and moving average



Source: SEAGRI

Family Agriculture

Overview of Subsector.

82. Family farming (*agricultura familiar*) is formally defined in Brazil in terms of area, management, labor, and income. The farm must be managed by the family, and the family must rely on agriculture as their principal source of income.[11] In general, family farming is characterized by low market access, low access to credit and technical assistance, and low levels of farmer organization. Some attribute low

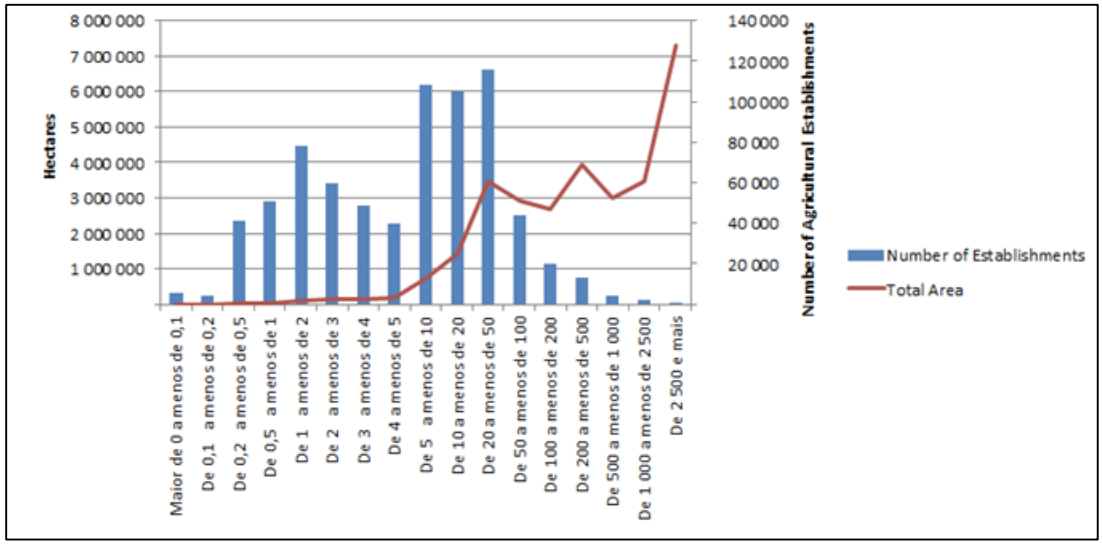
[11] Definition of *agricultura familiar* from Law No. 11326.

participation in associations to a lack of incentives to associate and a history of patronage arrangements that small farmers depend on to receive emergency relief supplies in times of drought.

83. Family farming is the most common kind of agricultural production in Bahia, comprising 87% of establishments, and Bahia has the largest number of family farmers' establishments in Brazil (nearly 15% of total). In Bahia, there are 2,326,437 people employed in family farming, 68% men and 32% women, on 665,767 family farming establishments. In terms of landholdings, however, family farming covers just 32% of total agricultural area, just about 9.95 million hectares. The average family farm is about 16 hectares in size and farmers with less than 20 hectares make up 71% of all agricultural establishments but possess only 9.4% of all agricultural land. Eighty seven percent of family farming establishments have title, covering 93% of all area under family farming. High rates of female-headed households stand out in Bahia at about 40% total households.[12] A long history of principally male out-migration to cities leaves family farmers in the hands of women, with many elderly and children. The portion of dependents (population under age 15 and over age 65) in total population, in many municipalities of Bahia exceeds 50%

Figure 15 below shows the land tenure structure in Bahia.

Figure 15: Agricultural Establishments and Landholdings, Bahia (2006)



Source: Censo Agropecuario 2006, IBGE.

84. Family farmers in Bahia manage mixed subsistence rain-fed systems that involve temporary crops (66% of all family farmer establishments) and some animals (50% raise chickens, 20% sheep and goats - and 27% cattle). A little more than a fifth cultivates permanent crops such as fruit or nut trees. Family farmers produce for their own consumption and for sale (especially cassava, beans and maize), though state transfers from pensions and social assistance programs provide a substantial proportion of families'

[12] Universo: Características da População e dos Domicílios, Censo Demográfico 2010, SIDRA, Tabela 3222.

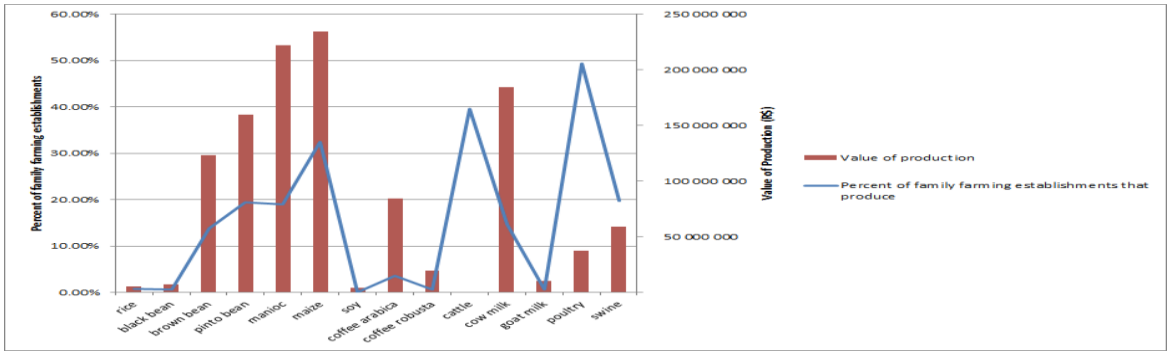
incomes and allow food to be purchased outside the household. Livestock provides important sources of animal protein in meat and milk.

85. Family farming in Bahia has a critical role in food and nutrition security by producing products consumed domestically. Figure 16 (following page) shows the dominant production structure of family farmers. Beans, maize, cassava and cow milk contribute the highest values from production.

86. In Bahia, produce is most commonly commercialized through middleman or in local fairs but also through producers associations and cooperatives. Family farmers also sale their products to institutional market mechanisms: *Programa Nacional de Alimentação Escolar (*PNAE*)* and *Programa de Aquisição de Alimentos (*PAA*).*

87. Bahia is the third producer of cassava in Brazil, behind Pará and Paraná States. In 2012, Bahia produced 2.2 million tons of cassava. Production chain of cassava in Bahia is dominated by family farmers. In Bahia, taking into account its socio-economic importance, cassava has some bottlenecks in its supply chain, such as low productivity and low technology adoption by farmers, over a background of recurrent droughts. In Bahia, maize is an important economic and social crop to family farmers, both for family and animal consumption and sales. Differently from maize production in the West of Bahia, family farming of maize presents a low technological level. Family farmers are responsible for the majority of beans production in Bahia. According to IBGE Agricultural Census (2006), family farmers produce 89% of beans. Productivity from family farming is low compared to producers from West of Bahia and Cerrado biome, due to the low level of technology. The main channels of commercialization are direct sales to local consumers or middlemen or through cooperatives.

Figure 16: Prevalence and Total Value of Family Farming Agricultural Activities[13]



Source: IBGE

Production risks - Climate.

88. The semi-arid region of Bahia is the largest in a single state of Brazil, and one of the most affected by drought. According to FETAG-BA (Federation of Rural Workers of Bahia), there are approximately

[13] Notes: (1) value of cattle not available. There are about 4.4 million heads of bovine cattle owned by family farmers. (2) Poultry value only incorporates value of eggs. There are about 12.65 million head of poultry.

625,000 properties of small family farmers in the Semi-arid region of Bahia. The access to technologies for coexisting with recurrent droughts is very difficult, and farmers tend to repeat the same production system used for decades by their ancestors. As such, very low yield are common, and the key variable is rain: all other risks faced by farmers are blinded by drought, as this determines whether or not there will be production, no matter what will be their productivity. An alternative to the narrow set of alternatives would be looking for crops more adapted to the dry weather, like *mamona* (castor) or sisal, once market problems and value chains organization are adequately addressed.

89. Recently, the 2010-2012 period was marked by severe drought conditions. Like other grain production in Bahia, drought affected the productivity of maize. The 2011-2012 crop season shows the maximum financial losses absorbed by *Garantia Safra* since its inception (see Table 3 on following page), not only because almost all municipalities and farmers received a compensation payout but because the approved compensation amount distributed per farmer almost doubled. During this event, the state authorities of Bahia declared an emergency in 238 municipalities. This event negatively affected the agricultural sector. For instance, the estimated losses in the dairy sector, which is important for smallholders, were estimated to be around R$ 90 million.

Table 3: *Garantia Safra* – Program Evolution in Bahia, 2002 to 2013

Crop Season	Enrolled Munic.	Munic. that received payments	% who received payout	Enrolled Farmers	Farmers who received payments	% who received payout	Total (R$)	Payout/ Farmer (R$)
2002-2003	NA	NA	NA	NA	NA	NA	NA	NA
2003-2004	20	2	10.0%	7,000	285	4.1%	156,750	550
2004-2005	39	1	2.6%	8,907	582	6.5%	320,100	550
2005-2006	35	8	22.9%	9,148	2,565	28.0%	1,410,750	550
2006-2007	22	8	36.4%	6,063	2,199	36.3%	1,209,450	550
2007-2008	54	31	57.4%	15,176	9,913	65.3%	5,452,150	550
2008-2009	87	61	70.1%	22,645	17,615	77.8%	9,688,250	550
2009-2010	151	137	90.7%	64,879	60,557	93.3%	36,334,200	600
2010-2011	204	128	62.7%	114,757	84,774	73.9%	54,255,360	640
2011-2012	209	203	97.1%	149,697	149,123	99.6%	184,912,520	1,240
2012-2013	221	NA	NA	204,285	111,543	54.6%	NA	NA

Source: SEAGRI, 2013.

90. *Garantia Safra* is a federal mechanism that disburses payouts to small farmers when the crops losses exceed 50% of the 10 year average yield registered within a municipality. See Text Box 2 for further details about this compensation mechanism. The number of enrolled farmers and municipalities has grown significantly since it started in 2003-2004 (see Table 3 above) and these figures are expected to increase now that the state government is subsidizing 50% of the cost that it should be paid by producers.

Text Box 2: Brazil - *Garantia Safra*

The *Garantia Safra* program was created in 2002 (Law No. 10420, and then it was modified in 2012 by the Law 12766) with the objective to provide compensations payouts to vulnerable farmers and rural families who are systematically affected by severe drought and excess water

events, within the semi-arid region of Brazil. Given that this federal program reduces the effects of extreme rainfall conditions (mainly drought) it has reduced the need from State Governments and enrolled farmers to request Federal emergency actions. The total annual cost is distributed among the stakeholders (federal, state and municipal governments and the farmers), with the Federal Government contributing the largest share.

The potential beneficiaries of this program are those rural families located in the semi-arid region and who meet the following criteria: monthly gross family income of up to 1.5 times minimum wage; grow between 0.6 and 5 hectares of beans, maize, rice, cassava, cotton or any other agricultural activity that effectively coexist with the semi-arid conditions; request their adherence to the program and pay a small contribution to the Garantia Safra Fund (FGS) for its enrollment.

Operation: The program triggers a compensation payout when crop losses exceed by 50% the 10 year average yield at the Municipality level. In this sense, all producers enrolled in the same Municipality will be treated equally despite registering different level of losses at their individual farming production units. *Garantia Safra´*s compensation payouts are primarily defined by a "hard trigger" scheme, which is an index parameter that is calculated by the INMET. This index is derived from the calculation of individual crop water balance models and whose results are extrapolated to the Municipal level. Given that rainfall conditions may vary in space and in time, there may be cases in which there are differences between what is recorded by the index and what is recorded at the Municipality level. If this happens, a "soft trigger" scheme is adopted; this means that the state extension service would make field inspections in order to determine the damages incurred.

Compensation amount: R$ 760 distributed in 5 monthly payouts[14]. One of the main advantages about this compensation system reported by the beneficiaries is that they receive the payouts directly and they can use them according to their needs. In addition, the timing of *Garantia Safra* payouts matches with the annual schedule of payment of other social benefits that are managed by the Federal Government.

Garantia Safra has shown to be a very popular compensation payout mechanism among small producers located in the semi-arid region. Over a ten year-period (2002-2011), the number of enrolled municipalities and enrolled farmers overall have increased 300% and 900%, respectively. On average, 57% of the total municipalities nationwide have received payouts. The less catastrophic year, measured by the number of municipalities that received payouts, was the 2010-2011 crop season. Interestingly, the previous and the precedent crop seasons were highly catastrophic where payments were triggered in 9 out of 10 enrolled municipalities.

[14] Each installment made by Garantia Safra is equivalent to approximately US$152 per month.

Garantia Safra: Program evolution between 2002-2003 and 2011-2012 crop season

Crop Season	Enrolled Munic.	Munic. that received payments	% who received payout	Enrolled Farmers	Farmers who received payments	% who received payout
2002-2003	333	140	42.0%	200,292	85,056	42.5%
2003-2004	367	136	37.1%	177,839	75,810	42.6%
2004-2005	465	311	66.9%	287,681	211,339	73.5%
2005-2006	543	174	32.0%	356,584	106,081	29.7%
2006-2007	471	392	83.2%	346,321	316,529	91.4%
2007-2008	635	181	28.5%	558,606	182,147	32.6%
2008-2009	714	509	71.3%	553,225	423,538	76.6%
2009-2010	859	801	93.2%	661,802	639,227	96.6%
2010-2011	990	243	24.5%	737,920	166,935	22.6%
2011-2012	1035	1015	98.1%	771,343	769,023	99.7%

Source: Secretaria da Agricultura Familiar

Production risks – Pests and diseases.

91. Beans and maize are attacked by caterpillars, and beans are also attacked by the whitefly, which causes direct damage and is also a vector of the *mosaico dourado*. These pests regularly appear in crops, with relatively small impact. Although less common *podridão da raiz* (cassava) can also cause losses of low impact. However, because of the great and destructive recurrent drought scenario dominating the Semi-arid region, as explained above, phytosanitary risks are not considered important by smallholder family farmers. Some of these risks, such as nematodes or root diseases, or other pests whose symptoms are not very apparent, are even not perceived by the farmers. Moreover, the impact of the pests is in effect low because the plants in the Semi-arid tend to be less palatable to insect, thus reducing its incidence.

92. As a rule, farmers do not adopt measures to control pests on their farms. There is availability of resistant varieties for some of the mentioned pests, but the lack of technical assistance and supply chain coordination prevent farmers to have access to appropriate technologies. Only a minority of farmers use pesticides and cultural practices to control pests on their crops, either due to ignorance, because the practices represent a cost, or because of the high risk of production losses caused by drought, which inhibits the investment in farming.

Price volatility Risk.

93. Price guarantees are used to incentivize production and to provide support to poorer farmers. They are mostly targeted by region, seeking to support poor small farmers (*agricultura familiar*) and commercial farmers. See Text Box 3 with details on the current price support and procurement programs. This has contributed to more stable prices of basic foodstuffs (like beans, maize, cassava flour, etc.) that are in turn the main crops grown by the family agriculture farmers. These interventions through CONAB, the national food supply agency, have led to maintenance of stable prices for consumers even in periods of domestic production scarcity in the state and represent an alternative for sale in periods of

overproduction. The program has limited coverage and can be expanded if more supplies were available. Nevertheless, it was not possible to identify evaluation studies on the impact of the Government price support and procurement programs in Bahia.

Text Box 3: Brazil - Procurement and Price Support Policies

The Brazilian government operates a series of food procurement and minimum crop price policies and programs. They are the PGPM (*Politica de Garantia de Preços Minimos*), which is concerned with commercial agriculture, and the PAA (*Programa de Aquisição de Alimentos*) that is specifically targeted to family farming. The Ministry of Agriculture (MAPA) is responsible for the former policy, and the latter program is the responsibility of the Ministry of Agrarian Development (MDA).[15] PAA is implemented by the Federal Government, states and municipalities. It is also executed by the National Supply Company – CONAB (*Companhia Nacional de Abastecimento*), which also participates in the implementation of PGPM. CONAB is a public enterprise of the MAPA; it is responsible for managing the Brazilian agricultural supply policies.

The PGPM is an instrument that works as a basis for several types of purchasing or financing operations, always with the objective of supporting the producer's income. It is used to smooth producer price variations over time and at the same time facilitate trade of agricultural products from the surplus regions to the deficit ones at prices that are competitive for the producers, particularly in periods of price drop when the transport cost may represent a serious obstacle for commodity flow across the country. The PGPM uses different instruments. One is the PEP (*Prêmio para o Escoamento de Produto*) program, which involves an "equalization" payment to buyers (wholesalers, processing companies, etc.) who agree to pay the producer a specified minimum price. The equalization premium (subsidy) is determined in an auction, with a maximum fixed selling value set by government. This is the most common instrument. A similar program is PEPRO (*Prêmio Equalizador do Produto*), which provides an equalization payment directly to the farmer and works like a deficiency payment by paying the seller (whether a farmer or a cooperative) the difference between the reference price and the price received at auction. A third program is PROP (*Prêmio de Risco para Aquisição de Produto Agrícola oriundo de Contrato Privado de Opção de Venda*), which provides a premium to commercial buyers under a sell option contract, i.e. where delivery takes place in the future (for instance, coffee). This instrument works as a hedging mechanism for the farmer. The Government may also operate the VEP instrument (*Valor de Escoamento de Produto*), through which the Government grants a subsidy to buyers that intend to buy government stocks to supply a specific food deficit region that has been prioritized. This instrument would operate when the market price is higher than the minimum price. Under the PGPM, the government also makes purchases from family farmers and their cooperatives (AGF - *Aquisições do Governo Federal*) at prices that are above market levels when the market operates below the minimum prices. The impact of this program throughout the economy is not supposed to be relevant. Since 2010 family farming has been entitled to 20% of the resources of the guaranteed minimum price program (PGPM).

The government defines the quality, quantity, value and delivery of the products and establishes the regions that have to be supplied on a case by case basis. The Bolsa Brasileira de Mercadorias (Sao Paulo) and other commodity exchanges operate the government stocks auctions and the CONAB'S

[15] MDA is also responsible for the National Program to Strengthen Family Farming (PRONAF).

commercial stock auctions. Among the main products included in the PGPM are: cotton, beans, rice, maize, cassava flour, milk, sorghum, coffee, etc.

PAA was created by Law in 2003. It has two basic purposes: promote access to food to those in need and support family farming. The PAA purchases a wide variety of food produced by family farmers including fruits, vegetables, animal products, etc. The Program is implemented through different modalities that do not involve a bidding process: Purchase with Simultaneous Donation, Direct Purchase (CDAF) and Stock Formation by Family Farming. The Purchase with Simultaneous Donation involves direct purchase of food from family farmers and simultaneous free distribution to people in food and nutrition insecurity as well as to those served by social assistance networks, public facilities for food and nutrition security, and public and philanthropic education institutions. The CDAF (*Compra Direta da Agricultura Familiar*) whereby the government purchases produce from family farmers (enrolled in PRONAF) at subsidized or market prices (reference prices) to supply populations facing food insecurity. The PAA also contributes to the formation of stocks of foodstuffs produced by family farmers and of stocks managed by family farmers´ organizations; farmers' groups stock part of their production in exchange for a promissory note that provides farmers access to financial resources.

The budget of PAA consists of funds from the Ministry of Social Development and Fight Against Hunger – MDS and the Ministry of Agrarian Development – MDA. Since its inception, the annual volume of funds invested increased from US$64 million in 2003 to US$434 million in 2012 – an increase of 580%.

Livestock Production Chains

Supply Chains Profile.

94. As was seen above, cattle, goat and sheep are the main supply chains in Bahia. There are medium and large commercial producers that supply the state, regional and external markets, and family agriculture producers mainly in semi-arid zone. In addition to subsistence crops (maize, beans and cassava) and selected cash crops (e.g. *mamona*) family agriculture farmers keep animals for self-consumption and as a reserve of value.

95. Cattle are produced in all the regions of the state but with emphasis in the West (*Cerrado*), South, Southwest and Valley of Sao Francisco. Production is still dominated by extensive farming models. EMBRAPA have made research for improving cattle production in the *Cerrado*. There is a good infrastructure of federal, state and municipal slaughter houses and processing plants and a good federal and state control and inspection system which is coordinated under the SUASA and SISBI orientations. However, the municipal system still needs more development, homologation and coordination with the Federal and State systems. In addition, there is a significant amount of milk produced in the state of Bahia but productivity per cow is low.

96. With the certification of the Bahia State granted in 2001 by the World Animal Health Organization (OIE) as FMD Free Zone with vaccination and the most recent certification, in 2014 of all the Northern

states as FMD Free with Vaccination, it signaled a promising future for the livestock sector in Bahia. In addition Brazil is certified as Insignificant Risk of BSE, which also contributes to attract meat exporting opportunities.

97. Goats in Bahia are the largest population of the country. There has been a constant increase in the total population except during the drought periods (1992-1995) and (2012-2013) in which there where loses of animals and slow recovery of the stock. Production is mainly in the semiarid area, and this production is in the hands of small family production units (*agricultura familiar*). To counteract the drought there are some isolated research and technical assistance actions to promote the use of *palma forrageira*, silage and hey for feeding the animals during these periods. Unfortunately the extension services at this time are deficient and uncoordinated and do not cover a significant percentage of the small producers, though there are some support projects. There are several slaughter houses for processing the commercial production but not enough for the small producers. EMBRAPA has a Research Goat Center and has contributed to the adaption of resistant breeds and to the development of feeding and management procedures for the semiarid areas.

98. Swine production is low, and the stock has remained constant over the years, mainly concentrated in small properties. In order to improve the production the state has adhered to the National Program for the Development of the Swine Industry. There are 12 slaughter houses with Federal (SIF) and State (SIE) inspection. Most of the State slaughter houses have incorporated the SISBI inspection system. The inspection system will be expanded through the SEAGRI project to build a basic network of slaughter houses and intermediate processing posts (*entrepostos frigoríficos*) to complement the state and municipal infrastructure. The outlook for the expansion of the swine production is good, based on the infrastructure and the expansion of the grains productions in the Cerrado (West) of the State.

99. Apiculture is an important activity, with 9,466 producers and the annual production is estimated in 4,400 tons. The quality of the honey is excellent favored by the environmental conditions. The producers are mainly small producers. There is an acceptable infrastructure of 93 processing plants. The production is used for the local market and to supply other states.

100. Commercial poultry production in Bahia is located in the southwest, southern and western regions. The growing region for commercial poultry is near the city of Feira de Santana, as it concentrates the production companies, input suppliers, service companies, etc., which are critical to support the poultry activity. This commercial activity is backed up by the large production of grains in the Cerrado (West region of the state). The state has good infrastructure for the inspection and control of chicken production. In addition to the large producers, there are many small producers being assisted to produce the chickens for their subsistence, in their backyard, and to supply local markets. For this sector, there are not enough slaughter houses and control and inspection system to facilitate marketing. The extension services for small producers is deficient.

Production risks - Drought.

101. All livestock chains are severely affected by drought in terms of animal losses and production reduction. Within the last two decades, there have been two mayor drought periods: 1992-1995 and 2012-2013. According to Miranda, L. (2014) livestock was severely affected by the 1992-1995 drought. It was estimated that the cattle stock decreased from 14 to 8 million heads. The 2012-2013 drought is considered the worst in 50 years. According to estimates by the Federação da Agricultura do Estado da Bahia (FAEB), the losses are of 100% for several crops and 60% in the herds. Lack of rain has left cattle and goats to starve to death in dry pastures.[16]

Production risks - Sanitary risks.

102. Animal diseases are important production risks. Their damaging potential varies very much among animal species and is very much correlated to the actual risk management actions in place. Bahia has a well-structured animal health program under the responsibility of the Agency for Agricultural Defense of Bahia (ADAB), executive, decentralized and independent regulatory agency of the Secretary of Agriculture, Irrigation and Agrarian Reform (SEAGRI). This Agency was created in 1999 and follows the federal orientations of MAPA.[17]

103. On a global level, there has been a noticeable increase in recent decades in the incidence of exotic animal diseases. Among the exotic diseases that affect world beef trade, two are most relevant: BSE (Bovine Spongiform Encephalopathy or *Mad Cow Disease*) and FMD (Foot and Mouth Disease). Bahia is free of these major exotic animal diseases, which gives a significant advantage to the producers and exporters. The situation about the principal exotic diseases risks can be summarized as follows.

104. FMD. Bahia was certified free of FMD with vaccination in 2001 by the World Animal Health Organization (OIE). In May 2014, other Northeastern states (Alagoas, Ceará, Maranhão, North Region of Pará, Paraiba, Pernambuco, Piauí and Río Grande do Norte) were also certified as free. In the past the occurrence of the disease in Bahia was sporadic and was classified as of medium risk. The last outbreak of FMD occurred in 1997. Currently this risk has diminished because the bordering states are also free with vaccination and because there is a strict national program to control movement of animals and animal products in the country, which provides additional protection to prevent the entrance of this disease.[18] Starting in 2014 the vaccination schedule has been modified and adult animals are vaccinated only once a year and animals less than two years old will continue to be vaccinated twice a year. The goal is to stop vaccinating and be certified as fee of FMD without vaccination in the next future. This will occur when

[16] Miranda, L. A Seca na Bahia. Bahia Agricola. Vol. 9n.2 mar. 2013.

[17] In order to evaluate the performance of the animal health and food safety services MAPA is requesting OIE to carry out the OIE/PVS and GAP Evaluation studies in several states including Bahia.

[18] There exists a Federal Program for the Eradication of FMD coordinated by the Ministry of Agriculture (MAPA) which was started in 1998 and is covering 78% of the area and 99% of the cattle and buffaloes stock. There is also an area free of FMD without vaccination which covers the State of Santa Catharina. The only states which are considered infected are Amazonas (BR-3), Amapá and Roraima (BR-4), in the North Region of the country. The last outbreak of FMD in Brazil occurred in Mato Grosso do Sul and Parana in 2006. (Informe de Situación de los Programas de Erradicación de la Fiebre Aftosa - año 2013 – Documento de trabajo para la COSALFA 41, abril 2014).

all the conditions of the MAPA Federal Program (PNEFA) are met. In any event, the impact of a disease outbreak could be catastrophic in terms of animal losses, eradication costs and export earning losses, and thus the controls have to continue.

105. BSE. According to OIE, Brazil´s risk status for BSE is *Negligible*, the safest of all. To reach this status the country presented a risk analysis situation which probes that there are not cases or possible animals imported from countries where the disease is present or imported feed for cattle containing cattle meat flour and that has a surveillance and prevention program in place. The major risk is from the importation of cattle from infected countries and the appearance of an atypical case as it occurred in the state of Mato Grosso, in 2014. For the prevention of this disease the State has a surveillance program which follows the orientations of the MAPA Federal Program.

106. Highly Pathogenic Avian Influenza (HPAI). Bahia is currently free of HPAI, Asiatic Types, as the whole country is. However, the risk still persists for the possibility of spread by wildlife as it has occurred in other parts of the world.[19] In order to prevent entrance of the disease, Brazil has a plan of action that calls for training of professionals and producers to detect the disease. Bahia is incorporated in the plan of action and has a surveillance system in place, including the wild life, to detect any possible outbreak of the exotic type of HPAI.

107. Classical swine fever (CSF). CSF is a very important swine disease, which causes severe losses of animals and low productivity. It has been eradicated from most of the developed countries, there is enough technology available, specially vaccines, and surveillance methods which make possible to eradicate the disease when well organize programs are executed. The CSF disease has been eradicated in 49% of the Brazilian territory, 54% of the properties and 81% of the swine population of the country. A free area has been established which includes the states of the South, South East and South Regions, and the states of Bahia, Tocantins, Sergipe and Rondônia. In Bahia CSF is part of the National Swine Health Program coordinated by MAPA and executed by ADAB. A survey will be necessary to have definite information on the absence of this disease and to get the certification as free of CSF. There are programmed activities in the State to carry out the risk analysis studies in order to get the OIE Certification.

108. Newcastle Disease Virus (NCDV). This is a very important poultry disease, which can cause serious losses to the producers from killed birds and delays in the restocking of the flocks. This disease is included jointly with the HPAI in the Federal Program of Avian Health coordinated by MAPA. The states have been classified according to the situation of the each state program to prevent and control these diseases. Bahia has been classified as C, which means that the state has medium capacity to execute the

[19] The current international HPAI or "bird-flu" outbreak began in poultry in Southeast Asia and has since spread to Asia, Europe, the Pacific, the Middle East and Africa. Although many countries have eradicated the virus from their domesticated poultry, worldwide eradication is not expected in the short term.

program. Epidemiological studies in Bahia, by Sales et al. in 2007,[20] indicated that there are not active outbreaks and the immunological state of the different modalities of production is acceptable.

109. Prevalent animal diseases of economic and public health importance. Bovine, Goat and Sheep Brucellosis is considered by FAO, WHO and the OIE as one of the most important and widespread zoonosis in the world, causing great economic losses. It can be transmitted to humans causing the undulant fever and joint arthritis syndromes and is a labor related disease due to the contamination of workers in the slaughter houses. Bovine brucellosis due to *Brucella abortus* is endemic and the most prevalent *Brucella* infection in Brazil. There is in place the National Program for Control and Eradication of Brucellosis and Tuberculosis Animal (PNCEBT) coordinated by MAPA, since 2001. Each state has to follow the orientations of the MAPA Federal Program.[21]

110. Alves[22] reported in 2009 a study carried out in Bahia in 2004 to characterize the epidemiological situation of bovine brucellosis. The State was divided into four similar production regions, 300 herds were randomly sampled in each region, and 10 to 15 adult bovine females were sampled in each of these herds. A total of 10,816 serum samples from 1,413 herds were collected. The serum samples were screened for antibodies to *Brucella* spp. by the Rose-Bengal Test (RBT), and all RBT-positive sera were re-tested by the 2-mercaptoethanol test (2-ME) for confirmation. The prevalence of infected herds and sero-positive adult bovine females in Bahia State were: 4.2% [3.1-5.3%] and 0.66% [0.41-0.93%] respectively. This result showed a decrease in the prevalence with reference to other studies carried out in 1972-1974 which showed a 10% rate (Almeida el al, 1988) as a result of the vaccination of heifers and the control of movement of animals.

111. Bovine Tuberculosis is an infectious disease of worldwide distribution caused by pathogenic Mycobacterium that affect humans and several mammals' species. Several studies were carried out. Costa in 2012[23] reported an epidemiological study to characterize the situation of the bovine tuberculosis in the State of Bahia, which was carried out between 2008 and 2010. The prevalence of outbreaks of bovine tuberculosis and positive animals in the state were 1.6% and 0.21% respectively. In production circuits 1 and 2, which correspond to the meso far west Valley St. Francisco, Center-South and South Bahia, and some municipalities of the North Central and Northeast Baiano, the prevalence of infected herds were 2.0% and 2.9% respectively and the prevalence of animals in these circuits were 0.08% and 0.66%

[20] Sales et al. Títulos de anticorpos contra o vírus da doença de Newcastle em três diferentes sistemas de criação avícola na região de Feira de Santana – Bahia. (*Antibody titers against Newcastle disease virus in three different poultry management systems located in Feira de Santana – Bahia).* Rev. Bras. Saúde Prod. An., v.8, n.4, p. 386-393, out/dez, 2007 http://www.rbspa.ufba.br

[21] Normativa Nº6 de 8 de janeiro de 2004. Aprova o Regulamento Técnico do Programa Nacional de Controle e Erradicação da Brucelose e Tuberculose Animal. Diário Oficial da União, Brasília, 12 jan. 2004, Seção 1, p. 6–10: 2001.

[22] ALVES, A.J.S. et al. Situação epidemiológica da brucelose bovina no Estado da Bahia. *Arq. Bras. Med. Vet. Zootec.* [online]. 2009, vol.61, suppl.1, pp. 6-13.

[23] COSTA, L.B. *Caracterização da tuberculose bovina em regiões de relevância econômica no Estado da Bahia*. 2012. Dissertação (Mestrado em Ciência Animal nos Trópicos). Escola de Medicina Veterinária da Universidade Federal da Bahia. Salvador.

respectively. The possible risk factors associated with the occurrence of bovine tuberculosis in cattle above circuits were the type of milk and mixed farm and the property has an excess of 18 female cattle over 24 months of age.

112. This information confirms the existence of these two diseases, brucellosis and tuberculosis, in Bahia and the need to continue and speed the actions for its control and eradication.

113. Food Safety. There has been an increase in the frequency of outbreaks of global food-borne diseases, turning food safety a major concern worldwide. Food-borne diseases pose an important risk because they endanger public health and can interfere with the domestic and external markets. In Bahia, there is very good Federal and State control and inspection service for livestock products. Actions are also underway to execute a project to decentralize the slaughtering which will improve the municipal system. This includes the construction of slaughter houses and intermediate processing units according to the needs of the municipalities. The goal is to have a unified system following the MAPA/SISBI orientations.

114. Finally, it should be mentioned that animal health and food safety risks have a significant impact on all the stockholders of the livestock food chains, which include producers, processors, distributors, consumers, exporters and the government. There have not been animal health risk events recently in Bahia, however there is a potential risk of presentation as have occurred in other states of Brazil and countries. In these cases the impact for the governments was significant and represented costs with actions of eradication, compensation to the producers, etc. On the other hand, exporters suffered high losses from the closing of external markets for long periods until the free status was regained.

CHAPTER 3: ADVERSE IMPACT OF AGRICULTURAL RISK

Indicative Value of Losses

115. The inter-annual agricultural output variations are fairly connected to the overall economy performance, as can be seen in Figure 17 (following page), though the intensity of the variations in the agricultural GDP are greater than in the overall economy but the direction has been the same in 4 out of 5 years between 2004 and 2009.[24]

116. Agricultural production is exposed to normal inter-annual variations and occasional shocks caused by climate, sanitary and other causes. Shocks have a direct impact on the farmers and other stakeholders in the supply chains but also have important fiscal repercussions, reduce the availability of foreign exchange, reduce household and national food security, and in general have an overall macroeconomic destabilizing effect.

[24] Data from IBGE was available only for the years shown.

117. The immediate step for analysis is to distinguish shocks from smaller inter-annual variations in output. Available data on actual losses is not always accurate or consistent enough to facilitate comparison and ranking of the costs of adverse events. Our analysis is thus based on estimates of the "indicative" value of losses over a reasonable long time period that is for the period 1990-2010.

118. The indicative value of agricultural output lost for a particular year is calculated as the deviation of the actual yield from the yield trend value. A loss threshold of 0.33 standard deviation from trend is then set to distinguish between losses due to shocks and those that reflect the normal or relatively easily absorbable downturns.

119. The yield difference in the years where the actual yields were below the loss threshold is then multiplied by the actual area that year, valued at 2010 producer prices and converted into US$ at 2010 exchange rate. Indicative loss values are also compared to agricultural GDP in the relevant year in order to provide a relative measure of the loss.[25]

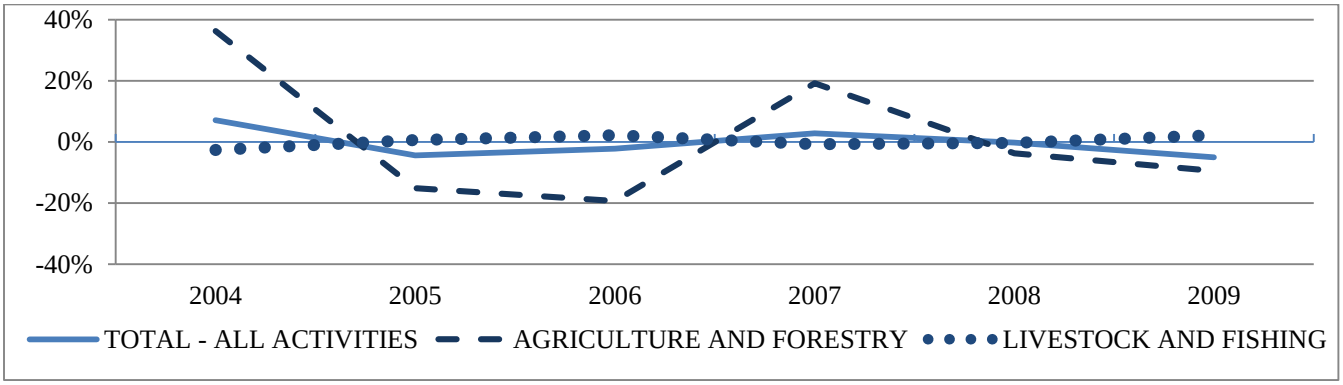
120. The quantification of losses presented in this chapter capture production risks, such as drought and pest and disease outbreaks. Approximately R$ 186 million (equivalent to US$ 105 million at 2010 exchange rate) or 1.9% of the agricultural GDP, was estimated as the value of the average production loss annually in the agricultural sector as a result of unmanaged production risks. Drought was the main cause of these shocks, sometimes in combination with other events, such as diseases or pests. The calculation involves all crops but the losses are concentrated in the following crops: cacao, soybean, cotton, beans, coffee, maize, fruits (papaya fruit, mango, banana and coconuts), cassava, and vegetables (mainly tomato). As indicated in Chapter 2, these crops are responsible for approximately 84% of the losses and are therefore representative of Bahia's agricultural sector risk profile.[26] See Table 4 with detailed information by crop.

121. Average figures are useful to understand the aggregate costs of production risk; yet, they tend to conceal the actual catastrophic impact that some shocks have at the time that they occur. For instance, during the 2002 and 2003 droughts, the worst in the period 1990-2010 for Bahia's agriculture, the losses amounted to R$ 398 million and R$ 390 million respectively, that is more than double the annual average. More recently, in 2006 and 2009, the estimated production losses amounted to R$ 238 million and R$ 263 million, respectively. See Figure 18 with information of the indicative production losses in agriculture for all years in the period 1990-2010.

[25] Analysis of this nature requires a consistent set of data on both production and prices, for an extended time period. The source of data chosen was IBGE, where complete statistical information was found for the period 1990-2010.

[26] The mission carried out a regional analysis in order to detect differences in production volatility. However, the results obtained using municipal data from IBGE were not consistent with the aggregate state data.

Figure 17: Gross Value Added, Growth Rate

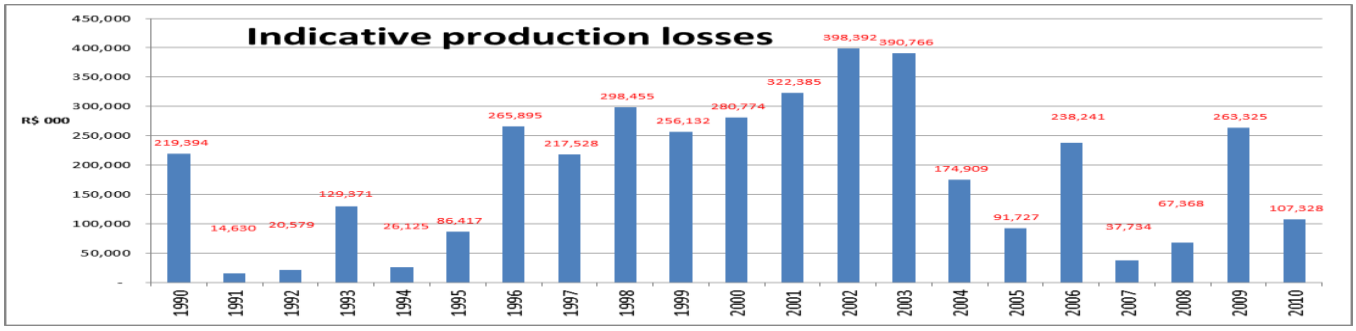


Source: IBGE.

Table 4: Indicative Agriculture Production Losses in Bahia, 1990 to 2010

Crop	Units	Annual average losses (Units)	Annual average losses (R$)	Annual average losses (US$)
Cacao	Tons	11,077	33,169,187	18,846,129
Soybean	Tons	91,425	27,543,470	15,649,699
Cotton	Tons	32,731	17,856,193	10,145,564
Beans	Tons	15,321	15,865,722	9,014,615
Papaya fruit	Tons	25,976	13,320,626	7,568,538
Coffee	Tons	6,147	12,764,459	7,252,534
Maize	Tons	48,094	9,578,931	5,442,574
Mango	Tons	27,980	6,694,441	3,803,660
Coconuts	Thousand fruits	25,891	6,490,757	3,687,930
Banana	Tons	16,775	5,418,082	3,078,456
Cassava	Tons	41,803	4,172,023	2,370,468
Tomato	Tons	8,485	3,936,509	2,236,653
Other			29,293,290	16,643,915
Total			186,103,690	105,740,733
Losses as percentage of Bahia's agricultural GDP			1.9%	

Figure 18: Indicate Production Losses



Source: Based on data from IBGE

122. Further, the losses with respect to the normal agricultural production values tend to concentrate in specific crops. In the period 1999-2003 the losses were highly concentrated in cacao: 48%, 62%, 46%, 44% and 20% of the total losses, respectively. During the very bad years of 2002, 2003, 2006 and 2009, the losses were particularly significant in soybean: 29%, 36%, 35% and 29% of the total losses, respectively. Whereas other years the drought conditions affected more seriously the fruit and vegetable production, like in the period 1996-2000, where the losses of papaya fruit alone accounted for 18%-22% of the total production losses in Bahia. As regards the subsistence crops of family agriculture, particularly beans, the years of 1995-1996, 2001-2004 and 2010 were particularly bad. In 2004 losses in beans were estimated to be R$ 66 million or 38% of the total agricultural production losses in the state. In occasions, the realized risks derive in longer term processes of production downturns (cacao) or recurrent production drops (cassava) or periods of production depression. Text Box 4 illustrates the cacao, cassava and cotton cases.

123. Although livestock production is greatly exposed to sanitary risks, Bahia has not suffered catastrophic events in recent years. The outbreak of an exotic disease (e.g. FMD or BSE) would trigger the elimination of animals, quarantine and disinfection, the loss of external markets, etc. as occurred during the 2005 FMD outbreak in Mato Grosso do Sul and Paraná. The outbreak had great impact on exports and prices of beef, poultry and pork, which only recovered after the lifting of the import bans by Russia (the main importing country) twenty eight months later. One to two months after the import ban by Russia and other countries, Brazilian beef exports decreased from 93.8 thousand tons in September 2005 to 66.1 thousand tons in December 2005.[27]

Text Box 4: Three Cases - Long Term Impacts of Realized Risks

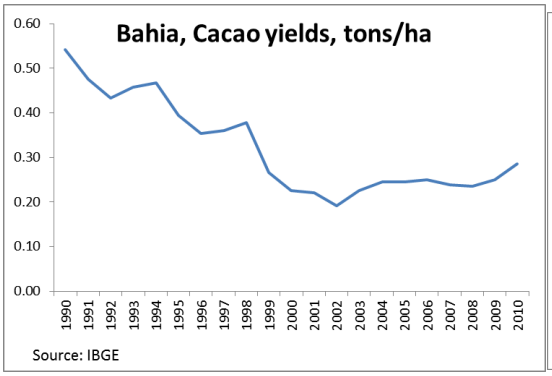
Cacao. Cacao productivity and production in Brazil has declined over the years because of different factors (see Chart below), including: (i) the fall of international prices during the 1990s; (ii) the infestation of the Bahian cacao plantations with the witches broom (*Moniliophtera perniciosa*), reported in Chapter 2; (iii) the erratic rainfall pattern reported between 1992 and 1997.[28] As a result of the above and the combination with other production risks discussed in the cacao section, the Bahia cacao share on the gross value of agricultural production declined from 36% in 1985 to 7.4% in 2010.

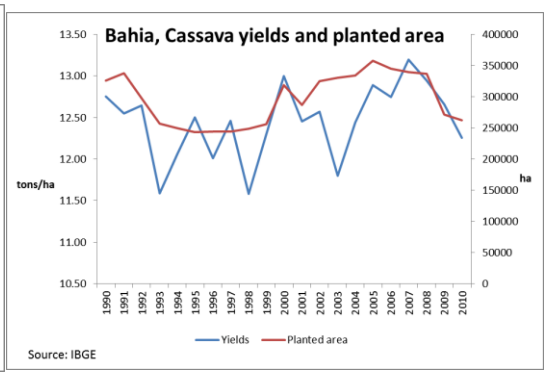
Cassava. Cassava is a very rustic plant that demands less water than many other crops. In consequence, it is a very popular crop among smallholder farmers. As a result, cassava is produced around the country and Bahia is the state that concentrates the largest planted area, with around 262,000 hectares (2010). Based on IBGE figures (1990-2010), it is observed that the planted areas have remained relatively steady between 1990 and 2010 but yields have shown an erratic pattern. Not surprisingly, the most

[27] Costa, R., David A. Bessler, David A. and C. Parr Rosson, C. Parr. The Impacts of Foot and Mouth Disease Outbreaks on the Brazilian Meat Market. Selected Paper prepared for presentation at the Agricultural & Applied Economics Association's 2011 AAEA & NAREA Joint Annual Meeting, Pittsburgh, Pennsylvania, July 24-26, 2011 http://ageconsearch.umn.edu/bitstream/103811/1/AAEA%202011%20Costa%20Bessler%20Rosson.pdf.

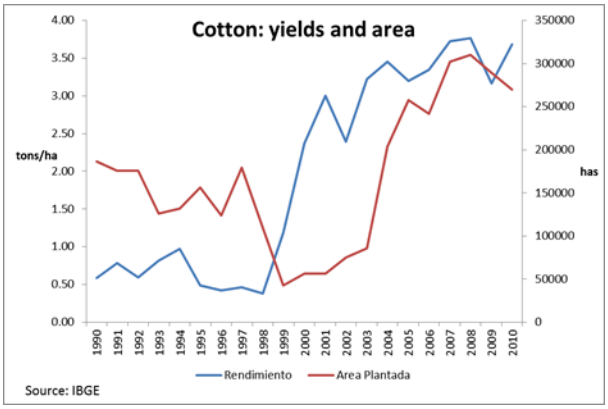
[28] Peres Filho, 2001.

severe cassava yields reduction occurred in drought years (i.e. 1992-1997, and 2010). This seems to be already a regular pattern.





Cotton. The 1994 season harvest, which was considered normal, and was mostly originated in the traditional cotton production areas of Semi-arid, was followed by a period (1995-1999) of rainfall scarcity and pest incidence (mostly *lagarta rosada* and *bicudo*) that resulted in a significant yield and output drop (see Chart below). It was in that period that production shifted from the traditional Semi-arid regions to the Cerrado, a shift that involved a technology transformation from traditional production methods to an entrepreneurial model. Cotton produced in Bahia's Cerrado in 1990 represented less than 7% of total cotton produced in Bahia and in 2000 it represented more than 93%. From 1999 there was a continuing increase in the planted area and the productivity in the Cerrado under the new entrepreneurial technological model while the cotton industry in the Semi-arid fell in an economic crisis.



The table below shows the climate behavior in Bahia's Semi-arid in the 1995-1999 crisis period that, together with pest attacks, precluded the continuation of cotton production in the Semi-arid.

Year 1994	Dry year, with moderate *El Niño* intensity.
Year 1995	Total rain fall indices lower than the average. Grain cultures suffered great losses.
Year 1996	Low amount of rain during cultivation periods.

Year 1997	*La Niña* in the Semi-Arid of Bahia, with lots of rain. More than half of the rain was concentrated in March. Dams filled up, rain was good for fruit and forage, but was not very beneficial to general crops as it was concentrated in one month.
Year 1998	Dry year, with strong *El Niño* intensity. SEAGRI published a study that indicated that grain culture were negatively impacted and suffered severe losses.
Year 1999	In the *Agraste* rainfall irregularity had severe impacts.
Year 2000	Rain in the Semi-arid region due to *La Niña*. Rain was evenly distributed from November to April, 2001. A year similar to this one occurs once every ten years in the Brazilian Semi-arid Region.

CHAPTER 4: STAKEHOLDERS ASSESSMENT

Impact of Risks at Individual Stakeholder Level

124. How the losses attributed to past occurred risks are distributed among stakeholders along the supply chains is to a great extent a function of the supply chain governance and the stakeholders' capability and opportunities for risk management. This section provides a discussion on the impact of the main agricultural risks identified in the section above on the different actors of the main agricultural supply chains in Bahia.

Table 5: Stakeholders risk profile

Stakeholders	Most common risks	Significance of risk	Current capacity to manage risk
Farmers - Agriculture	Severe drought events, irregular rainfall and high temperature.	Yield variability, increase in unit production costs among commercial farmers. Prolonged drought conditions affect the size and quality of fruits. Seedlings mortality (vegetables).	Crop diversification to local low water demanding cash crops, such as mamona, etc. (family agriculture). Poor technical assistance services prevent risk management (see Text Box 5).

Stakeholders	Most common risks	Significance of risk	Current capacity to manage risk
		Low productivity and risk of food insecurity among family agriculture farmers.	
	Pests and diseases	Family agriculture in the Semi-arid: pests and diseases are blinded by the major risk represented by droughts; growers do not pay necessary attention to pests. Commercial farmers: some pests and diseases represent a critical threat to agro-industry (cacao, resistant weeds, etc.). Cost of production is high due to pest controls in West Bahia.	Only a minority of family agriculture farmers practice pest control or plant resistant varieties. Most of fruit producers monitor and control major pests. Large commercial farmers: pest monitoring, and biological, cultural, biological, genetic and chemical control. Poor technical assistance services prevent risk management.
Livestock producers	Drought. Animal diseases: Exotic diseases (FMD, BSE, HPAI). Animal diseases: Prevalent diseases of economical and public health importance (Brucellosis, Tuberculosis, Classical Swine Fever, Newcastle Disease).	Animal losses, decreased production. Quarantine and restricted movement and trade of animals and animal products. Public health risk from zoonosis (contamination of meat and milk). Financial losses.	FMD vaccination. Good Federal and State FMD and other exotic diseases eradication and prevention programs; non updated programs for the control of diseases, such as bovine brucellosis and tuberculosis.

Stakeholders	Most common risks	Significance of risk	Current capacity to manage risk
		Reduced exports. Family farmers: greater exposition to food insecurity.	Alternative feeding with Palma Forrageira in semiarid areas. Family agriculture: financial aid by the government -Government programs such as Garantia Safra e Bolsa *Estiagem*. Extension services are very deficient to assist small producers on animal health and animal production aspects.
Processors/ Exporters	Animal diseases: Exotic diseases. Food Safety: Risk of contaminated products with bacterial of chemical agents. Risk of chemical or biological contamination of agricultural products.	Shortage of primary products to operate the processing plants. Loss of domestic and external export markets. Shipment returned. Loss of markets.	Good infrastructure of slaughter houses and processing plants. Good Federal and State inspection and control system for animal's products (SISBI). Limited municipal slaughter facilities and control and inspection programs. Need to fully coordinate the control and inspection municipal system with the federal and state system.
Government	Drought Animal Diseases: Exotic and prevalent diseases.	Social instability. Budget implications. Reduction of GDP.	Budget provisions for risk coping programs (drought support programs, emergency funds, compensation funds).

Stakeholders	Most common risks	Significance of risk	Current capacity to manage risk
	Food Safety.		
Consumers	Food safety.	Food borne diseases.	Government contention and emergency programs. Non well-coordinated Federal, State and Municipal food safety systems: initiative to establish a State Food Security and Safety system following the SISBI orientations.

Text Box 5: Lack of Technical Assistance - Limitation to Agriculture Risk Management

The Empresa Baiana de Desenvolvimento Agrícola S.A. (EBDA) was established in 1991 from the merger of Empresa de Pesquisa Agropecuária da Bahia (EPABA) and the Empresa de Assistência Técnica e Extensão Rural da Bahia (EMATER-BA). The resulted corporation, whose shareholders are the State Government and the Brazilian Agricultural Research Corporation (EMBRAPA), has the largest coverage in regard of free public Technical Assistance and Rural Extension, operating in 417 municipalities in Bahia, with over two thousand professionals, including researchers, extension workers, and support staff.

Its mission is "to contribute to the promotion of sustainable rural development, focusing on expansion and strengthening of family agriculture, enabling the necessary conditions for the full exercise of citizenship and improving life quality of the farmers".

Although the EBDA represents, in theory, the most important organization of the State Government regarding the generation and transfer of technology, in practice its operational capacity is heavily truncated and far distant from the minimum expected standards, in accordance to the testimony of government agents, farmers and their organizations. There are no research projects in progress and technical assistance activities are severely restricted or do not exist at all. With indebtedness estimated up to US$ 150 million, mainly related to debts with its own employees, without conditions to perform financial operations on its own, and having not hired or substituted staff since its establishment, the EBDA is also suffering from recurrent strikes. During the period of the mission in Bahia, EBDA personnel were on strike for over 60 days.

The proposed risk management solutions in Bahia are to a great extent technological, comprising a first step of generating innovations, followed by transferring the technology to the farmers. The latter is the

most crucial now. In effect, the mission members could observe pilot projects aimed at coping with drought, which were developed by EMBRAPA, comprising a set of simple, efficient and inexpensive technologies, perfectly adapted to the semi-arid and costal conditions of the state of Bahia. There are also technologies in the two EMBRAPA research centers visited (Semiarid and Cassava and Fruit) readily available to be transferred to growers. The lack of an efficient technical assistance service aborts the possibility of growers to benefit from already available risk mitigation technologies.

Vulnerable Hotspots

125. The impacts of the aforementioned risks have greater consequences for human welfare among the individuals, communities and regions of Bahia that are more vulnerable. As we have already seen, a single risk such as drought has different effects on different systems of productions and producers. Vulnerability is the concept that explains this heterogeneity in impact.[29]

126. Climate variability has long been considered a constraint to economic development and poverty alleviation in Northeast Brazil. Long-term impact of repeated exposure to shocks bring household food insecurity, which is much higher in the rural Northeast than urban, and whose rural levels are amongst the highest in Brazil. In addition, repeated shocks confine rural households into a poverty trap, exhausting savings and dissolving investments that would otherwise help propel the household ahead. In effect, although poverty has been declining in the Northeast as in the rest of Brazil in the last decade, poverty in rural areas, where livelihoods concentrate on agriculture, remain high. The portion of the rural population living in a household with less than ¼ minimum salary[30], at 12.4%, is nearly triple than the urban rate (4.7%) in Bahia.[31]

127. Vulnerable households respond to shocks by reducing household consumption, selling household and productive assets, and seeking income sources off the farm with diverse strategies. Expenditures on drought mitigation and emergency measures also divert resources from longer term investments in human capital and productivity.

128. State transfers for old age pensions and Bolsa *Familia* serve to diversify the poor's portfolio and buffer the direct effects of drought.

[29] Vulnerability is "the likelihood that at a given time in the future, an individual will have a level of welfare below some norm or benchmark." Common welfare indicators include poverty measurements, household expenditures, savings levels, and food security and nutrition measures (such as food consumption score and household dietary diversity). Though vulnerability depends on the severity of external shocks like climate, the likelihood of a drop in welfare depends on both people's context and capacity to act and react. Socio-economic assets and institutions play an important role in people's vulnerability.
[30] One minimum salary is R$510.
[31] Census 2010. Tabela 3.16.3.6.

129. To capture why vulnerability varies between individual to individual, household to household, vulnerability can be seen as the function of three factors: (i) sensitivity, (ii) adaptive capacity, and (iii) exposure.[32]

i. **Sensitivity** is the degree of impact of the initial shock. Sensitivity can be thought of as the elasticity of household welfare (e.g. consumption levels) in response to a shock.
ii. **Adaptive capacity** is the ability of the household to access ex-post coping strategies that helps the household return to pre-shock welfare levels.[33]
iii. **Exposure** is the probability of the given shock materializing and affecting the household's assets.

130. Annex 2 expands upon these relevant indicators and suggests measurements for analyzing vulnerability to drought, the most significant agricultural risk for small farmers in Bahia.

131. Policy can reduce all three aspects of vulnerability: sensitivity through encouraging diversification away from drought-exposed livelihoods to better adapted sources of income/production; adaptive capacity through education, land regularization, market access and social protection; exposure through territorial planning. This methodology should be applied at the municipality level using available IBGE data, and state or policymakers should identify which welfare indicators they wish to prioritize in the analysis. For example, a state that is more concerned with vulnerability that causes hunger or malnutrition will involve a very different policy response than a concern for rural exodus/out-migration. Participatory territorial planning methods should be involved to validate and gain ownership over a technical vulnerability analysis.

CHAPTER 5: RISK PRIORITIZATION AND MANAGEMENT

132. To better allocate scarce resources, it is important to understand which risks are causing the largest shocks to the sector in terms of losses and observe at what frequency they occur. This chapter summarizes the priority risks faced by the agricultural sector in Bahia and the possible risk management solutions, as identified, validated, and prioritized with sector stakeholders.

Risk Prioritization

133. Below are the tables containing the agricultural risk prioritization defined based on the probability of the events (number of years when the risk event is expected to occur) and their expected impact, for domestic and export crops. The identified risks located in the shadowed area represent the most significant ones due to their potential to cause the greatest losses and the higher frequency of their occurrence.

[32] Lindoso et al. 2012. "Indicators for Assessing the Vulnerability of Smallholder Farming to Climate Change: The Case of Brazil's Semi-Arid Northeastern Region." Instituto de Pesquisa Economica Aplicada. International Policy Centre for Inclusive Growth.
[33] Adaptive capacity is a subset of resilience. USAID defines resilience as the ability of people, households, communities, countries, and systems to adapt to and recover from shocks and stresses in a manner that reduces chronic vulnerability and facilitates inclusive growth.

Table 6: Large scale entrepreneurial production system in the West of Bahia: soybean, maize, bean, cotton

Impact / Likelihood	Low	Moderate	High	Critical
Highly Probable (1 in 3)	▪ Drought (maize) ▪ Pests -*falsa medideira* e helicoverpa (soybean), *broca* (cotton), *lagarta do cartucho* (maize) 1/ ▪ Diseases -antracnose and *cancro da haste* (soybean) ▪ Disease-*ramulose* (cotton) 1/ ▪ International price volatility 3/ 4/	▪ Drought (soybean and cotton) ▪ Pests –*percevejo marron* (soybean), *lagartas e bicudo* (cotton), *lagarta de espiga* (maize), mosca branca (beans) 2/ ▪ Disease –*ferrugem* e nematodes (soybean), *virus do mosaico dourado* (beans) 2/	▪ Weeds resistant to herbicides (cotton, soybeans, maize)	
Probable (1 in 5)		▪ Input price increase 3/		
Occasional (1 in 10)			▪ Severe drought 5/	
Remote (1 in 20)				

1/ Control is usually adequate and damage is therefore relatively low and even if not properly controlled damaged will not be very significant because these pests/diseases are not very aggressive.

2/ Control is usually less effective than for those pests and diseases quoted as low impact because they are more aggressive if not properly controlled and even if properly controlled there always be some losses.

3/ Price volatility of soybean is relatively high but the current prevalent high level of prices make price variations less relevant; however there is an increasing risk of rising input prices that may jeopardize the entire business for smaller, less technological and more distant farmers.

4/ Significant price drops of crops that are consumed principally domestically (maize and beans) are prevented by the minimum price policy.

5/ Very large scale farmers have high absorption capacity and count on market mechanisms to transfer risk (insurance) but other farmers may accrue important losses when severe droughts occur.

Table 7: Commercial fruit-culture (papaya fruit, mango, pineapple, citrus, banana, etc.) and cacao/coffee-culture, small, medium and large scale

Impact Likelihood	Low	Moderate	High	Critical
Highly Probable **(1 in 3)**	▪ Pests –*moscas das frutas* (citrus, papaya fruit), *cochonilhas* (grapes) ▪ Diseases –virus (citrus), fungus (grape)	▪ Pests–*moscas de fruta* (grape), *broca do café* (coffee) ▪ Diseases –*fusariosis* (pineapple), *cancro bacteriano* (grape), *virosis* (papaya), *podridão parda and vassoura de bruxa* (cacau) ▪ Price volatility (cacao) 4/		
Probable **(1 in 5)**	▪ Price volatility (fruits) 3/	▪ Disease –amarelinho (citrus)		
Occasional **(1 in 10)**		▪ Severe drought 5/ 7/	▪ Diseases – HLB (citrus), sigatoka negra (banana), *cochonilha rosada* (grapes and mango) 1/ ▪ Severe drought (coffee) 6/	▪ Disease – *moniliase* (cacao) 2/
Remote **(1 in 20)**				

1/ These diseases are present in Brazil but not in Bahia for the moment.

2/ This disease is not present in Brazil but it is present in neighboring countries and if it arrives in Bahia will be catastrophic for cacao production.

3/ Supply chains are relatively well coordinated and vertically integrated and therefore there is a great deal of production and marketing planning, though it could be improved.

4/ Cacao domestic price follows international price adjusted by draw back imports by cacao processing plants that push production prices down. Volatility is high.

5/ When there is an extreme dry spell the municipalities have restricted the use of water for commercial purposes but not for water consumption, with the exception of fruit plantations located close to San Francisco River.

6/ Coffee losses may range between 15% in high altitude lands (benefited from having more fertile soils, higher precipitation regime) to 50% in low altitude lands (prone to higher temperatures).

7/ Irrigation available.

Table 8: Commercial horticulture (potato, tomato, onion, etc.), small and medium scale

Impact / Likelihood	Low	Moderate	High	Critical
Highly Probable (1 in 3)	▪ Diseases –*requeima* (tomato and potato), nematodes (tomato and onions), mancha *purpura* and mildio (onion), virus (potato)	▪ Pests –*traça do tomateiro* and *mosca branca* 2/ ▪ Diseases -virus (tomato), nematodes (potato) 2/ ▪ Drought and high temperatures (general) 3/	▪ Price volatility 1/	
Probable (1 in 5)				
Occasional (1 in 10)		▪ Severe drought 4/		
Remote (1 in 20)				

1/ Highly uncoordinated supply chain and poor loyalty result in low supply/demand planning and high price volatility. Limited irrigation and low technology prevent production stability and fulfillment of quality standards further increasing volatility.
2/ Very aggressive pests and diseases and difficult to control as is relatively less sensitive to pesticides than the other pests and diseases classified as low impact.
3/ Yields are negatively affected due to lack of soil humidity; in addition, dry spells may reduce products quality (less uniform products) thus farm gate prices are less competitive.
4/ Irrigation available only to some farmers.

Table 9: Family agriculture mainly in semi-arid zone, subsistence (maize, beans and cassava) and limited trade of food crops and some selected cash crops (e.g. mamona) and livestock (goat and sheep)

Impact / Likelihood	Low	Moderate	High	Critical

Highly Probable (1 in 3)	▪ Pests- *lagartas* (maize) 2/ ▪ Pests-*lagarta* and *mosca branca* (frijol) 2/ ▪ Virosis e nematodes (cassava) 2/ ▪ Drop in prices(corn, beans) 1/	▪ Irregular precipitation (heavy rain followed by extended dry spells) ▪ Price volatility (cassava)		
Probable (1 in 5)	▪ Disease-*podridao da raiz* (fungus) (cassava)			
Occasional (1 in 10)				▪ Severe drought
Remote (1 in 20)			▪ Virus *cuarentenarias* (cassava)	

1/ Price drop are limited because of government price support policy.

2/ Low impact risk because these diseases are part of the production environment and the farmers are used to cope with them with little harm.

Table 10: Livestock (beef and dairy, goats and sheep, poultry and swine production –commercial and family agriculture)

Impact **Likelihood**	**Low**	**Moderate**	**High**	**Critical**
Highly Probable (1 in 3)		▪ Bovine brucellosis, tuberculosis and cattle rabies 3/		
Probable (1 in 5)		▪ Food-borne diseases from animal products	▪ Moderate drought	
Occasional (1 in 10)	▪ Newcastle disease virus (poultry)	▪ Classical swine fever	▪ Export suspension because of appearance of exotic diseases in	▪ Foot and mouth

			Brazil's states other than Bahia (enabling environment risk)	disease (cattle) 2/ ▪ Severe drought 1/
Remote **(1 in 20)**			▪ Highly pathogenic avian influenza (poultry)	▪ BSE (cattle)

1/ Severe droughts occurred in 1951-53, 1992-95 and 2012. Losses of the most recent one were estimated as 60% mortality of total livestock stock.

2/ The risk is considered occasional subject to the consolidation of the current prevention and contention measures.

3/ Lack of appropriate sanitary attention increase the risk of these contagious diseases among family agriculture producers.

134. Corollary: No highly probable or probable risks are expected to have high or critical impact. However, a number of other types of risks were identified that have expected moderate impact and 1 in 3, 1 in 5 and 1 in 10 year occurrence probability. They are climate (drought), pest and diseases and price volatility risks (high impact) and involve all five farming systems analyzed. To a great extent the realization of those risks have no high or critical impact because of the many government interventions that are in place to produce innovations, cope with drought and support crop prices. In addition, there are few risks that still having occasional (1 in 10) occurrence likelihood could cause high/catastrophic damage if they occur. They are fruit and cacao diseases, severe drought and exotic livestock diseases. It should be noted that some risks like foot and mouth disease and *moniliase* (cacao) are quoted as occasional and remote and of critical impact but they can occur any moment and the relevant sanitary agencies must be duly prepared to prevent and respond adequately.

135. Considering the production value as a measure of the aggregated impact of risks, drought, aggressive pests and diseases and weeds resistant to herbicides in Western Bahia are the greatest challenge, involving soybean, maize, cotton and fruits, see Figure 19 on following page. Aggregated these crops account for more than 70% of Bahia's agricultural gross production value. In particular, severe drought has an extremely high damaging potential for the agricultural economy of the State though it is expected to occur only every ten years. As for family agriculture, irregular rainfall and drought appear as the only important risk.

136. The picture looks slightly different if we look at the risks from the perspective of their impact potential (moderate to critical) in relation to the possibility to manage them appropriately (none to very high). Table 11 (on following page) illustrates that situation. Under such perspective, severe drought and moniliase disease in cacao appear as the risks with the most critical potential impact and the ones that have the minimum management capacity, therefore requiring medium to long term technology investments and advance preparation to cope with them. Other diseases such as sigatoka negra (banana) and cochonilha rosada (grapes and mangoes) have also minimum possibility to manage successfully though with a lower damaging potential. Weeds resistant to herbicides (cotton, maize soybean) are a high impact risk for agriculture in West of Bahia.

Figure 19: Risk Incidence based on Likelihood, Expected Impact and Relative Economic Relevance of Subsector

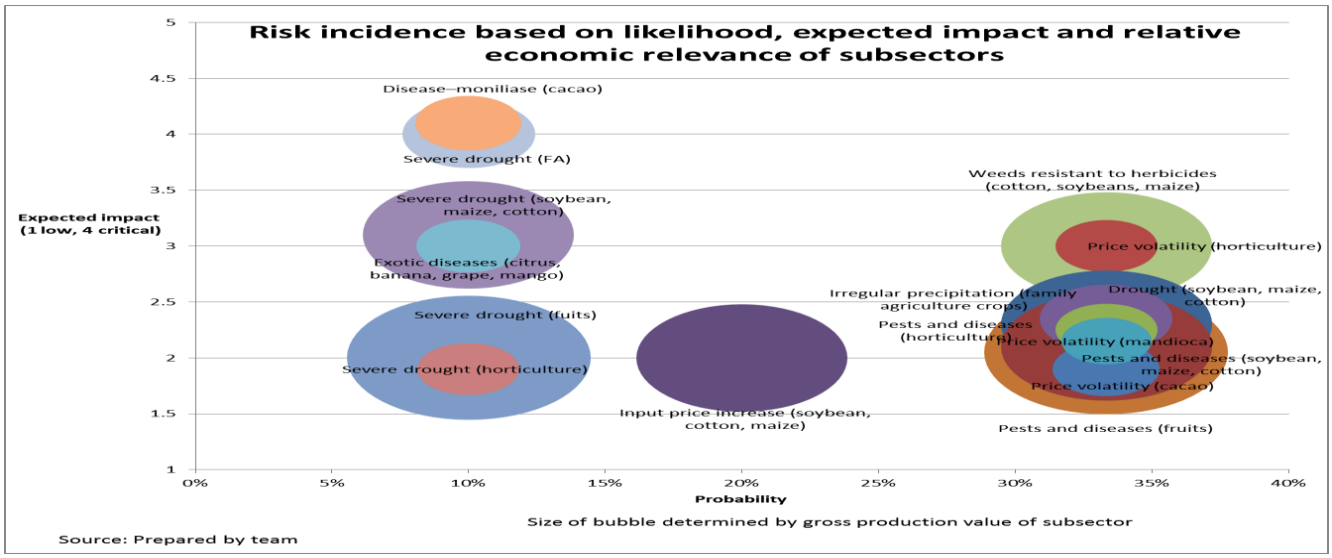


Table 11: Risk management assessment summary (risks with moderate to critical impact and not highly managed)

Current possibility to manage risk Impact	None or Almost None	Low to Medium	Medium to High	Very high
Critical	▪ Severe drought (family agriculture and livestock producers) ▪ Disease: moniliase (cacao)		▪ Foot and mouth disease. ▪ BSE (cattle)	
High	▪ Diseases –greening (citrus), sigatoka negra (banana), cochonilha rosada (grapes and mangoes) ▪ Weeds resistant to herbicides (cotton, soybeans, maize)	▪ Severe drought (soybean producers)	▪ Highly pathogenic avian influenza (poultry) ▪ Export suspension because of appearance of exotic diseases in Brazil's states other than Bahia (enabling environment risk)	

Current possibility to manage risk **Impact**	**None or Almost None**	**Low to Medium**	**Medium to High**	**Very high**
Moderate	▪ Irregular precipitation (heavy rain followed by extended dry spells) ▪ Price volatility (cassava) ▪ Price volatility (horticulture) ▪ Drought and high temperatures (general) ▪ Price volatility (cacao)	▪ Pest –*percevejo marron* (soybean), *caterpillar* and *boll weevil* (cotton), *lagarta de espiga* (maize), *mosca branca* (beans). ▪ Disease –*ferrugem* and nematodes (soybean), virus do mosaico dourado (beans) ▪ Input price increase (soybean production) ▪ Pests –traça do *tomateiro* and *mosca branca* ▪ Diseases -virosis (tomato), nematodes (potato) ▪ Pest –moscas de fruta (grape), broca do café (coffee) ▪ Diseases –furiosis (pineapple), cancro bacteriano (grape), virosis (mamona), *podridao parda* and *vassoura de bruxa* (cacao) ▪ Disease: amarelinho (citrus)	▪ Bovine brucellosis, tuberculosis and cattle rabies ▪ Food-borne diseases from animal products ▪ Classical swine fever	
Low				

Proposed Long List of Solutions

137. The potential solutions presented below were identified during field interviews as well as already suggested in various government and non-government documents. To the largest extent they regard interventions that are within the jurisdiction of State institutions, though it is well noted that federal programs such as *Garantia Safra* and Price Guarantee are key risk management programs.

138. Usually, risk strategies are a combination of risk mitigation, risk transfer, and risk coping instruments (as detailed in Table 12 on following page). Risk Mitigation refers to actions taken to eliminate or reduce events from occurring, or reduce the severity of losses; risk transfer are mechanisms to transfer the risk to a willing third party, at a cost (e.g., insurance); and, risk coping (e.g. government assistance to farmers, debt re-structuring, etc.). How instruments are applied for a given risk will likely depend on the current risk management strategies and the probability of the risk and the severity of its impacts.

Table 12: Risk Mitigation, Transfer, and Coping Instruments

Risks	Mitigation	Transfer	Coping
Climate	▪ Development of an integrated national weather information system for better weather data analysis and improved accuracy of short and medium-term rainfall (weather) forecasting. Some key activities to be considered include: Integration of weather station networks (both at Federal and State level) generating common database; Review and strengthen current institutional arrangement coordination (i.e. roles and objectives); Improve the current mechanism of data/information distribution. ▪ Update the State Irrigation Plan (former plan was approved in 1993): implement development plans for each productive sub-sector based on potential irrigated areas and water availability for irrigation. ▪ Update the State irrigation program in order to improve efficient use of water, to contribute to the increase of both crops and livestock productivity, and to reduce farmers' vulnerability to drought events.	▪ *Garantia Safra*: adjust "hard trigger" (which is based on weather indexes) when the weather stations network is improved, and improvement of the operational procedures for loss adjustments through strengthening of the agro-extension system at the state level; review the rating methodology based on which the premium is defined.	▪ A State drought management committee has to be strengthened. ▪ Inter-institutional coordination issues are important and are contained within the institutional development proposals under Mitigation.
Pests and diseases	▪ Preparation and implementation of a RD&I program on pest control for the major crops, including crop resistance to pests, biological, cultural and chemical control, to be executed by a network of public (federal and state) and private organizations. ▪ Developing of training and sanitary education programs, to strengthening consciousness of farmers regarding the importance of adopting IPM and other recommended phytosanitary measures.		Inter-institutional coordination issues are important and are contained within the institutional development proposals under Mitigation.

Risks	Mitigation	Transfer	Coping
	▪ Modernization of the Federal Pesticide Legislation and the associated technical processes, in order to speed up the analysis of novel pest control products. ▪ Strengthen the inspection of pesticide trade and use. ▪ Reinforcement of both Federal and State Sanitary Agencies, to assure: minimum risk of introduction of exotic pests; early detection of exotic pests; preparedness for quick response to an event of an exotic pest introduction; and, full capacity for implementing phytosanitary confinement, eradication and control measures in the case of an exotic pest introduction.		
Pests and diseases, climate and price volatility	▪ Reinforce public technical assistance services (Empresa Baiana de Desenvolvimento Agropecuário – EBDA) in order to cope with the demands of the family and median farmers, especially regarding technology transfer on Integrated Pest Management (IPM) techniques. In addition, promote private sector technical assistance under demand driven approach. Specific actions would include: promote agricultural practices and technologies as well as crop diversification that are appropriate for the semi-arid region; develop, organize or adapt an integrated system of technical assistance for small producers on livestock production, marketing and sanitary measures; promote increasing supply chain coordination and supply/demand planning and price information (cassava, horticulture, fruticulture and cacao production); improve technical support to *Garantia Safra* program on the execution of field loss assessment activities.		▪ Inter-institutional coordination issues are important and are contained within the institutional development proposals under Mitigation.

Risks	Mitigation	Transfer	Coping
Livestock production risks	▪ Review, update and strengthen the animal health services (ADAB), according to the recommendations of the OIE/PVS evaluation, in order to respond to the new reality of an area free of foot and mouth disease and other mayor exotic diseases. ▪ Review, update and speed the programs for the control and eradication of disease of economical and public health such brucellosis, tuberculosis and cattle rabies. ▪ Speed up the certification process of Classical Swine Fever and Newcastle disease in poultry. ▪ Establish a state integrated food safety system along the entire food supply chains that prevents the presentation of food borne diseases. ▪ Promote the use of complementary feed sources such palm, hey and ensilage for the feeding of animals during the drought occurrence.		▪ Establish a contingency fund to allow rapid control and elimination of animal exotic disease outbreaks.
Price volatility	▪ Develop demand driven initiatives involving innovative technologies and methods for increasing supply chain coordination and supply/demand planning. ▪ Improve farmer organization, cooperatives and other forms of associations to facilitate technical assistance and marketing services and facilitate small scale farmers integration in the supply chains. ▪ In addition, credit resources for small (not assisted by PRONAF) and medium scale farmers should be available for on farm risk management investments.		
Enabling environment			

139. The proposals under the integrated national weather information system and *Garantia Safra* involve some actions that correspond to the Federal level. The Federal and State scope of the proposed actions will be clarified during the solutions assessment mission.

Key Risk Management Measures

140. Many programs and projects are already addressing some of the identified risks along the lines of the solution proposed in the table above. The following Table contains a number of these projects and programs as were identified by the mission (see Annex 3), indicating their connection with the risk assessment results and the potential gaps to be covered with specific risk management actions additional to the existing ones.

Table 13: Projects and Programs Already Addressing Some of the Identified Risks

Long list solutions	**Current projects or programs**	**Gap?**
Develop an integrated national weather information system.	Various weather stations in the Northeast run by different entities, with limited coordination between each other or communication with agricultural producers	Improve coordination
*I*mprove *Garantia Safra*	*Garantia Safra* improvements.	Partial adjustments required
Increase irrigation coverage.	No specific improvement program detected.	Improve irrigation program.
Strengthen the State agricultural technical assistance and extension system.	Various projects to provide technical but unsystematic and limited in coverage. Limited coordination between providers and between agricultural research and extension agents.	Entire system to be reformulated, upgraded and coordination strengthened
Livestock sanitary measures and food safety (see table above).	Existence of a Federal and State Programs for the Eradication of FMD coordinated by the Ministry of Agriculture (MAPA) which was started in 1998. Existence of Federal and State programs for Control and Eradication of Bovine Brucellosis and Tuberculosis. Existence of Animal health Programs for Poultry, Swine's, Apiculture, Goats and	Partial coordination and coverage and need to update programs.

Long list solutions	Current projects or programs	Gap?
	Sheep's, Horses and Aquaculture and Fisheries. Existence of Federal and State programs for the Control and Inspection of Meat and other Animal products. Existence of partial Municipal Control and Inspection of meat and other animal products.	
Increasing supply chain coordination and greater farmer organization (cooperatives, etc.).	Isolated project actions.	Need to strengthen supply chain coordination services within the improved technical assistance services.

141. The above long list of general solutions and the corresponding gap analysis were used to start narrowing down onto specific areas of solution that tackle the key risk issues. The final result will be a package of interventions that could effectively lower volatility and increase resilience in agriculture and since the emphasis is placed on the more vulnerable segments of the supply chains the agricultural risk management program will have a direct positive impact on the reduction of poverty.

142. In brief, the following are the key risk management areas proposed for deepening during the solutions risk assessment:

143. Upgrade state's extension and technical assistance system in order to cope with the demands of the family and median scale farmers, especially regarding: technology transfer on IPM techniques, increasing supply chain coordination and supply/demand planning, improved farmer organization, cooperatives and other forms of associations, etc. It should be noted that there are already many simple and validated technologies in a situation of stock or stand by, poorly or not adopted by the growers, chiefly small familiar peasants, for whom the almost only transfer channel is the public technical assistance service. The system should include EBDA and private technology suppliers as well as projects, universities, etc.

144. Review and reinforce State's animal health sanitary services with a view to respond to the new reality of an area free of foot and mouth disease and other exotic diseases, evaluate the performance of the animal health and food safety services following the OIE/PVS methodology, improve control and

eradication of diseases of economic and public health importance, and promote the active participation of producers in the animal health prevention, control and eradication programs.

145. Reinforce both Federal and State phytosanitary agencies, to assure: minimum risk of introduction of exotic pests, early detection of exotic pests, preparedness to act in case of introduction, contingency plans for eradication or contention of an exotic pest entry, availability of technology to cope with a new established pest

146. Update the State irrigation program in order to improve efficient use of water, to contribute to the increase of both crops and livestock productivity, and to reduce farmers' vulnerability to drought events.

147. Development of an integrated weather information system. Under this system it would be desirable that both federal and state institutions collaborate to each other to improve the analysis of weather information in Bahia, the accuracy of weather forecasting, and the generation of weather products to support the process of decision making. Some activities to be considered, include:

a. Integration of weather station networks and weather database.
b. Assess the current institutional arrangement coordination and provide recommendations on how to achieve better coordination between national and state weather authorities.
c. Improvement of current mechanism of data and information dissemination to decision makers and stakeholders from the agricultural sector.
d. Strengthening the institutional capacity of the Bahian Meteorological Service.
e. Transfer technical capacity and establish a state working group that will execute preparedness and response risk management activities based on the analysis of weather information and weather forecasting.

148. *Garantia Safra*'s current operation is based on the estimation of crop losses due to drought events. The losses are derived from a hard trigger or weather index. Given that not all regions have a dense weather station network, hard triggers are extrapolated. In consequence, there is the possibility that the resulted output does not accurately reflect the actual yields. In these cases, *Garantia Safra*'s compensation payouts are triggered after the conduct of field loss assessments (soft trigger). Loss assessments are made by the state extension service or alternatively by professionals with background in agronomy that work in public institutions. Because there are several crops that are covered under this risk transfer mechanism, and that these crops show different phenological structure and level of resilience to drought, there is a need to train Bahia's extension officers and professionals associated with this program on the collection of crop loss data in order to minimize sampling errors and to reduce the risk of moral hazard.

Next steps

149. The present report will be the basis for continuing the dialogue between the World Bank and the Government of Bahia on the risk management strategy. A solutions mission will follow within 2014 that will make concrete proposals on the risk management strategy and action plan.

VOLUME 2: RISK MANAGEMENT STRATEGY

CHAPTER 1: SUMMARY OF THE AGRICULTURE RISK MANAGEMENT STRATEGY

1. The first phase of the risk assessment identified the following risk management intervention areas to address the priority risks: (i) strengthening State rural extension and technical assistance system including both production and marketing aspects; (ii) review and reinforce State animal and plant health sanitary system; and (iii) develop an integrated agroclimatic information system. Furthermore, an update of the State irrigation program is necessary to improve efficient water use. However, the study of this complex issue was postponed and, proposed that the *Bahia Produtiva* project incorporate this into its activities. See Text Box 1 below with a more complete presentation of the proposed risk management intervention areas.

Text Box 6: Key risk management areas identified during the first phase of the Risk Assessment

The following are the key risk management areas identified during the first phase of the Risk Assessment:

- Upgrade State Extension and Technical Assistance System in order to cope with family and small-median scale farmer demands for technology. Specific actions would include: promote agricultural practices and technologies as well as crop diversification that are appropriate for the semi-arid region; technology transfer on Integrated Pest Management techniques; organize or adapt an integrated system of technical assistance for small producers on livestock production, marketing and sanitary measures; promote increasing supply chain coordination and price information (cassava, horticulture, fruticulture and cacao production). The System should include public and private sector technology suppliers as well as development projects, universities, etc.
- Review and reinforce State animal health sanitary services as to respond to the new reality of an area free of foot and mouth disease and other exotic diseases, evaluate the performance of the animal health and food safety services following the World Organization for Animal Health (OIE) PVS methodology, improve control and eradication of diseases of economic and public health importance, and promote active participation of producers in animal health prevention, control and eradication programs.
- Reinforce both Federal and State phytosanitary agencies, to assure: minimum risk of introduction of exotic pests, early detection of exotic pests, preparedness to act in case of introduction, contingency plans for eradication or contention of an exotic pest entry, availability of technology to cope with a new established pest
- Update the State irrigation program in order to improve efficient water use, to contribute to the increase of both crops and livestock productivity and, to reduce farmers' vulnerability to drought events.
- Development of an integrated Weather Information System. Under this system it would be desirable that both federal and state institutions collaborate to improve the analysis of weather information in Bahia, the accuracy of weather forecasting, and the generation of weather products to support the decision making process. Some activities to be considered, are:
    - Integration of weather station networks and weather database;
    - Assess the current institutional arrangement coordination and provide recommendations on how to achieve better coordination between national and state weather authorities;
    - Improvement of current mechanism of data and information dissemination to decision makers and stakeholders of the agricultural sector;
    - Strengthening institutional capacity of the Bahian Meteorological Service;
    - Transfer technical capacity and establish a state working group that will execute preparedness and response risk management activities based on the analysis of weather information and weather forecasting.
- Garantia Safra's current operation is based on the estimation of crop losses due to drought events. The losses are derived from field loss assessments which are triggered by a weather index. Given that not all regions have a dense weather station network, hard triggers are extrapolated. In consequence, there is the possibility that the resulted output does not accurately reflect the actual yields. In these cases, Garantia Safra's compensation payouts are triggered after field loss assessments (soft trigger) are conducted; the loss assessments are made by the state extension service or alternatively by professionals with background in agronomy that work in public institutions. There is a need to train Bahia's extension officers and professionals associated with this program on the collection of crop loss data in order to minimize sampling errors and to reduce the risk of moral hazard.
- The State Drought Management Committee has to be strengthened.

2. The strategic lines identified during the ARM assessment[34] are as follows:

V. Agroclimatic Information System:

- Development of a Weather Database Integrated System for the state of Bahia;
- Strengthening the State Drought Committee in order to make actions more proactive and less reactive;
- Professional training of the extension workers that participate in the claim adjustment in the Garantia Safra order to reduce moral hazard and technical issues.

VI. Sanitary and Phytosanitary System

- Implementation of a wide area Integrated Pest Management (IPM) for the Cerrado of Western Bahia;
- Actions to delay or avoid the introduction of exotic pests;
- Enhance and expand the RENIVA[35] program;
- Evaluate and improve animal health programs.

VII. Supply Chain Coordination

- Identify actual farm to market experiences and business opportunities for family farmers in Bahia;
- Capacity building on business development among associated small scale farmers

VIII. Agricultural Innovation System

- Improve the coordination of the Agriculture Innovation System for agriculture risk management of family farmers;
- Improve efficiency of the Agricultural Innovation System for family agriculture risk management - strengthen the research sub-system;
- Improve efficiency of the Agricultural Innovation System for family agriculture risk management - strengthen the Technical Assistance and Rural Extension (ATER - *Assistência Técnica e Extensão Rural*) Sub-system for family farmers;
- Improve efficiency of the Agricultural Innovation System for family agriculture risk management;
- Scale-up of successful programs and projects for family farmers.

CHAPTER 2: BAHIA AGRICULTURE RISK MANAGEMENT FRAMEWORK

A. Brief information on the agriculture sector

I. Agroecology

3. There are four major climate regions in Bahia: i) Western Savanna; ii) Hyper-humid region in the *Recóncavo* and the southern coastal areas; iii) Hot semi-arid region; and iv) Tropical Savanna. The Western Savanna experiences a rainfall regime of 1,000 mm[36]/year in summer and a seasonal drought during winter. The hyper-humid region in the *Recóncavo* and the southern coastal areas records around 2,000 mm/year and 23°C[37] of mean temperature. The hot semi-arid region has an annual rainfall regime that ranges 500 mm to 700 mm per year with high spatial and temporal volatility and where rainfall regimes decrease from the north to the east of Bahia. Finally, the Tropical Savanna covers the regions of *Chapada Diamantina* and *Espinhaço*, temperature value ranges between 18° and 21°C. An important factor regarding the weather impact on the agriculture sector in the State is the occurrence of two distinct scenarios: prolonged drought and high temperatures; and irregular rainfall. Severe droughts occur occasionally with critical impact, while irregular rainfalls occur frequently with moderate impact. Nonetheless, both affect all agriculture subsectors but with different intensity depending on the different farmers' risk management capacity.

[34] The detailed actions under each strategic line are contained in Chapter 4: ARM Action Plan.
[35] Network of multiplication and transfer of propagating materials of cassava with genetic and phytosanitary quality - *Rede de Multiplicação e Transferência de Manivas-semente de Mandioca com qualidade Genética e Fitossanitária*.
[36] Millimeter.
[37] Centigrade.

II. Main Features of Bahia's Agriculture

4. Bahia being a large state with very different climatic regions and historical backgrounds has diverse agricultural systems. The West of Bahia recently opened for extensive agricultural exploitation. The majority of the properties are large or very large, accounting for thousands of hectares of maize, soybean and cotton cropping, along with other crops like beans and coffee. Farmers in the region rank among the most efficient rural entrepreneurs in Brazil, with modern technologies and business management systems.

5. There are also several fruit production clusters in Bahia. In the so-called middle *São Francisco* region, fruit farming is essentially driven by commerce, partially export-oriented, and uses updated technology (mangoes, grapes, and bananas). Closer to the coast (*Reconcavo* and the North Coast), fruit production is concentrated on citrus, especially orange and lemon, and pineapple. Smallholders predominate in this region, including family farmers.

6. The cocoa region is on the coastal area of southern Bahia, centered on the axis *Itabuna - Ilhéu*s, concentrating all cocoa production of the State. Important centers for the production of papaya (directed to export) are located on the extreme south of Bahia, Southwestern region. The dominant system is entrepreneurial, with large and medium size producers, though several smallholders produce papaya for the domestic market.

7. The horticultural sector in Bahia is mainly comprised of tomatoes, onions and potatoes. Tomatoes are cultivated in the coastal region, onions grown largely on the farms close to the borders of *Sobradinho* Lake, on the *Medio Sao Francisco* Basin, generally irrigated along its growing cycle, and potatoes are a temperate to cold weather crop, so its production is concentrated on the highlands of *Chapada Diamantina*.

8. Family farmers spread across the coastal region, south and southwestern Bahia, but are located for the most part in the Semi-arid central Bahia that lives the majority of them (see section III. Family Agriculture bellow), under the most adverse conditions and subject to higher vulnerability to risks. Livestock is very important for the economy of Bahia. Livestock population accounts for 11 million cattle; 2.7 million goats; 3.9 million sheep; 1.6 million swine, and 1.1 million horses[38]. Goats in Bahia are the largest population of the country. Production is mainly in the semiarid area, and this production is in the hands of family farmers.

III. Family Agriculture

9. Family agriculture[39] comprises 87% of establishments in Bahia. There are 2,326,437 people in Bahia employed in family farming, 68% men and 32% women, on 665,767 family agriculture units, representing 15% of the total number of family agricultural units in Brazil. According to the Federation of Rural Workers of Bahia (FETAG-BA - *Federação dos Trabalhadores na Agricultura no Estado da Bahia*), there are approximately 625,000 properties of small family farmers in the Semi-arid region of Bahia.

10. However, in terms of landholdings family agriculture covers only 32% of total agricultural area, approximately 9.95 million hectares. The average family farm is around 16 hectares in size and farmers with less than 20 hectares make up for 71% of all agricultural establishments but possess only 9.4% of all agricultural land. High rates of female-headed households stand out in Bahia at around 40% total households.[40] A long history of principally male out-migration to cities leaves family farmers in the hands of women, with many elderly and children. The portion of dependents (population under age 15 and over age 65 in regards to total population) exceeds 50% in many municipalities.

[38] According to data from the Brazilian Institute of Geography and Statistics - *Instituto Brasileiro de Geografia e Estatística* (IBGE).

[39] Family farming (*agricultura familiar*) is formally defined in Brazil in terms of area, management, labor, and income. The farm must be managed by the family, and the family must rely on agriculture as their principal source of income. Definition of *agricultura familiar* from Law No. 11326.

[40] Universo: Características da População e dos Domicílios, Censo Demográfico 2010, SIDRA, Tabela 3222.

11. Family farmers manage mixed subsistence rain-fed systems that involve temporary crops (66% of all family farmer establishments) and some animals (50% chickens, 20% sheep and goats and 27% cattle). A little more than a fifth cultivates permanent crops such as fruit or nut trees. Family farmers produce for their own consumption and for sale (especially cassava, beans and maize). State transfers from pensions and social assistance programs account for a substantial proportion of family income and allow food to be purchased outside the household. Livestock provides important sources of animal protein in meat and milk.

B. Agricultural risk profile and risk management options

12. Risks in Bahia's agricultural sector are highly concentrated in soybean, maize, cotton, cacao, fruits, vegetables and beans, as shown in Volume 1. The aggregated gross output value of these crops accounts for 84% of total gross output value of State agriculture and 82% of total estimated annual losses due to realized production risks in the last 20 years.[41] These crops are particularly important both for household food security and for the sustainability of commercial farming. The following productive systems aggregate the above crops and are targeted under the agriculture risk management strategy: agro-industrial commercial agriculture in the western region of the State (*Cerrado*); Commercial fruit subsector; Commercial horticulture subsector; Family agriculture; and, Livestock production chains.

13. The Risk Assessment (Volume 1) concluded that in Bahia there are no highly probable or probable risks that are expected to have high or critical impact. Nonetheless, there are a number of risks that have moderate expected impact in all five farming systems analyzed, with 1 in 3, 1 in 5 and 1 in 10 year occurrence probability. The latter risks are climate (drought), pest and diseases and price volatility. The realization of those risks have no high or critical impact because of the many government interventions that are in place to produce innovations, cope with drought and support crop prices. In addition, there are a few risks that still having occasional occurrence (1 in 10 years) likelihood and could cause high/catastrophic damage: fruit and cacao diseases, severe drought, and exotic livestock diseases.

14. Considering output value as a measure of aggregated impact of risks in Bahia, the greatest challenges are: drought; aggressive pests and diseases; and, weeds resistant to herbicides in Western Bahia, and are present in (commercial) soybean, maize, cotton and fruit production. If focusing on family agriculture, with small participation in State output value but significant in social terms, irregular rainfall and drought appear as the only important risks. In effect, most family farmers live in the *Sertão* (Semi-arid) region where a destructive recurrent drought scenario dominates. Family farmers do not consider Phytosanitary risks important in relation to the great weather related risks. Market risks are also minor because of their small participation in sold production and because of federal procurement and price support programs. However, the risk management opportunity resulting from these programs is very limited due to predominant low farmers association and poor business development capacity.

15. Looking at risks from the combined perspective of their impact potential (moderate to critical) and management possibility (none to very high), severe drought and *moniliase* disease in cacao appear as the risks with the most critical potential impact and minimum management. Therefore, they require medium to long-term investment and previous preparation to cope. Other diseases such as *sigatoka negra* (banana) and *cochonilha rosada* (grapes and mangoes) also have minimum management possibility and lower damaging potential. Weeds resistant to herbicides (cotton, maize soybean) present high impact risk for agriculture in the West of Bahia and one that requires an integrated pest management approach.

16. Family farmers usually do not adopt pest control measures, as mentioned above. There is availability of resistant varieties for some of the mentioned pests, but farmer low perception of its value and the lack of technical assistance and marketing opportunities limit access to the appropriate technologies. Moreover, access to technology for coexisting with recurrent droughts is challenging, and farmers tend to repeat the same production system used for decades by their ancestors. An alternative, to the narrow set of options, would be

[41] See Agriculture Sector Risk Assessment, Volume I.

looking for crops adapted to dry weather, for instance *mamona* (castor) or *sisal*, once market issues and value chain organization are adequately addressed.

17. To counteract drought in livestock production (mainly goat) there are isolated research[42] and technical assistance actions (such as: promoting the use of *palma forrageira*, silage and hey for feeding the animals during droughts). Unfortunately, extension services are deficient and uncoordinated. They do not cover a significant percentage of the small producers despite the existence of support projects.

18. Finally, the Agroclimatic Information and Management System in Bahia needs to be improved in order to assure adequate and timely data for taking decisions at all levels (production, stocking, policy, etc.). Some actions include data generation, management and dissemination. Accordingly, institutional coordination mechanisms should also be upgraded.

C. Current ARM programs and policies

19. Following the 2012 drought[43], several initiatives to coexist with drought were established in addition to the existing Federal and State policies and programs that contribute to risk management. The main measures are: i) postponing rural credit repayment; ii) creation of special emergency lines of credit for family farmers; iii) public funding of underground dams in order to store rain water; and, iv) emergency purchases of caprine and sheep for family farmers in the Semiarid (SEAGRI, 2014).

20. The State Government of Bahia by the decree 13.796 of March 21, 2012, created the State Committee of Emergency Actions for Combat of Drought Effects, to coordinate the drought response activities. The Civil Office coordinates the activities, and receive support from several State Secretariats, among which: Secretariat of Agriculture, Livestock, Irrigation, Land Reform, Fishery and Aquiculture, Secretariat of Social Development and Combat to Poverty, Secretariat of Urban Development, Secretariat of Environment, Secretariat of Regional Integration and Development, and the Secretariat of International Relations.

21. Particularly, the committee must: (i) identify public works and services aimed to reduce the damage caused by the drought; (ii) oversee, inspect and evaluate the technical assistance offered to the population affected by drought; and, (iii) coordinate activities with the local and federal institutions.

22. In addition, several State and Federal programs and policies include actions that impact the management of agricultural risks.[44] More specifically, in regards to weather related agriculture risks, Annex 4 provides a detailed description of the current programs and policies. The most relevant initiatives are as follows:

- The Agricultural Climate Risk Zoning (ZARC - *Zoneamento Agrícola de Risco Climático*) of MAPA, which aims to minimize the risk related to weather phenomena, and allows identify the best moments for planting in selected municipalities considering different types of soil and crop cycles.
- The Agriculture and Livestock Activity Guarantee Program (PROAGRO), which is a public insurance operated by financial institutions. It aims to compensate the rural producer for the occurrence of adverse weather phenomena, plagues and diseases afflicting crops and livestock.
- The Agriculture and Livestock Activity Guarantee Program for Family Farmers (PROAGRO MAIS) aiming to compensate the Family Farmers for the occurrence of adverse natural phenomena, plagues and diseases. The difference between PROAGRO and the PROAGRO MAIS is the target public: the

[42] EMBRAPA has a Research Goat Center and has contributed to the adaption of resistant breeds and to the development of feeding and management procedures for the semiarid areas.

[43] In 2012, Bahia suffered from one of the worst droughts in the past 50 years. The losses in agriculture production were 100% in many regions while livestock loss reached 60%. More than half of municipalities, at all, 259 declared state of calamity. Almost 3 million people suffered from the drought. Not only farming, but also the human consumption was affected (Miranda, 2013).

[44]These policies and programs are additional to those indicated in Volume 1.

PROAGRO MAIS focuses only on the Family Farmers and the traditional PROAGRO aims the remaining farmers.

- The Rural Insurance Premium Subsidy Program (PSR - *Programa de Subvenção ao Prêmio do Seguro Rural*), through which insurance companies accredited by the Ministry of Agriculture, Livestock and Supply (MAPA) are allowed to operate a subsidy. In general, the program consists of establishing percentages of subventions for each modality of insurance and crops.
- The Program *Garantia Safra* (GS), operated by the Ministry of Agrarian Development (MDA) since 2002. It aims to guarantee minimum conditions of survival of the rural family farmers affected systematically by drought or excess rainfall. The family farmers may receive a benefit on the occurrence of drought or excess rainfall, which causes at least 50% of loss on productions of beans, corn, rice, cassava or cotton crops.
- The program Drought Benefit (BE – *Bolsa Estiagem*), managed by the Ministry of National Integration (MI), MDA and the Ministry of Social Development and Fight Against Hunger (MDS). This program aims to support families of agricultural workers who receive a limit of two minimum wages monthly as income and are located in municipalities that have suffered a disaster or emergency as recognized by federal government.
- The Brazilian Company for Agriculture and Livestock Research (EMBRAPA - *Empresa Brasileira de Pesquisa Agropecuária*) developed an Agrometeorological Monitoring System (AGRITEMPO[45]), which allows access of meteorological and agrometeorological information for all the Brazilian territory on an aggregated level. Since 2002, the products available are drought maps, water available in soil, rainfall, agricultural drought areas, necessity of reposition by rainfall and accumulated rainfall.
- The National Institute for Space Research (INPE/CPTEC) supplies weather monitoring information regarding drought, frost, soil moisture and weather forecast for all Brazilian territory with applicability to agriculture and livestock.
- The World Bank, MI, ANA[46] and state institutions are conducting a technical assistance program named "Preparation for drought and resilience to weather changes" in response to the long lasting droughts in 2012 and 2013. The goal is to define specific instruments for drought management in a proactive manner, and it is based on the concept of risk for the entire Northeastern region.

23. There are several permanent or transitory sanitary and phytosanitay programs undertaken by the Bahia Agency for Agricultural and Livestock Defense (ADAB - *Agência Estadual de Defesa Agropecuária da Bahia*), the State plant and animal health agency, with the participation of other institutions. Among the permanent programs are the traffic control of animal, plants and its products; epidemiological surveillance; registrations and certification; pesticide market and use control; and slaughterhouses inspection. Transit control of live animals and animal products are performed together with Plant Protection Transit barriers.

24. Specific programs include:

- Pineapple plant project.
- Prevention and control of carmine scale (*cochonilha do carmim*).
- Control of the fruit flies (*mosca das frutas*).
- Prevention of the *Moniliasis* of Cocoa.
- Cotton Phytosanitary Program.
- Integrated pest management of Annonaceae pests.
- Prevention of the introduction of Black *Sigatoka* and *Moko* (Bananas diseases).
- Asian soybean rust management.
- Tobacco blue mold.

[45] *Sistema de Monitoramento Agrometeorológico*.
[46] *Agência Nacional de Águas* – National Water Agency.

- Plant health program of the citrus.
- PNSS - National Program of Swine Health.
- PNSCO - Health Program for Goats and Sheep.
- PNSA - Avian Health Program.
- PNSE - National Equidae Health Program .
- PNEFA - Program for the Eradication and Prevention of Foot and Mouth Disease (FMD).
- PNCRH - Program for Prevention and Control of Rabies of Herbivores and other Encephalopathies.
- Bovine Spongiform Encephalopathy (BSE) surveillance.
- PNSAA - National Program of Health of Aquatic Animals.
- PNSAp - National Program for Bee Health.
- National Program for Control and Eradication of Brucellosis and Tuberculosis.

25. The details of the above programs are in Annex 5.

26. In addition, the Family Agriculture Superintendence (SUAF - *Superintendencia de Agricultura Familiar*) of SEAGRI is responsible for programs targeting the family farmers in Bahia. RENIVA, one of the programs led by SUAF and several other institutions, including EMBRAPA *Mandioca e Fruticultura*, EMBRAPA *Semi Árido*, ADAB, EBDA, Universities and private partners. The project aims at the substitution of the presently grown cassava varieties by modern ones, with higher yield potential, resistant to several diseases, especially to the Cassava Common Mosaic Virus (CsCMV) and the Cassava Vain Mosaic Virus (CSVMC).

27. Concerning food procurement and price volatility, there are a series of Federal food procurement and minimum crop price policies and programs: Policy for Minimum Price Guarantee (PGPM - *Politica de Garantia de Preços Minimos*) concerned with commercial agriculture; and, the National Program for Acquisition of Food from Family Farmers (PAA - *Programa de Aquisição de Alimentos*) that specifically targets family farming. MAPA is responsible for PGPM and MDA for PAA. The Federal Government, states and municipalities, as well as the National Supply Company (CONAB - *Companhia Nacional de Abastecimento*) implement PAA. CONAB also actively participates in the implementation of PGPM.

28. Finally, several research and technical assistance State programs and projects (with the exemption of INSA) that provide specific support to small scale and family agriculture farmers. Among them are (see Annex 6 with detailed information):

- National Institute for the Semi-Arid (INSA) projects. INSA is a Federal institution belonging to the Ministry of Science, Technology, and Innovation;
- PROATER (Technical Assistance and Rural Extension Program);
- *Semeando* Program;
- RENIVA Project;
- State Plan of Beekeeping Development;
- Genetic Improvement of Goat Herds (with *Sertao Produtivo* and *Vida Melhor Programs*);
- Program for Food Security for Family Farming Animal Herds;
- Project Bahia Produtiva, co-financed by the World Bank;
- Resources from CHESF[47];
- Sustainable Rural Development Project for Bahia Semiarid Region (*Pró-Semiárido*), co-financed by the International Fund for Agricultural Development (IFAD);
- State Program for Agriculture/Livestock Defense;
- State Program for Plant Sanitary Defense.

[47] Hydroelectric Company of São Francisco - *Companhia Hidroelétrica do São Francisco*.

CHAPTER 3: PROPOSED ARM STRATEGY

29. This Chapter presents the proposed ARM strategy based on the intervention areas (identified during the first phase - Volume 1: Risk Assessment), the existing risk management framework and the identified gaps.

A. Agroclimatic Risk Information System (ACIS)

I. Need for improved ACIS

30. Droughts have historically devastated Northeast Brazil and, to a certain extent, has shaped the current socio-economic scenario. One of the first records of drought in the region happened in the XVIII century, between 1777 and 1779. In the subsequent century, "the Great Drought" happened from 1877 to 1879, followed by other droughts in 1897, 1898, 1915, 1931 to 1932, 1951 to 1953, 1992 to 1995 and 2012 to 2013. The 2012/13 drought is considered the worst drought in the last fifty years (Miranda, 2013).

31. The main investments to coexist with droughts since the XIX century were the construction of weirs and aqueducts, river transposing and the construction of wells (Miranda, 2013). Although these initiatives have smoothed the problems caused by the droughts, they have limited scope. In their majority, current actions of both Federal and State governments are limited to emergency responses.

32. In order to have efficient drought management public policies, it is necessary to have good quality agro-meteorological data available; historical and updated information from weather stations properly spread throughout the state. The density of stations in Bahia compared to other states in the country, such as the state of Paraná, is relatively low. Taking into account only the automatic stations, the Institute for the Environment and Water Resources (INEMA - *Instituto do Meio Ambiente e Recursos Hídricos*) owns only 146 stations, that is, approximately one station per 3,885 km^2. Taking into account all types[48] of stations, there are 255 stations, with up to 16 years of data available, which increases the average density to 1 station per 2,224 km^2 (Banco Mundial, 2014). Of this total, the majority is automatic and has short time series. The survey of stations in the Northeast, carried out by the World Bank, with the State of Ceara Meteorology and Water Foundation (FUNCEME - *Fundação Cearense de Meteorologia e Recursos Hídricos*), has not assessed the quality of the data yet.

33. It is necessary to improve the density of the stations, preferably by the acquisition of automatic agrometeorological stations that ensure speed and quality of data collection. Another important aspect refers to the storage of the data in a proper data center. In general, the stations send the data through a mobile telephone system or satellite transmission. In many regions of the state, there are challenges with the use of both transmissions mechanisms. Moreover, supposing correct data transmission, there is need of storing it in an efficient database management system (DBMS). The INEMA stores the precipitation data in ORACLE but the temperature data is stored in MS Excel and txt files. The processing and data query is an issue. There is a need to centralize the database in a unique DBMS such as SQL, MySQL or PostgreSQL. Surpassing data issues, another arises: lack of trained personnel both to work on IT and meteorological issues. The INEMA has four meteorologists to analyze the data and release the meteorological products, such as, weather forecast, ocean temperature monitoring, ultraviolet radiation. However, there is not enough time and specialists to develop new meteorological products, especially for the agricultural sector. INPE/CPTEC elaborates all available products and sends them to INEMA.

34. Another challenge is the dissemination of weather information and products to farmers. The commercial-export farmers have their own facilities to monitor the weather, but the family farmers do not receive proper assistance to carry out the same activity. In some cases, the information exists, but it does not reach family farmers. Technical assistance and rural extension should analyze and transmit the information appropriately to family farmers. However, EBDA has faced financial and operational difficulties and it is not able to execute the work properly (see specific discussion on EBDA below).

[48]Conventional meteorological, automatic pluviometer, conventional pluviometer and others.

35. The implementation of the drought assessment methodology for *Garantia Safra* should also be improved. The extension workers of the state, associated to EBDA, are responsible for the enrollment of family farmers into the *Garantia Safra* program. When a drought occurs, the extension workers should be able to confirm the losses in the affected municipalities (claim adjustment). This step demands improved training. The loss adjustment methodology adopted to evaluate the losses is not standardized nor recognized by MDA, the institution that manages the *Garantia Safra* program. Moral hazard issues may arise due to the aforementioned limitations.

36. Finally, another important issue is the articulation among federal and state Risk Management Programs. Overlapping policies in the same region and waste of public resources might happen when there is limited policy articulation. A Drought Bill is currently passing through State Representatives and most likely will be voted on in 2015. The Bill establishes the creation of a State Policy of Coexistence with the Semi-arid Conditions and the State System of Coexistence with the Semi-arid.

II. Main elements of the ACIS

37. The strategy would comprise the following elements:

A. Development of an Integrated Weather Database System in the State of Bahia;
B. Establishment of the State Policy of Coexistence with the Semi-arid Conditions and the State System of Living with the Semiarid;
C. Professional training of the extension workers that participate in the claim adjustment in *Garantia Safra*.

A. Development of an Integrated Weather Database System in the State of Bahia

38. The first step is to create an integrated systematic weather database in order to support policymakers in the elaboration of risk management tools. This system should integrate other databases such as the INMET, CPTEC and ANA database, to optimize all resources available at both federal and state level. The following institutions would be part of the system: Brazil's National Institute for the Environment and Water Resources (INEMA); National Institute of Meteorology (INMET); National Water Agency (ANA); National Institute for Space Research (INPE/CPTEC); Brazilian Company for Agriculture and Livestock Research (EMBRAPA). It would also include the participation of the Secretariat of Agriculture of Bahia (SEAGRI), municipalities and extension workers of EBDA. INEMA would be responsible for managing the system, which would require it increase the number of specialists.

Text Box 7: The Drought Monitor

Brazil has a long history of drought management, especially in the semi-arid region of the Northeast. There have been cycles of increasing and decreasing dialogue and intensity of reflections in the past. Due to the 2012 drought, an intense dialogue on integrated policies of coexistence with the Semi-arid has started in order to be better prepare to future droughts. In particular, the Ministry of National Integration (MI), the National Water Agency (ANA), the state committees of drought and various weather agencies/state hydrological (specifically, the FUNCEME, APAC and INEMA) have led the progress towards the improvement of the actions to manage drought. The main challenge Brazil faces at this time is to avoid losing the opportunity to take bold and progressive measures.

Adapting to climate change through a more proactive management of droughts is a key theme for the World Bank, in order to reduce poverty and promote prosperity. In 2010, in partnership with ANA, the Bank technically assisted on producing a study on the impact of climate change at basin level on the allocation of water resources, called "Planning for Water Resources and Adaptation to Variability and Climate Change in Selected Watershed in Northeastern of Brazil". This took place throughout 2010 to 2012, and was carried out by the Bank along with four of the Northeastern states (Ceara, Rio Grande do Norte, Paraiba, Pernambuco).

In 2013, as a continuation to the aforementioned study, the Bank initiated a Technical Assistance (TA Drought) program "Preparing for Drought and Resilience to Climate Change in Brazil", demanded by the MI. The Ministry is carrying out efforts against the current drought, while taking the opportunity to build a National Policy on Droughts, and setting new instruments to manage drought proactively and risk based. The TA Drought program is divided into two areas: (i) support for the policy framework and national dialogue; and (ii) a regional pilot program in the Northeast.

The second area seeks to demonstrate tools and concrete strategies for proactive management of drought, through the development of a Northeast Drought Monitor (Drought Monitor) and drought preparation plans (PPS) in selected case studies.

For the design and development of management tools, TA Drought has relied on support from international experiences of the United States of America (USA), Mexico and Spain. The Drought Monitor allows monitoring of drought stage, based on set of indicators, such as the Standardized Precipitation Index (SPI) and the Standardized Precipitation Evapotranspiration Index (SPEI), establishing different degrees of severity. Furthermore, it allows spatio-temporal evolution monitoring. The Brazilian version is being constructed and adapted to local conditions based on the US Drought Monitor (USDM), developed by the National Drought Mitigation Center (NDMC), and based on the Mexico Drought Monitor (MSM), managed by the National Water Commission (CONAGUA).

B. Establishment of the State Policy of Coexistence with the Semi-arid Conditions and the State System of Living with the Semi-arid

39. The State Policy of Coexistence with the Semi-arid Conditions and the State System of Coexistence with the Semi-arid would play an important articulation role. The State Policy is a management tool that defines intersectoral policies and programs. The State System of Coexistence with the Semi-arid, composed of public, private non-profit organizations and other social organizations, seeks to integrate efforts and formulate, implement and monitor State Policy on the Coexistence with Semi-arid Conditions (programs, projects and actions). See under AIS (Agriculture Innovation System – section D, chapter 3) for more information on these instruments. One of the main beneficiaries of the development of an Integrated Weather Database System is the State Committee.

40. The Secretariat of Agriculture of Bahia (SEAGRI) with the participation of other State Secretaries is responsible for coordinating actions against the effects of drought in Bahia. It would have a leading role in the System of Coexistence and in the operation of the created associated committee. The created committee would be responsible for planning and defining the actions and coordinating the activities. The main beneficiaries are family farmers located in municipalities in the Semi-arid region.

41. It is advised to support the State Committee in order to shift its primary focus from reactive activities to emergency preparedness. The solutions assessment could concentrate on the following aspects: (i) develop a communication plan and a communication system; and, (ii) improve institutional capacity.

C. Professional training of the extension workers that participate in the claim adjustment in *Garantia Safra*

42. Garantia Safra would benefit from the development of the weather database integrated system. As a type of public catastrophic insurance, the program uses an agrometeorological trigger as a definition of loss and the payment of the indemnity, provided by the INMET. Compared to the actual trigger, the agrometeorological index that could be provided by the system would be more accurate due to the increased number of stations, reduction of failures and development of alternative methodologies. In this context, beyond the improvement offered by the use of more accurate indexes, Garantia Safra program would be improved by better-qualified extension workers, which would be trained by State universities and experts from other research and education institutions.

43. The universities that should coordinate the courses are: Federal University of Bahia (UFBA) and the Federal University of Reconcavo Bahiano (UFRB), counting on the support of the State Secretariat of Agriculture of Bahia (SEAGRI), municipalities and EBDA, and the universities from the other states such as the University of São Paulo (USP/ESALQ), and Federal University of Viçosa (UFV), the Federal University of Lavras (UFLA), and EMBRAPA.

B. Sanitary and Phytosanitary System (SPS)

44. Based on above and considering the variety of pest and diseases in Bahia affecting different categories of agricultural and livestock supply chains, the following are the main proposed elements of the SPS risk management strategy.

Plant Health

45. The plant health component has the following elements (see on this regard Annex 7 with a detailed presentation of the prevalent plant pests and diseases in Bahia):

- Implementation of a wide area Integrated Pest Management (IPM) in the *Cerrado* of West of Bahia;
- Prevention actions to delay or avoid the introduction of exotic pests in the fruit, tobacco and *palma forrageira* producing areas; and,
- Enhance and expand the RENIVA program.

I. Implementation of a wide area Integrated Pest Management (IPM) in the Cerrado of West of Bahia

46. The general strategy of IPM must take into consideration the following aspects:

- The *bicudo do algodoeiro* (anthonomus grandis) is a key cotton pest in the *Cerrado* of West of Bahia. The use of 10-12 applications of insecticides during the season kept it under control. Recently the average number of insecticide applications more than doubled to 25-30 per season, with extreme cases of around 40 applications. The major reason for this profound change is the increased use of RR[49]-cotton varieties, resistant to the herbicide glyphosate, used to completely kill the cotton plants after harvesting. The current legislation mandatorily determines cotton residues in the field after harvesting be destroyed, in order to eliminate off-season reproduction sites of the *bicudo do alogodeiro.* This strategy reduces its population at the beginning of the following season, reducing the infestation and damage, thus reducing the need for insecticide application. Growers used to apply the herbicide glyphosate for cotton stalks destruction, but this herbicide cannot be used on RR-cotton varieties, due to their glyphosate resistance. This situation is unsustainable, with three major consequences: increase of production costs; negative impacts on the environment, especially on biodiversity; and, high risk of developing insect resistance to the insecticides used for its control. Therefore, new techniques for destroying the cultural debris should be investigated and adopted seeking a minimum use of insecticides for the *bicudo do algodoeiro* control.

- When using Bt[50]-cotton varieties, resistant to some of the most important caterpillar cotton pests, part of the plantation (20%) should be grown with conventional, non Bt varieties, is required. This technique is very important in order to maintain at a low level the field genetic frequency of the genes conferring caterpillar resistance to the Bt trait. Once a caterpillar develops resistance to the Bt toxin, the Bt variety will not control the pest. Furthermore, this technique implies partnership among the growers of a given region (scale), and cannot be adopted by a sole grower. Thus, it is crucial to maintain pest refuges on cotton fields planted with Bt cotton.
- The continuous use of RR-varieties (resistant to the herbicide glyphosate) for cotton, maize and soybean production might lead to the development of herbicide glyphosate resistant weeds. When this problem arises and becomes widespread, RR varieties cannot be used in the region anymore, due to difficult weed control with herbicide glyphosate and due to resulting increase in production costs. Integrated management of weeds is a key recommendation for avoiding or delaying the occurrence of this problem in the West of Bahia.

47. All the previous sanitary risks can be conveniently managed by an Integrated Pest Management strategy, largely adopted by the growers. The strategy includes the consciousness of growers and their associations about the gravity of sanitary risks: a serious threat to the sustainability of grain production in the

[49] Roundup Ready.
[50] *Bacillus thuringiensis*.

West of Bahia. To manage the risks and maintain cotton as sustainably growing business in Western Bahia, growers face the problem in partnership and in holistic way, through organization with the following background:

- Scope: Adequate management of the sanitary risks following technical recommendations.
- Beneficiaries: Cotton and in general grain growers in West Bahia, Government.
- Institutional framework: AIBA[51], ABRAPA[52], EMBRAPA, MAPA and ADAB should develop and implement a partnership program to reach the desired scope.
- Connection with national policies: There is a directive of the MAPA to implement Integrated Pest Management Programs on Brazilian commercial crops.
- Potential benefits and losses: Each insecticide application for controlling the pest represents between R$200 and R$250 per hectare, being responsible for more than 50% of the cost of pest control in cotton farms. Appropriate practices will reduce those costs.

48. Actions planned for the short and medium term:

- AIBA and ABRAPA lead a task force jointly with EMBRAPA, ADAB and Universities to develop a sound and feasible proposal for wide area Integrated Pest Management Program for the cotton in the *Cerrado*, including the technical, operational and financial aspects. The program should include technology and procedures to manage all risk aforementioned. A coordination and follow up group should be created to conduct the operational aspects of the proposal.
- AIBA and ABRAPA organize a workshop involving the cotton growers of the region to present, discuss and approve the proposal. A compromise of the growers is expected to strictly follow the proposal, with the following initial targets: reduce the number of pesticide application for control of the *bicudo do algodoeiro* to the previous historic levels (10-12 applications); implement alternative technologies for the destruction of the cotton stalks after harvesting, when planting RR varieties; implement coordinated refuge areas in the region involving all the growers that plant Bt varieties.
- AIBA and ABRAPA organize training of the personnel involved in the implementation of the IPM.
- Establish a coordination group to follow up on the implementation of the IPM, including statistics of its adoption and monitoring of pesticide use.
- During the months of July or August every year, a workshop will be promoted to present the results of the previous season and to approve plans for the next season.

II. Prevention actions to delay or avoid the introduction of exotic pests in the fruit, tobacco and palma forrageira producing areas

49. The most important exotic pests of fruit production in Bahia are black *sigatoka* and *moko* (bananas), HLB (citrus), *moniliasis* (cacao), the blue mold (tobacco) and *cochonilha do carmim* (palma forrageira). The background of the strategy for avoiding or delaying the introduction of exotic pests and contributing to sustainability of the agricultural production in Bahia, is as follows:

- Scope: Strict follow up of all protection protocols.
- Beneficiaries: Growers, processors, distributors, exporters, consumers, Government.
- Institutional framework: The strategy takes into account a partnership among the involved stakeholders, including MAPA, private sector (growers, processors, distributors, drivers, importers, exporters), EMBRAPA, universities, state Government, under the leadership of ADAB.
- Connection with national policies: There are several ongoing permanent and transitory programs at national level (MAPA) targeting to reduce the risk of introduction of exotic pests.
- Potential benefits and losses: Benefits are economic, the economic losses could be devastating if exotic diseases/pests arouse in Bahia.

50. The following actions are advised for the short and medium term:

- Strengthen the structure of the sanitary barriers (transit control, fixed and mobiles); reinforce the active and passive surveillance; and preparation for quick action of containment and control of quarantine pests in case of introduction.

[51] *Associação dos Agricultores e Irrigantes da Bahia* - Association of Growers and Irrigators of Bahia.
[52] *Associação Brasileira dos Produtores de Algodão* - Brazilian Association of Cotton Growers.

- Develop a study to realistically establish the adequacy of the structures of health protection agencies (ADAB and MAPA) given size and diversity of agriculture and ranching sanitary risks in Bahia, in coordination with the Agriculture and Livestock Federation of Bahia (FAEB - *Federação da Agricultura e Pecuária do Estado da Bahia*).
- Expand the citrus seedling production program in individual cage environments to meet the demand of small producers. The suggested goal is the availability of 30 individual nurseries (*viveiros*) to be implemented over the next 5 years, to provide clean seedlings to the family growers. Furthermore, it is suggested that this action be incorporated in the activities of CAR/*Bahia Produtiva* to support for smallholders.
- Review the former study of CEPLAC[53] (conducted in 2009) regarding the risk of the introduction of the *moniliasis* of cacao in Brazil and particularly in Southern Bahia, including an assessment of the possible impact taking into account the economic, social, environmental and trade impacts.
- CEPLAC could organize a workshop for creating a Latin American research network of *moniliasis* of cacao, primarily aiming at developing technologies of coexistence with the pest.
- It is suggested that MAPA establishes scientific and technological cooperation between Brazil and Latin American cocoa producing countries where *moniliasis* has already established, to implement studies of preventive breeding, pest bio-ecology and its biological control.
- Identify and multiply varieties of *palma forrageira* resistant to the *cochonilha do carmim*, which must have high yield potential, adapted to the semi-arid regions of Bahia, being nutritive and largely palatable to the animals (cows, sheep and goats). These varieties should be multiplied to support a program to substitute the present varieties for resistant.

III. Enhance and expand the RENIVA program

51. RENIVA is a program led by SUAF/SEAGRI, in partnership with CAR, EMBRAPA, universities and other stakeholders, to substitute the presently grown cassava varieties for modern varieties that have higher yield potential and are resistant to several diseases. Among the problems presently faced by the RENIVA, are: the absence of a formal *maniva* (planting material) market, including *maniva* nurseries and the culture of using certified *manivas*; limited *maniva* nurseries to support the expansion of the program; restricted installed capacity for in vitro production of indexed *manivas*; poor capacity of the *maniva* nurseries personnel to multiply high quality material; and, the need to expand the indexed virosis (presently produced *manivas* are indexed only for two virosis).

52. The proposed strategy seeks to expand the present program, solving the bottle necks mentioned above and making it available to a larger number of family farmers that rely on cassava for food security. The following aspects should take into account for this strategy:

- Scope: Substitute older cassava varieties with modern ones, of higher yield potential and resistant to several diseases.
- Beneficiaries: Family farmers, Government.
- Institutional framework: SUAF/SEAGRI currently lead a program of limited impact. The currently program network has potential capacity for expansion, as to benefit a larger number of family growers.
- Connection with national policies: There is a national policy aiming at the coexistence of family farmers with the adverse conditions of the Semi-arid region, cassava being a key crop.
- Potential benefits and losses: Benefits are higher cassava yield and production, meaning more availability of food and better nutritional condition for rural households.
- Actions planned for the short and medium term: SUAF should elaborate a study in order to identify the barriers and gaps of the present RENIVA program and propose ways to overcome them. The study should specify the institutional, operational, technical and financial resources necessary to expand the program. The revision of the present RENIVA program should use outcomes of the study as inputs.

53. General and transversal recommendations for the SPS risk management strategy:

- Discussion, preparation and implementation of a Research, Development and Innovation (RD&I) program on pest control for the major crops in Bahia, including crop resistance to pests, biological,

[53] Executive Planning Commission of the Plan of the Cocoa Farms - *Comissão Executiva do Plano da Lavoura Cavaueira*.

cultural and chemical control, to be executed by a network of public (federal and state) and private organizations.
- Strengthening the training on the sanitary education program, to develop the consciousness of farmers regarding the importance of adopting IPM and other advised phytosanitary measures.
- Reorganization and strengthening the technical assistance system in Bahia. Special attention should be given to reinforcement of the public technical assistance services (*Empresa Baiana de Desenvolvimento Agrícola S.A.* – EBDA) in order to cope with demands of family and medium-scale farmers, especially regarding technology transfer on Integrated Pest Management (IPM) techniques.
- Modernization of the Federal Pesticide Legislation and the associated technical processes, in order to speed up the analysis of new pest control products.

Animal Health

54. Animal health situation is under control in Bahia and only requires some adjustments:
- Strengthen the animal health services (ADAB) according to the recommendations of the OIE/PVS evaluation, in order to respond to the new reality of an area free of foot and mouth disease and other mayor exotic diseases.
- Scope: Evaluate the adequacy of the present animal health actions to maintain the FMD free area status.
- Beneficiaries: farmers, consumers, Government and the global economy.
- Institutional framework: ADAB/MAPA leads a program currently under implementation that led to the recognition of the FMD free area status for Bahia.
- Connection with national policies: There is a national policy aiming to the recognition of all Brazilian states as FMD free area.
- Potential benefits: The main benefit is the reduction of risks of FMD re-introduction in Bahia.

55. Actions planned for the short and medium term: Internal study and discussion between MAPA, ADAB, ranchers associations and other stakeholders to evaluate the presently conducted program and propose any needed corrections.

I. Review, update and speed the programs for the control and eradication of disease of economical and public health such brucellosis, tuberculosis and cattle rabies, and the recognition of Bahia as a free area for major cattle diseases.

- Scope: Evaluate the adequacy of the present animal health actions to eradicate important cattle diseases like tuberculosis, brucellosis and rabies.
- Beneficiaries: Producers, consumers, Government.
- Institutional framework: There are eradication programs for the above mentioned diseases being conducted under the leadership of ADAB/MAPA.
- Connection with national policies: There is a national policy aiming to the eradication of these diseases in all Brazilian states.
- Potential benefits: Benefits are represented by reducing the time frame necessary to eradicate the diseases.

56. Actions planned for the short and medium term: Internal study and discussion between MAPA, ADAB, producers associations and other stakeholders to evaluate the program and propose corrections, and to establish a feasible chronogram for the eradication of these diseases.

II. Speed up the certification process of Classical Swine Fever (swine) and Newcastle disease (poultry), to obtain recognition of Bahia as a free area for major poultry diseases.

- Scope: Improve production and commercialization environment for swine and poultry production in Bahia.
- Beneficiaries: Growers, consumers, Government.

- Institutional framework: There are eradication programs for the above mentioned diseases being conducted under the leadership of ADAB/MAPA, and a process to evaluate the health status of swine and poultry production to prepare a bid to be submitted to the OIE for the free area certification
- Connection with national policies: There is a national policy aiming to the eradication of these diseases in all Brazilian states and for submitting a bid for recognition of free area for these diseases.
- Potential benefits: Benefits are represented by reducing the improved conditions for swine production and commercialization, including exports.

57. Actions planned for the short and medium term: Internal study and discussion between MAPA, ADAB, ranchers associations and other stakeholders to establish a feasible chronogram for obtaining a recognition of Bahia as a free area of these diseases.

III. Establish a state integrated food safety system along the entire food supply chains that prevents the presentation of food borne diseases.

- Scope: Reduce the risks of food borne diseases outbreak.
- Beneficiaries: Growers, consumers, Government;
- Institutional framework: There are surveillance and fiscalization programs for food safety under the leadership of ANVISA and ADAB, involving other stakeholders like state and municipal government institutions;
- Connection with national policies: There is a national policy regarding food safety, whose directives are strictly accomplished in Bahia;
- Potential benefits: Benefits for the society as a whole from reduced risks of food borne diseases outbreack, protecting the consumer health.

58. Actions planned for the short and medium term: Workshop followed by a Working Group to establish an integrated food safety system in Bahia, involving federal, state and municipal institutions, along with private stakeholders.

C. Supply Chain Coordination

59. Bahia's large agricultural sector has subsectors that are technologically dynamic and integrated into both the world and domestic markets, through coordinated supply chains, involving large, medium and small scale producers specialized in soybean, maize, cotton, cacao and fruit production. By far, these aggregated subsectors contribute to the greatest share of the State's overall agricultural output value.

60. Commercial agriculture (soybean, cotton, maize) in West Bahia is strongly integrated into the world market, farmers have access to hedging market instruments, mostly of soybean and cotton, and their price volatility is similar to that of the world market. Maize, however, is mostly a product for domestic market consumption and is included in the Minimum Price Guarantee Policy. Unlike soybean and cotton, maize is traded SPOT and the destination is mostly for the poultry industry. Price volatility is mainly connected to supply-demand forces (despite Bahia being a surplus state). Maize farmers are usually benefited by CONAB guarantee policy auctions and direct purchases which results in relatively low price volatility. Under these circumstances, no specific price volatility risk management actions are recommended. General scope recommendations would include investments in infrastructure, to reduce transactions costs, and in weed and pest/disease control technologies, for greater production sustainability.

61. Price volatility of fruit (papaya fruit and banana) is relatively low for seasonally adjusted series, which denotes relatively low price risk and is a good indication of reasonably well-coordinated supply chains. As for cacao, the domestic price is strongly influenced by international market behavior. The relationship between level of stocks and prices is evident. Therefore, in general, no action is required except for some family farming production areas with little supply chain coordination, which would benefit from the ATER system.

62. Horticultural production spreads all over the State with production clusters in *Chapada Diamantina* and *Irecê* regions. Though there is no statistical evidence of grater price volatility than fruit, several traders

interviewed at the Bahia State Water Supply Company (CEASA-BA - *Empresa Baiana de Abastecimento*) wholesale market of Salvador claimed poor organization of vegetable supply chains involving family farmers and, consequently, a lack of supply guaranteed. Improved supply chain coordination[54] and production planning is advisable.

63. Family farmers in Bahia manage mixed subsistence rain-fed systems that encompass temporary crops (especially cassava, beans and maize), some animals and, to a lesser extent, permanent crops such as fruit or nut trees. Price guarantees (mostly PAA and PNAE programs)[55] are used to incentivize production and to provide support to poorer farmers. They have resulted in relative stable prices of basic foodstuffs grown by the family agriculture farmers. However, the program has limited coverage but could expand if more volume was available, quality improved (mostly in animal products), and more value added products produced (fruit pulp, etc.). Thus, there is an opportunity to expand ATER activities, in coordination with CONAB programs, in order to improve farmer organization and supply chain coordination and thus benefit from the opportunities made available by the CONAB's managed projects. *Bahia Produtiva* and the upgraded AIS could take up the leading responsibility.

Summing up.

64. Strengthening family farmer farm-to-market relation requires greater farmer organization (cooperatives and other forms of associations) to facilitate technical assistance and marketing services and facilitate increased participation in institutional markets like PAA and PNAE. *Bahia Produtiva* can act as a focal point to develop supply chain coordination and supply/demand planning.

D. Agricultural Innovation System (AIS)

I. Current research and extension framework in Bahia

65. State agricultural technology generation and transfer services under the Agriculture Development Company of Bahia (EBDA – *Empresa Baiana de Desenvolvimento Agrícola S.A.*) are undergoing an acute crisis[56]; almost no research projects are being developed and technical assistance activities are very limited. However, based on the work developed by EMBRAPA's decentralized units and experimental stations, there are many simple and validated technologies in stock[57] or standby that could substantially reduce the risks, which have not been disseminated on a large-scale and therefore are poorly adopted or not adopted at all by farmers, especially family farmers. Aside from the need to develop and adapt EBDA research[58] to local conditions, the coordination of work among the research and extension institutions operating within the State in needed.

66. Many of the programs and projects that support family agriculture in regards to production risks management are unsystematic and limited in terms of geographic coverage and recipients. The majority of Bahia's family farmers does not receive technical assistance, and the number of assisted families is not expected to increase significantly in coming years. Data from the SEAGRI/SUAF (2014) indicates that approximately more than half of the 665,700 family farmers in the State do not receive technical assistance of any kind. According to this data, EBDA currently assists 27% of Bahia's family farmers, and the ATER non-governmental network, composed of 37 institutions, assists 20.8% of those farmers. However, some of the

[54]A definition of coordination in the literature is "the act of managing dependencies between entities and the joint effort of entities working together towards mutually defined goals" (Malone and Crowston, 1994). Supply chain coordination means a particular degree of relationship among supply chain members (farmers, traders, processors, etc.) to share risks and rewards that result in overall higher business performance than would be achieved by the members individually. In practical terms it implies collaborative working for joint production and marketing planning, joint product development, information exchange and contract enforcing (including commodity exchanges), long term technical cooperation, etc.

[55] PAA is the National Program for Acquisition of Food from Family Farmers, and PNAE the National School Feeding Program.

[56] EBDA is currently undergoing important institutional changes.

[57] See *Text Box 4: EMBRAPA´s contribution with technological innovations to the semiarid*, for a list of validated technologies.

[58] EBDA has 19 experimental stations, as well as a Laboratories' Center in Salvador with 12 laboratories.

interviewed technicians questioned data veracity, pointing out that the number of assisted farmers is overestimated.

67. Recently there have been efforts in the State of Bahia to organize, integrate and coordinate the services being provided through the several ongoing initiatives underway. Namely, within the framework of State Bill No.12732 which established the Technical Assistance and Agricultural Extension State Policy for Family Agriculture (PEATER – *Política Estadual de Assistência Técnica e Extensão Rural para a Agricultura Familiar*) and the Technical Assistance and Agricultural Extension State Program for Family Agriculture (PROATER – *Programa Estadual de Assistência Técnica e Extensão Rural para a Agricultura Familiar*).[59] Despite the importance of these coordination efforts, they are still insufficient and must be reinforced.

68. In addition to coverage, the quality of the technical assistance must also be taken into account. The quality of technical assistance refers to both, the content of technological packages promoted and to the methods and methodologies used to provide technical assistance. This brings to light, once again, the coordination that should exist amongst agencies that provide technical assistance and research services.

69. The quality of technical assistance provided by both, EDBA and NGOs, has been questioned several times. In the case of EBDA, some interviewees consider that it that EBDA does not assists 180,000 farmers, due to the poor quality of such assistance. Furthermore, EBDA's technicians are demotivated, average age is advanced and this year they were on strike for four months. As for technical assistance provided by non-governmental organization (NGO) networks, it has been pointed out in interviews that their technicians need to be trained and qualified. In addition, there are disagreements between technicians of the EBDA and NGOs, in terms of the type and quality of ATER provided by each party.

70. The exposed reinforces the belief that improving coordination and increasing efficiency of the AIS is needed, while expanding access to available technology feasible to over half of the total amount of family farmers. In short, family farmers have technological options through which they can improve production risk management in the Semi-arid, maintaining its vocation for livestock. The limitation to overcome is how to disseminate and communicate the existing improved technology.

71. In addition to this, it would be very inefficient to propose uniform solutions for a heterogeneous family farmer population. Faced with the current limitations in human and material resources, that hinder technical assistance universalization for the vast number of family farmers in Bahia's semi-arid, it is necessary to provide specific assistance according to farmer potentials. It is necessary to carry out a detailed analysis of farmer profile in the State to identify, among other things, the most appropriate solutions for each group, and which farmers can be integrated into profitable production chains.

II. Need for a working Agricultural Innovation System

72. According to the World Bank (2012), "an innovation system is defined as a network of organizations, enterprises and individuals focused on bringing new products, new processes and new forms of organization into social and economic use, together with the institutions and policies that affect their behavior and performance. It includes science suppliers as well as the totality of actors and interactions involved in innovation. It extends beyond the creation of knowledge to encompass the factors affecting demand for and use of knowledge in new and useful ways."

73. The State of Bahia should be create an Agriculture Innovation System (currently, there is no coordination, interaction, etc.). It is useful to refer to it as a category of analysis. The main components of the system would be the institutions responsible for generating knowledge, i.e. research centers; the institutions responsible for transferring that knowledge to end-users, i.e. technical assistance and extension agencies, and those in charge of training farmers.

[59] It is important to note that in Brazilian legislation, technical assistance is established as a right. The 1988 Constitution of the Federative Republic of Brazil and the 1991 Agricultural Law determine that the Union must maintain technical assistance and agricultural extension services public and free of charge for small farmers (Primo Junior, J. et al., 2013).

74. Regarding family agriculture, in the case of Bahia institutions comprising the AIS can be classified by research and technical assistance. On the research side - EBDA, and to a lesser extent the UFRB, the UNEB and the UESB, as state level research institutions, and EMBRAPA-Cassava and Tropical Fruits (Cruz das Almas, BA60), EMBRAPA-Semi-Arid (Petrolina, PE61), EMBRAPA-Goats and Sheep (Sobral, CE62) and INSA (Campina Grande, PB63), at regional level. On the technical assistance side - extension, and training of family farmers, the EBDA, the ATER non-governmental network, other civilian entities (which provide technical assistance and are not currently part of the network), the municipalities, some universities, and externally funded rural development projects, such as *Bahia Produti*va (World Bank) and *Pró-Semiárido* (IFAD, which is about to start). Regarding institutions not related to semi-arid, CEPLAC (Comissão Executiva do Planejamento da Lavoura Cacaueira) carries out technical assistance activities for family farmers engaged in cacao planting.

III. Main elements of the AIS related risk management strategy

75. A strategy focused on the improvement of the AIS efficiency and coordination is needed. It should include both, the improvement of the efficiency and coordination of the existent public sector technical services (research and technical assistance, agricultural extension and training), as well as the coordination and complementation with private sector technology service providers. The expected result is increased technological availability to family farmer, increase adoption of techniques and technological practices and, ultimately, better risk management and increased capacity to coexistence with semi-arid production conditions.

76. Improve coordination of the AIS for family agriculture risk management. It is necessary to establish and/or strengthen inter-agency coordination mechanisms. The State of Bahia has decision-making bodies that bring together entities that provide Technical Assistance and Rural Extension (ATER) but technology generation and transfer activities coordination is not under specific direction.

77. The "Coexistence with Semi-arid State Policy" and the "Coexistence with Semi-arid State System", expected to be created soon under a State Bill, would provide a framework for coordination. This system would be composed of: the Coexistence with Semi-arid State Conference; the Coexistence with Semi-arid State Forum; and the Coexistence with semi-arid Governmental Committee. The latter aims to promote direct and indirect organization and integration of State administration entities linked to coexistence with semi-arid. Therefore, it is in charge of coordinating, supervising and evaluating the execution of coexistence with semi-arid State policy and State plan. Private non-profit organizations, other civil society organizations prominently related to the semi-arid as well as decision-making territorial groups are expected to participate in the State Forum that will be chaired by the Governor of Bahia.

78. In accordance with article 28 of the aforementioned Bill, the "coexistence with semi-arid initiatives" are contained in programs under the Multiannual Plan – PPA. Some of the programs are universal access to water for consumption and production; technical assistance and agricultural extension; productive inclusion and fight against poverty; acquisition and distribution of seeds and supplies needed for production; sheep and goat females; and plant seedlings. Article 35 establishes that the Administration will promote public selection of private profit-driven and non-profit organizations for the implementation of actions, projects or programs related to the coexistence with the semi-arid State policy.

79. The integration and attributions of these bodies (the State Forum and Governmental Committee), per se, as foreseen in the Bill do not guarantee that there will be good coordination amongst the institutions that should be a part of Bahia's AIS. In addition, there is no mention of national/regional organizations, such as INSA or EMBRAPA's research centers, participation. The Bill has not been approved yet and there is no certainty about the date this will take place. Therefore, it would be important to propose the creation of a of a

[60] State of Bahia.
[61] State of Pernambuco.
[62] State of Ceará.
[63] State of Paraíba.

council a similar organ that can bring together the institutions that are part of the AIS and act as the coordinator, at least until the bill is passed.

80. Thus, the proposal is to create a council or similar organ to coordinate initiatives and research of the institutions that would be part of the Agricultural Innovation System, defining who will integrate the council, how the institutions will interrelate and what are the individual responsibilities and procedural rules for its proper functioning. With this general framework, it is possible to create formal AIS for the State of Bahia.

81. Furthermore, implementing measures for internal coordination of the two sub-systems is necessary: the research sub-system, and the ATER sub-system. Once the coordinating sub-committee within the "Coexistence with Semi-arid State System" is established it would be possible to organize more focused mechanisms to coordinate AIS subsystems. See Text Box 3 with a preliminary discussion.

Text Box 8: Coordination within AIS subsystems

While there is some communication between all institutions involved in agricultural research, it still lacks formal coordination mechanisms. As a federal research institution, INSA[64] has the mission of making "… inter-agency solutions viable for the fulfillment of actions related to the research, training, dissemination, and policy formulation to reach sustainable coexistence with the Brazilian semi-arid from the socio economic and environmental potentialities of the region." INSA could have had an important role in the coordination and organization of technology generation activities in the semi-arid region. However, INSA seems to have been mostly oriented towards research, putting aside the role of organizer or coordinator. INSA works mostly alone, not interacting with the institutions in Bahia, and therefore it does not seem feasible to assign INSA the practical role of coordinator or organizer of the research sub-system of the AIS. Therefore, it is required to determine the most suitable organization and operation of the research sub-system with a focus on semi-arid in the State of Bahia.

As for the ATER sub-system, the Technical Assistance and Agricultural Extension State Program for Family Agriculture (PROATER - *Programa Estadual de Assistência Técnica e Extensão Rural para a Agricultura Familiar*), created by State Bill No.12372, is the first coordination instance with SEAGRI's partner institutions. One of PROATER´s initiative is the institutional integration of ATER networks and public dialogue and discussion forums relating to Technical Assistance and Agricultural Extension State Policy for Family Agriculture (PEATER - *Política Estadual de Assistência Técnica e Extensão Rural para a Agricultura Familiar*) –- in the SUAF/SEAGRI field of activities. Within the SUAF, there is an ATER Coordinator.

SEAGRI's partner institutions for the implementation of PROATER are NGO's, prefectures, CEPLAC, CODEVASF[65], MDA, among others. EBDA is not listed among the partner institutions, though its participation may be implied. According to SUAF (SEAGRI/SUAF, 2014), one of the merits of PEATER's implementation is that it made it possible to work in networks and with better articulation between the different ATER providers. However, according to some interviewees, there are disagreements between EBDA's technicians and those from the NGOs regarding the type and quality of the ATER provided by each party.

82. Another important related issue is the dual role of EBDA as provider of both research and extension services. This model, established in many states since 1991, has not led to positive results. The majority of interviewed key informants believe that different institutions should carry out these attributions. The feasibility of separating research and technical assistance activities in the institutional structure of Bahia's public sector should be assessed.

83. Restructuring of EBDA is being discussed within the State Government (see detailed discussion in Text Box 4). In effect, that was mentioned by the President of EBDA and is confirmed in one of the paragraphs of a note sent by SUAF's Superintendent in response to a request from EBDA's President. It read": "all the

[64] INSA was founded 10 years ago and is linked to the Ministry of Science, Technology, and Innovation (MCTI) as a research unit focused on the Brazilian Semi-arid.

[65] São Francisco and Parnaíba Valley Development Company - *Companhia de Desenvolvimento dos Vales do São Francisco e do Parnaíba*.

Government, especially SUAF, is working for EBDA's restructuration because we understand such organization is essential for our State's rural development. But we all also understand that there is a need for cultural change in the company, where inactivity and lack of preparation of some professionals who deal with favor exchanges, competitive desire and institutional corporatism must make way to a productive work environment, committed to results".."

84. Until the proposed AIS coordinating council is created and EBDA undertakes a positive restructuring, it might not be possible to make any substantive progress in the organization of AIS.

85. Improve efficiency of the Agricultural Innovation System. In parallel to the efforts made to improve coordination among the institutions of the AIS, it will be essential to begin to implement measures aimed at improving the efficiency of the institutions responsible for the generation and transfer of technological innovations.

86. Concerning the research sub-system, it was mentioned above that based on the work developed by EMBRAPA's decentralized units and experimental stations, there are already many simple and validated technologies in stock or standby which can be immediately transferred to farmers. However, farmers adopt technologies poorly or not at all. The adoption could substantially reduce the risks faced by the farmers. For instance: (i) EMBRAPA - Semi-Arid contribution with technological innovations has been very important for water catchment and management, as well as for soil management and grazing management, tests on the use and cultivation of forage species, introduction of species, among other technologies; (ii) EMBRAPA - Goat and Sheep has contributed to the adaption of resistant breeds and to the development of feeding and management procedures for semi-arid areas; and (iii) EMBRAPA-Cassava and Tropical Fruits has contributed with the RENIVA project. See Text Box 4 for further details.

Text Box 9: EMBRAPA´s contribution to the semiarid with technological innovations

EMBRAPA (Brazilian Corporation of Agricultural Research) aims at technological innovation. Its focus is on knowledge and technology generation for Brazilian agriculture. EMBRAPA has 47 Decentralized Units scattered in all regions in Brazil.

For the semiarid region of the Northeast, and specifically for Semi-arid Bahia, there are three decentralized units generating technology adapted to family agriculture basic needs:

- ✓ *Embrapa Semi-Arid* (Petrolina, Pernambuco); ecoregional research unit, responsible for generating technologies that transform the driest area of Brazil in a place full of productive possibilities. Innovately, build their research alternatives for small farming and irrigated farming business.
- ✓ *Embrapa Cassava and Tropical Fruits* (Cruz das Almas, Bahia); products research unit, which conducts research on cassava, citrus, banana, pineapple, mango, umbu-cajá, and other fruits.
- ✓ *Embrapa Goats and Sheep* (Sobral, Ceará); products research unit that operates with the productive sector of goats and sheep promoting, for instance, the increase of quality of milk, meat and meat products and improvements in the organization of production systems for regular supply of products.

EMBRAPA-Semi-Arid's contribution with technological innovations has been very important for:

- water harvesting and management (rural cisterns, small reservoirs for supplementary irrigation, underground dams, "in situ" rainwater harvesting systems);

- soil management (soil conservation practices, soil cover, fertilization)

- range management (sustainable rangeland use, grazing management, native pasture management)

- tests on the use and cultivation of forage species and introduction of species (buffel grass, *maniçoba* - Manihot pseudoglaziovii, *leucena* - Leucaena leucocephala, *palma forrageira* - Opuntia spp.).

EMBRAPA-Cassava and Tropical Fruits, in partnership with EMBRAPA Semi-Arid, have developed a production system for cassava cultivation in the semiarid region, with advised varieties. This originated the

RENIVA program (explained in section B. III. – pg. 13). The unit also contributed with the development of varieties of citrus resistant to key pests and new technologies for producing clean citrus seedlings (meaning they are certified to be free of pests), as well as other technologies for pest control.

EMBRAPA - Goat and Sheep has contributed to the adoption of resistant breeds (evaluation and conservation of breeds, selection and crossbreeding) and to the development of feeding and management procedures for semi-arid areas. The *Breeding Program for Meat Goat and Sheep* was launched in 2003 to improve the exploitation of meat goats and sheep and optimize the use of genetic resources available to breeders. For feeding and management procedures, the unit develops intensive forage production systems in small areas, integrated production systems, range management, green manure, and in forage species improvement (Cenchrus, Opuntia) and native species domestication (Mimosa caesalpinifolia).

87. As for State institutions, it can be assumed that research carried out in EBDA's experimental stations and in universities have also generated technologies for Bahia's semi-arid region. However, contributions have not been systematized and probably have not even been published.

88. Therefore, it would be important to carry out a survey to identify available technologies for coexistence with semi-arid in the State of Bahia. The short-term proposal is to make an exhaustive inventory of the techniques and practices known that will allow for an increase in resilience of the agricultural systems used, independently of implementation at field level. The inventory should also be useful to coordinate research activities among all the institutions involved, avoiding duplicated efforts and improving sub-system's efficiency.

89. In regards to ATER, the lack of an efficient technical assistance service aborts the possibility of family farmers to benefit from already available risk mitigation technologies. According to testimonies by government agents, farmers and their organizations, EBDA's operational capacity is heavily shortened and far from the minimum standards expected. As expressed above, EBDA is currently undergoing a deep crisis that reflects on the provision of its services to family agriculture farmers. Currently EBDA has 1500 extension agents, with advanced average age (800 are already retired but continue working), high percentage of its technical body is extremely unmotivated and the quality of their work has been called into question. Overall, technical assistance activities are severely restricted at present because no other institutions in the State have the potential to provide massive services like EBDA. In other words, ATER sub-system's efficiency should be improved and EBDA should be part of that general improvement.

90. The regulatory framework in the State has recently been modified, mirroring similar actions at federal level, seeking to revitalize ATER, directed at family agriculture. Federal Law No.12188 (January 2010), established the ATER National Policy, and recently (May 2014) the Technical Assistance and Rural Extension National Agency (ANAT–R - *Agência Nacional de Assistência Técnica e Extensão Rural*) was created, in order to promote technical assistance and agricultural extension across the country. Article 19 of Law No.12897 (December 2013) authorizes ANATER to sign "specific partnerships with state bodies in charge of technical assistance and agricultural extension for the execution of services", enabling resource allocation to state institutions.

91. The President of EBDA perceives this as an opportunity to begin to overcome the institutional crisis. However, not all interviewees were optimistic about the future of the institution. A proposal to create a new Technical Assistance State Agency, incorporating the positive aspects of EBDA and leaving aside the negative ones, was mentioned. However, no documentation to support this was provided.

92. The key point of the strategy to improve ATER sub-system efficiency is the strengthening of services provided by EBDA, both quantitatively and qualitatively. More extension agents are needed, with longer work hours (8 hours instead of the current 6 hours), better trained and with updated communication methods and techniques. Extension agents do not have access to updated knowledge and ongoing training. According to EBDA authorities, the current technical assistance methods date back 20 years, and must be modernized.

93. EBDA currently has 132 local offices; its authorities estimate they would need 300. To carry out its work as intended, EBDA would require approximately 2,000 well prepared and trained extension agents, an achievable goal according to its President, and a suitable number considering the institution's current dimensions. Each extension agent assists 100 farmers, this means that EBDA can assist approximately 200,000 family farmers (barely 30% of the total in Bahia). It does not seem possible that the network of NGOs being established through the implementation of the PEATER, plus the technical assistance that can be provided at municipal level, are enough to for the lack of extension agents and provide services to all family farmers, not even in the medium-term.

94. Recurring droughts motivate small farmer migration to urban areas in search of better living conditions. This leads to the assumption that on the short and medium-term the number of family farmers in the State would decreased noticeably. However, data from the agriculture censuses does not confirm this hypothesis. Considering farms of up to 50 hectares in size (proxy for family farmers), the total number of establishments increased 7.7% between the last two censuses (1995-2006), while its total area increased 4.6%. Why do all those small farmers remain in rural areas? Small scale family farmers in the semiarid may not be able to become efficient farmers even in the event of having access to appropriate technology due to their size and capital restriction. This leads to the issue of providing massive extension services ignoring diversity of family farmer profile and different opportunities to develop as efficient farmers.

95. The size of almost half (a total of 328,000 farms, equivalent to 49.9% of total number of establishments) of the farms with less than 50 hectares is of less than 5 hectares, with an average area of less than two hectares. It is unlikely for a family in the semi-arid to reach the subsistence threshold if it relies solely on farm production with less than 5 hectares, or even worse of 2 hectares. In the case of livestock production, the average stocking rate for the Caatinga area is around 12.5 ha/Animal Unit (AU)/year, although the verified average stocking rate is around 4.4 ha/AU/year (A. Maia Neto, 2012). It can be argued that those smallholders' breeding of sheep and goat is carried out with the support of the so-called Fundos de Pastos (areas for collective use where flocks of several farmers are extensively raised).

96. Even so, it is most likely that family farmer households currently rely more on other sources of income, and thus have low incentives to adopt technological innovations that mean an increase in investment and may incur on recurrent costs and compel the increase of labor use on the farm.

97. Therefore, the proposal is to perform a baseline study to assess the heterogeneity, and its economic and productive implications, of family farmers in the Semi-arid of Bahia; it is necessary to have a first approximation to a farmers' typology. Once the study is performed, and an assessment exists on the technical assistant requirements by type of farmers, and the need to incorporate extension agents, both in the public sector and in the network of NGOs, may be determined.

98. There is no doubt that EBDA should allocate more resources to expand the quantitative and qualitative coverage of the extension services, improve program coordination, upgrade training programs, develop tailor made risk management programs, etc.

99. In regards to the quality of services, it was clear during the Risk Assessment (Volume 1) that EBDA's communication methods and techniques need to be updated. The proposal is that new training models for technicians and farmers be tested; promoting trainers' training; cascade training; and farmer-to-farmer technology transfer methodology. Another proposal is to adapt agricultural extension means and methods to user specific situation, widening the use of information and communication technologies (ICT) as a way to reduce costs. The use of cell phone messaging to transmit technical information should become widespread, and farmer training through distance education methodologies should take place, as to contribute to cost reduction.

100. Furthermore, several interviewees (EMBRAPA's technicians, SUAF's Superintendent) mentioned that some municipalities that have local agriculture secretaries with good resources: vehicles and hired technicians to provide technical assistance, but who "don't know well what they have to do". To a certain extent, and in specific locations, it would be possible to undertake "municipalization" of technical assistance;

the SUAF wants to create ATER networks at local level, but assessment of accurate current situation is necessary.

101. In regards to NGOs that provide technical assistance, according to SUAF/SEAGRI data, 37 institutions belonging to the network were assisting 138.600 family farmers in 2013. In interviews during the Assessment, SUAF's Superintendent said that the number of hired institutions at present ascended to 42, and they intend to reach 50 institutions this year (currently there are 18 credited institutions). However, the quality of the technical assistance provided by the NGOs was questioned, as mentioned above.

102. Finally, there is a need to register family agriculture technical assistance providers in the State, to assist in the identification of available resources, plan proper coordination between public and private technical assistance for family farmers, and in efficient resource allocation. Thus, while in general terms the medium-term strategy must aim at strengthening the State agricultural assistance and extension system, private sector technical assistance suppliers should also be incentivized. Simultaneously in the short-term it would be important to expand priority programs like the RENIVA Project, the distribution program for pure breed sheep and goats to rebuild flocks and improve their quality after drought, and the program to increase planting of *palma forrageira* by establishing several places for plants reproduction.

CHAPTER 4: ARM ACTION PLAN

103. The present ARM action plan reflects the strategic lines described in the previous section and includes some basic details on who, when and how much is required for the implementation of the actions proposed. The cost of the entire ARM action plan has been estimated at a total of US$ 129,522,000 over 5 years, with a strong concentration of activities within the first two years. Out of this total, US$ 5,622,000 would correspond to studies, training and pre-investment, US$ 38.900,000 to program investments, and US$ 85,000,000 are estimated for covering staff costs associated to the EBDA reform. The summary break down by category of intervention is as follows:

Category of intervention	**Total Cost (US$)**	**Execution of field programs (US$)**	**Payments to EBDA staff (US$)**	**Studies, training and pre-investment (US$)**
Weather Information System	3,581,000			3,581,000
Sanitary and Phytosanitary System	746,000			746,000
Supply Chain Coordination	230,000			230,000
Agricultural Innovation System	124,965,000	38,900,000	85,000,000	1,065,000
Total Action Plan	129,522,000	38,900,000	85,000,000	5,622,000

ACIS

Strategic Line	Actions	Institutions Responsible	Period (quarter and year)	Resources	Cost (US$)
A. Development of Weather Database Integrated System in the state of Bahia	A.1 Mapping of the current infrastructure (strengths and weaknesses) of the state and federal weather stations	INEMA supported by an external consultant	I Quarter 2015	Short-term consulting	
	A.2 Verifying the quality of data collected by INEMA and the federal institutions	INEMA supported by an external consultant	I Quarter 2015	Short-term consulting	45,000
	A.3 Development of debugging procedures for the data available in order to correct failures in the climatic time series collected by INEMA and federal institutions	INMET, ANA, CPTEC, INEMA supported by an external consultant	II Quarter 2015	Short-term consulting	100,000
	A.4 Centralizing INEMA's database in an unique DBMS, maintenance and increase the servers capacity and computers from which the committee can improve the decision-making process	INEMA supported by an external consultant	II Quarter 2015	Short-term consulting	175,000
	A.5 Development of the information system counting on INEMA and federal institutions information	INMET, ANA, CPTEC, INEMA supported by an external consultant	a. II Quarter 2015 b. III Quarter 2015	Short-term consulting	a. 250,000 b. 250,000 Subtotal: 500,000
	A.6 Definition of the weather variables and the products to be released in websites and newsletters and improvement of the product dissemination to the family farmers	INEMA supported by an external consultant	II Quarter 2015	Short-term consulting	9,000
	A.7 Reviewing of the current institutional structure and strengthening both regulation and structure	INEMA, EBDA, SEAGRI supported by an external consultant	II Quarter 2015	Short-term consulting	40,000

Strategic Line	Actions	Institutions Responsible	Period (quarter and year)	Resources	Cost (US$)
	A.8 Establishment a state work team in order to guide and coordinate the usage of the data for commercial and research purposes	INEMA, EBDA, SEAGRI supported by an external consultant	II Quarter 2015	Short-term consulting	15,000
B. Strengthening the State Drought Committee in order to make actions more proactive and less reactive	B.1 Mapping of the current institutional structure, issues and current policies regarding the effects of drought and contract technical studies that take into account the social, environmental and economic issues	EBDA, SEAGRI supported by an external consultant	a. III Quarter 2015 b. IV Quarter 2015 c. I Quarter 2016 d. II Quarter 2016 e. III Quarter 2016 f. IV Quarter 2016	Long-term consulting and meeting expenses	a. 40,000 b. 40,000 c. 40,000 d. 40,000 e. 40,000 f. 40,000 g. 40,000 Subtotal: 280,000
	B.2 Creation of a working group to develop and initiate the program of drought management	EBDA, SEAGRI	III Quarter 2015	Short-term consulting and meeting expenses	17,000
	B.3 Creation of communication and supervision tools	SEAGRI	III Quarter 2015	Meeting expenses	40,000
	B.4 Perform workshops in order to standardize the guidelines established by the Committee	SEAGRI, EBDA, State Universities and Federal Research Institutions supported by an external consultant	a. IV Quarter 2015 b. IV Quarter 2016	Short-term consulting e professional training	a. 45,000 b. 45,000 Subtotal: 90,000

Strategic Line	Actions	Institutions Responsible	Period (quarter and year)	Resources	Cost (US$)
C. Professional training of the extension workers that participate in the claim adjustment in the Garantia Safra order to reduce moral hazard and technical issues.	C.1 Definition of the training contents along with SEAGRI and Universities and development of the training content emphasizing on the institutional, technical, operational, agronomical and geotechnological issues	SEAGRI, EBDA, State and Federal Universities and Federal Research Institutions supported by an external consultant	III Quarter 2015	Short-term consulting e professional training	50,000
	C.2 Establishment of partnerships with Federal and State Universities, and Research Centers in the northeastern region	SEAGRI, EBDA	III Quarter 2015	Short-term consulting e professional training	20,000
	C.3 Execution of the professional training related to Garantia Safra claim assessment	SEAGRI, EBDA, State and Federal Universities and Federal Research Institutions	a. IV Quarter 2015 b. a. IV Quarter 2016	Short-term consulting e professional training	a. 1,100,000 b. 1,100,000 Subtotal: 2,200,000
Total ACIS					**US$ 3,581,000**

SPS

Strategic line	Actions	Responsible institution	Period (quarter and year)	Resources	Cost (US$)
A. Implementation of a wide area Integrated Pest Management (IPM) for the Cerrado of Western Bahia	A.1 Development of the IPM proposal	AIBA and ABRAPA	I Quarter 2015	Financial resources	8,000
	A.2 Workshop for discussing and approving the proposal	AIBA and ABRAPA	II Quarter 2015	Financial resources	12,000
	A.3 Training and capacitation courses and other actions	AIBA and ABRAPA	III Quarter 2015-2020	Financial resources	80,000

	A.4 Workshop for following up the program and plan next season	AIBA and ABRAPA	II Quarter 2016-2020	Financial resources	50,000
B. Actions to delay or avoid the introduction of exotic pests	B.1 Develop a study. Under the auspices of FAEB to realistic establish the adequacy of the structures of health protection agencies	FAEB	II Quarter 2015	Financial resources	10,000
	B.2 Expand the citrus seedling production program, financing individual cages environments	CAR	III Quarter 2015-2020	Financial resources	500,000
	B.3 Develop studies to establish the actual impact of the introduction of *moniliasis* of cacao	CEPLAC	II Quarter – III Quarter 2015	Financial resources	15,000
	B.4 Review the the risk of the introduction of the *moniliasis* of cacao	CEPLAC	II Quarter 2015	Financial resources	4,000
	B.5 Workshop for creating a Latin American research network of *moniliasis* of cacao	CEPLAC	II Quarter 2015	Financial resources, diplomatic support	30,000
	B.6 Establishment of scientific and technological cooperation between Brazil and Latin American cocoa producers countries	MAPA, MRE, CEPLAC	II Quarter – III Quarter 2015	Diplomatic negotiations	-
	B.7 Identify and multiply varieties of *palma forrageira* resistant to the *cochonilha do carmim*	EMBRAPA	2015-2017	Field and laboratory resources	15,000
C. Enhance and expand the RENIVA program	C.1 Develop a study to establish the needs for improving the RENIVA to benefit a larger number of smallholders	SUAF	II Quarter 2015	Financial resources	12,000
D. Evaluate and improve animal health programs	D.1 Evaluate capability for maintaining FMD free area status	ADAB	I Quarter 2015	Internal workshop	No financial costs
	D.2 Accelerate the eradication of important cattle diseases like	ADAB	I Quarter 2015	Internal workshop	No financial costs

	brucellosis, tuberculosis and cattle rabies				
	D.3 Recognition of Bahia as a free area of Classical Swine Fever (swine) and Newcastle disease (poultry)	ADAB	I Quarter 2015	Internal workshop	No financial costs
	D.4 Establish a state integrated food safety system	ADAB	I and II Quarter 2015	Workshop & Working Group	10,000
Total SPS					**US$ 746,000**

Supply Chain Coordination

Strategic line	**Actions**	**Responsible Institution**	**Period**	**Resources**	**Cost (US$)**
A. Identify actual farm to market experiences and business opportunities for family farmers in Bahia	A.1 Identify value adding activities for family agriculture farmers groups that can be developed as projects for CONAB's managed PAA or PNAE and make an assessment of the conditions for success	Project Bahia Produtiva and CONAB-BA	I-II Quarter 2015	Consultants	80,000
	A.2 Propose a practical methodology to incorporate the market oriented cooperation approach into the Bahia Produtiva planning	Bahia Produtiva	I-II Quarter 2015	Consultants	50,000
B. Capacity building on business development among associated small scale farmers	B.1 In cooperation with EBDA, and within the framework of the AIS, develop and test a methodology to support small scale farmers' organizations to develop business plans	Project Bahia Produtiva and EBDA within framework of AIS	I –III Quarter 2015	Consultant and EBDA	60,000
	B.2 Training of EBDA staff in business development methodologies for small scale farmers	EBDA and CONAB with assistance from Project Bahia Produtiva	III-IV Quarter 2015	Project Bahía Produtiva staff and consultants	40,000

Strategic line	Actions	Responsible Institution	Period	Resources	Cost (US$)
Total Supply Chain Coordination					**US$ 230,000**

AIS

Strategic Line	Actions	Responsible Institution	Period (year)	Resources	Cost (US$)
A. Improve the coordination of the Agriculture Innovation System for family agriculture risk management	A.1 Carry out a study to propose the creation of a sub-committee within the "Coexistence with semi-arid State system", for the coordination of the institutions that would be part of the AIS.	SEAGRI	2015	Consulting services to carry out the study, decide its integration, interrelation among members, internal rules of procedure, the appointment of an Executive Secretary, etc.	20,000
	A.2 Formalize and start up the sub-committee for coordination of the AIS within the "Coexistence with semi-arid State system".	SEAGRI	2015	One consultant to explain the proposal to State authorities and conduct the institutional-political articulation to formalize the sub-committee.	15,000
	A.3 Carry out a study to explore the feasibility of separating research and technical assistance activities in the institutional structure of Bahia's public sector.	SEAGRI	2015	One consultant to carry out the study.	15,000
B. Improve efficiency of the Agricultural Innovation System for family agriculture risk management - Strengthen the research sub-system	B.1 Carry out a survey to gather information regarding available technologies for the coexistence with semi-arid.	SUAF/ SEAGRI, with support of research institutions	2015	Consulting services to make an inventory of techniques and practices known, have they been or not implemented at field level, which will allow an increase of the resilience of agricultural systems used.	45,000
	B.2 Regular meetings to coordinate research activities for the coexistence with semi-	EBDA, EMBRAPA,	2015	One expert to organize the meetings.	40,000

Strategic Line	Actions	Responsible Institution	Period (year)	Resources	Cost (US$)
	arid, until the sub-committee is created.	INSA, Universities		Premises, equipment.	
C. Improve efficiency of the Agricultural Innovation System for family agriculture risk management - Strengthen the ATER sub-system	C.1 Carry out a study to assess the development opportunities and specific technical assistance requirements for the different types of smallholders within family agriculture.	SUAF/ SEAGRI, Project Bahia Produtiva	2015	Consulting services to carry out the study.	60,000
	C.2 Conduct a survey on potential technical assistance providers in the State, as well as explore other non-public TA modalities.	SUAF/ SEAGRI, Project Bahia Produtiva	2015	Consulting services to conduct the survey and to explore other technical assistance modalities.	45,000
	C.3 Conduct a survey to gather information regarding rural households organized in Community Associations.	SUAF/ SEAGRI, EBDA, Project Bahia Produtiva	2015	Consulting services to conduct the survey.	45,000
	C.4 Allocate funds to terminate contracts of EBDA´s retired staff.	State Government, SEAGRI	2015	Allocation of funds from State budget	
	C.5 Hire 500 extension agents by EBDA.	EBDA, SEAGRI	2015-2019	Allocation of funds from State budget (Vida Melhor Program)	
	C.6 Test new training models for extension agents and farmers.	EBDA	2015	Consulting services to test new training models for extension agents and farmers.	30,000
	C.7 Establish and implement a program for training EMATER-BA[66]´s personnel	EBDA	2015-2019	Program prepared by EBDA´s Human Resources Coordination. Allocation of funds from EBDA´s budget to implement the training program.	30,000 300,000
	C.8 Widen the use of information and communication technologies	EBDA	2015-2019	Contracting a massive SMS system with a	300,000

[66] Bahia Technical Assistance and Rural Extension Company - *Empresa de Assistência Técnica e Extensão Rural da Bahia*.

Strategic Line	Actions	Responsible Institution	Period (year)	Resources	Cost (US$)
	(ICT) as a way to reduce ATER costs.			mobile telephone company. Implementation of distant education methodologies.	120,000
D. Improve efficiency of the Agricultural Innovation System for family agriculture risk management. Enlargement of successful programs and projects	D.1Enlarge "Semeando" Program to produce 5,000 ton of seeds and seedlings in 2015/16 to benefit 500,000 family farmers and cooperatives and farmer associations who produce seeds and seedlings.	SUAF/ SEAGRI, EBDA	2015/2016	Allocation of funds from the State Government	7.7 million
	D.2 Expand the coverage of the RENIVA project to encompass 300 producers of cassava cuttings (*maniveiros*), to benefit 100,000 cassava producers.	EMBRAPA, SUAF/ SEAGRI, EBDA	2015-2017	Allocation of funds from the State Government	7.2 million
	D.3Enlarge the "State Plan of Beekeeping Development" to benefit 6,000 additional beekeepers.	SUAF/ SEAGRI, EBDA	2015-2016	Allocation of funds from the State Government and the Ministry of National Integration	19 million
	D.4 Enlarge the "Program for Food Security for Family Farming Animal Herds", establishing 1,000 field production sites to plant and transfer *palma forrageira* plants to family farmers.	SUAF/ SEAGRI, EBDA	2015-2017	Allocation of funds from SEAGRI and CODEVASF	5 million
Total AIS					**US$ 124,965,000**

Policy actions

Below is a suggested EBDA policy reform as a measure to assure a proper functioning of the AIS and the success of the risk management strategy.

Policy action	Legal evidence	Indicator
EBDA reform, including allocation of funds to terminate contracts of EBDA´s retired staff (estimated requirement US$ 40 million) and hiring of 500 extension agents (estimated requirement (US$ 45 million in 5 years)	Legal instruments approved	New, estension staff profile, with younger and more motivated professionals providing higher quality TA services

Short term plan by responsible institution

ACIS

INEMA

	2015 (cost-US$)				2016 (cost-US$)			
Actions	I	II	III	IV	I	II	III	IV
A.1	X 60,000							
A.2	X 45,000							
A.4		X 175,000						
A.6		X 9,000						

INMET, ANA, CPTEC, INEMA

	2015 (cost-US$)				2016 (cost-US$)			
Actions	I	II	III	IV	I	II	III	IV
A.3		X 100,000						
A.5		X 500,000						

INEMA, EBDA, SEAGRI

	2015 (cost-US$)				2016 (cost-US$)			
Actions	I	II	III	IV	I	II	III	IV

A.7		X 40,000						
A.8		X 15,000						

EBDA, SEAGRI

	2015 (cost-US$)				2016 (cost-US$)			
Actions	I	II	III	IV	I	II	III	IV
B.1			X 40,000	X 40,000	X 40,000	X 40,000	X 40,000	X 40,000
B.2			X 17,000					
B.4				X 45,000				X 45,000
C.1			X 50,000					
C.2			X 20,000					
C.3				X 1,100,000				X 1,100,000

SEDAP

	2015 (cost-US$)				2016 (cost-US$)			
Actions	I	II	III	IV	I	II	III	IV
B.3			X 30,000					

SPS

Private institutions (AIBA, ABRAPA, APROSOJA)

	2015 (cost-US$)			
Actions	I	II	III	IV
A1	X			

	8,000.00			
A2		X 12,000.00		
A3			X 16,000.00	

FAEB

	2015 (cost-US$)			
Actions	I	II	III	IV
B1		X 10,000.00.		

CAR

	2015 (cost-US$)			
Actions	I	II	III	IV
B2		X 20,000.00.	X 30,000.00	

CEPLAC

	2015 (cost-US$)			
Actions	I	II	III	IV
B3		X 5,000.00.	X 10,000.00	
B4		X 4,000.00		
B5		X 30,000.00		

EMBRAPA

	2015 (cost-US$)			
Actions	I	II	III	IV
B7		X 5,000.00.		

SUAF

	2015 (cost-US$)			
Actions	I	II	III	IV
B2		X 12,000.00.		

ADAB

	2015 (cost-US$)			
Actions	I	II	III	IV
D4		X 2,000.00.	X 8,000.00	

Supply Chain Coordination

CAR-Bahia Produtiva

	2015 (cost-US$)			
Actions	I	II	III	IV
A1	X 40,000	X 40,000		
A2	X 25,000	X 25,000		
B1	X 30,000	X 30,000	X 30,000	
B2			X 20,000	X 20,000

AIS

SEAGRI

	2015 (cost-US$)			
Actions	I	II	III	IV
A1		X 20,000		

A2		X 15,000		
A3			X 15,000	

SUAF/SEAGRI, with research institutions

	2015 (cost-US$)			
Actions	I	II	III	IV
B1		X 45,000		

SUAF/SEAGRI (with Bahia Produtiva in C2)

	2015 (cost-US$)			
Actions	I	II	III	IV
C1		X 30,000	X 30,000	
C2		X 45,000		

SUAF/SEAGRI, EBDA (with Bahia Produtiva in C3)

	2015 (cost-US$)			
Actions	I	II	III	IV
C3	X 45,000			
D1			X 1,500,000	X 1,500,000
D3		X 2,000,000	X 2,000,000	X 2,000,000
D4		X 500,000	X 500,000	X 500,000

EBDA

	2015 (cost-US$)			
Actions	I	II	III	IV
C6		X 15,000	X 15,000	
C7				X 30,000
C8			X 75,000	X 60,000

EBDA, EMBRAPA, INSA, Universities

	2015 (cost-US$)			
Actions	I	II	III	IV
B2			X 20,000	X 20,000

State Government, SEAGRI

	2015 (cost-US$)			
Actions	I	II	III	IV
C4	X 10,000,000	X 10,000,000	X 10,000,000	X 10,000,000

EBDA, SEAGRI

	2015 (cost-US$)			
Actions	I	II	III	IV
C5		X 2,250,000	X 2,250,000	X 2,250,000

EMBRAPA, SUAF/SEAGRI,EBDA

	2015 (cost-US$)			
Actions	I	II	III	IV
D2		X 800,000	X 800,000	X 800,000

REFERENCES

Volume 1: Risk Assessment

ALMEIDA, G.L.G.; D'ALMEIDA, J.M.; HORN, S.C. As doenças dos animais no Brasil: Histórico das primeiras observações. Bol. Def. Sanit. Anim, n.esp, 101p, 1988

ALVES, A.J.S. et al. Situação epidemiológica da brucelose bovina no Estado da Bahia. *Arq. Bras. Med. Vet. Zootec.* [online]. 2009, vol.61, suppl.1, pp. 613.)

ALVES, A et Villar.KS. Brucelose bovina e sua situacao saniataria no Brasil. (Bovine brucellosis and its epidemiological situation in Brazil) Revista de Educacao Continuada em Mwedicina Vetertinair e Zootecnia. Vol 9. No. 2 pag. 1217, 2011bastecimento, Brasília, p.5168.

ALVES A.J.S., Gonçalves V.S.P., Figueiredo V.C.F., Lôbo J.R., Bahiense L., Amaku M., Ferreira F., Ferreira Neto J.S. & Dias R.A. 2009. Situação epidemiológica da brucelose bovina no Estado da Bahia. Arq. Bras. Med. Vet. Zootec. 61:613.

ALVES[I], A.J.S.; Gonçalves[II] V.S.P.; Figueiredo[III] V.C.F.; Lôbo[III] J.R.; Bahiense[IV] L.; Amaku[I] M.; F. Ferreira[I]; Ferreira Neto[I] ,J.S.; Dias[I], R.A. Situação epidemiológica da brucelose bovina no Estado da Bahia (Epidemiological situation of bovine brucellosis in the State of Bahia, Brazil) Arq. Bras. Med. Vet. Zootec. vol.61 supl.1 Belo Horizonte Nov. 2009. http://www.scielo.br/scielo.php?script=sci_arttext&pid=S010209352009000700002

ALVES, A.J.S. et al. **Situação epidemiológica da brucelose bovina no Estado da Bahia.** *Arq. Bras. Med. Vet. Zootec.* [online]. 2009, vol.61, suppl.1, pp. 613.

ALVES, A. J. S.; VILLAR, K. S. Brucelose Bovina e sua situação sanitária no Brasil / Revista de Educação Continuada em Medicina Veterinária e Zootecnia do CRMVSP / Journalof Continuing Education in Animal Science of CRMVSP. *São Paulo: Conselho Regional de Medicina Veterinária, v. 9, n. 2 (2011), p. 12–17, 2011.*

Asociacao Bahiana de Avicultura. Perfil da avicultura da Bahia http://www.aviculturaba.com.br/perfilagricolanabahia/

Brasil 2006. Manual Técnico do Programa Nacional de Controle e Erradicação da Brucelose e Tuberculose (PNCEBT). Departamento de Defesa Animal, Secretaria de Defesa Agropecuária, Ministério da Agricultura, Pecuária e Abastecimento (MAPA), Brasília. ***Arq. Bras. Med. Vet. Zootec.*, v.61, supl. 1, p.15, 2009**

BERNUÉS A., Manrique E. & Maza M.T. 1997. Economic evaluation of bovine brucellosis and tuberculosis eradication programmes in a mountain area of Spain. Prev. Vet. Med. 30:137149.

Codevasf, 2002. Access at: http://www.codevasf.gov.br.

COSTA, L.B. *Caracterização da tuberculose bovina em regiões de relevância* 302 *econômica no Estado da Bahia*. 2012, 121f. Dissertação (Mestrado em Ciência Animal 303 nos Trópicos). Escola de Medicina Veterinária da Universidade Federal da Bahia. 304 Salvador.

COSTA, R., David A. Bessler, David A. and C. Parr Rosson, C. Parr. The Impacts of Foot and Mouth Disease Outbreaks on the Brazilian Meat Market. Selected Paper prepared for presentation at the Agricultural & Applied Economics Association's 2011 AAEA & NAREA Joint Annual Meeting, Pittsburgh, Pennsylvania, July 2426, 2011
http://ageconsearch.umn.edu/bitstream/103811/1/AAEA%202011%20Costa%20Bessler%20Rosson.pdf

DUARTE, L.F.C. *Investigação de Mycobacterium bovis em bovinos abatidos no* 314 *município de Feira de Santana, Bahia*. 2010, 61f. Dissertação (Mestrado em Ciência 315 48

EDINGTON, L.Abate de suínos: implicações técnicas eeconômicas / Lucia Novis Edington ._ Cruz das Almas, BA, 2012.EMBRAPA. Centro de Inteligencia do Leite
http://guernsey.cnpgl.embrapa.br/ http://www.cnpgl.embrapa.br/nova/principal.php
http://www.cnpgl.embrapa.br/nova/informacoes/estatisticas/producao/grafico02.73.php

EMBRAPA. Central de Inteligencia da Embrapa Suínos e Aves. ANUÁRIO ESTATÍSTICO SUINOCULTURA 2012.
http://www.cnpsa.embrapa.br/sgc/sgc_publicacoes/publicacao_e3n75c3h.pdf

FERREIRA, A. and Mello, N. (2005) "Main Atmospheric Systems Acting Over the Northeastern Region of Brazil and the Influence of Pacific and Atlantic Oceans on the Climate of the Region", *RevistaBrasileira de Climatologia*, Vol. 1 (1): 15-28MAPA. Instrução Normativa, Programa Nacional de Controle e Erradicação da Brucelose e Tuberculose Animal. Departamento de Defesa Animal, Secretaria de Defesa Agropecuária, Ministério da Agricultura, Pecuária e Abastecimento (MAPA). Diário Oficial da República Federativa do Brasil, Poder Executivo, Brasília, DF, 16 de janeiro de 2001, Seção 1, (2):1117. MAPA.. Secretaria de defesa Agropecuária **P**rograma Nacional de Controle e Erradicação da Brucelose e Tuberculose (PNCEBT). Brasília: Departamento de Saúde Animal, 2006. 188p. (Manual Técnico) **.**

MAPA. Secretaria de defesa Agropecuária. Programa Nacional de Controle e Erradicação de Brucelose e Tuberculose Animal (PNCEBT): evolução no controle da brucelose bovina de 2001 a 2010

MAPA. Manual Técnico. Programa Nacional de Controle e Erradi cação da Brucelose e Tuberculose (PNCEBT) Departamento de De fesa Animal, Ministério da Agricultura, Pecuária e A Alves, A et Villar.KS. Brucelose bovina e sua situacao saniataria no Brasil. (Bovine brucellosis and its epidemiological situation in Brazil) Revista de Educacao Continuada em Mwedicina Vetertinair e Zootecnia. Vol 9. No. 2 pag. 1217, 2011.

MIRANDA, L. A Seca na Bahia. Bahia Agricola. Vol. 9n.2 mar. 2013

MOLION AND BERNARDO (ND) Dinâmica das Chuvas no Nordeste Brasileiro, *Departamento de Meteorologia, UFCL* [Online] Available from:http://www.cbmet.com/cbm-files/12-7ea5f627d14a9f9a88cc694cf707236f.pdf

PANAFTOSA. Informe de Situación de los Programas de Erradicación de la Fiebre Aftosa año 2013 – Documento de trabajo para la COSALFA 41, abril 2014.

POESTER F., Figueiredo V.C.F., Lôbo J.R., Gonçalves V.S.P., Lage A.P., Roxo E., Mota P.M.P.C., Müller E.E. & Ferreira Neto J.S. 2009. Estudos de prevalência da brucelose bovina no âmbito do Programa Nacional de Controle e Erradicação de Brucelose e Tuberculose: Introdução. Arq. Bras. Med. Vet. Zootec. 61:15.

SANTOS[I], Renato L.; Martins[I], Telma M.; Borges[I], Álan M.;Paixão[II] , Tatiane A.·Economic losses due to bovine brucellosis in Brazil (Perdas econômicas devidas à brucelose bovina no Brasil) Pesq. Vet. Bras. vol.33 no.6 Rio de Janeiro June 2013 http://dx.doi.org/10.1590/S0100)SALES et al. Títulos de anticorpos contra o vírus da doença de Newcastle em três diferentes sistemas de criação avícola na região de Feira de Santana – Bahia. *Antibody titers against Newcastle disease virus in three different poultry management systems located in Feira de Santana – Bahia* Rev. Bras. Saúde Prod. An., v.8, n.4, p. 386393, out/dez, 2007 http://www.rbspa.ufba.br. ISSN 1519 9940SILVA AND AZEVEDO (2008) Índices de Tendências de Mudanças Climáticas no Estado da Bahia, Vol 5 (3), pp. 141-151

VIEIRA, G.A. Análise Estrutural da Cadeia Produtiva Suína na Bahia. Revista Nacional da Carne, v.421, p. 7377, 2012.

Volume 2: Risk Management Strategy

ALMEIDA, G.L.G.; D'ALMEIDA, J.M.; HORN, S.C. As doenças dos animais no Brasil: Histórico das primeiras observações. Bol. Def. Sanit. Anim, n.esp, 101p, 1988

ALMEIDA, S.W. Massificação das operações do seguro rural: o grande desafio brasileiro. Revista de Política Agrícola, n. 4, p. 21-26, 2007.

ALVES, A.J.S. et al. Situação epidemiológica da brucelose bovina no Estado da Bahia. Arq. Bras. Med. Vet. Zootec. [online]. 2009, vol.61, suppl.1, pp. 6-13.

Banco Mundial. 2012. Agricultural Innovation Systems, An Investment Sourcebook. Washington, DC: World Bank

Banco Mundial. 2014. Bahia state agriculture sector risk analysis. Volume 1: risk assessment. Brasilia, Brazil.

Banco Mundial. 2014. Preparação para as secas e resiliência às mudanças climáticas.

Batista Lopes, E. (Organizador). 2012. PALMA FORRAGEIRA. Cultivo, Uso atual e Perspectivas de Utilização no Semiárido Nordestino. EMEPA-PB, João Pessoa-PB, Brasil.

BRACALE, G. 2012. III Reunião técnica do CEMADEN. Ceará: Fortaleza, abril de 2012.

CAMPOS, J. N. B.; STUDART, T. M. C. 1997. Droughts and water policy in Northeast of Brazil: Background and rationale: water policy, USP, São Paulo, v.11, n.29, p.127-54, 1997.

Central Bank of Brazil. Manual do crédito rural. Available at: http://www4.bcb.gov.br/NXT/gateway.dll?f=templates&fn= default.htm&vid=nmsGeropMCR:idvGeropMCR.

CONAB. 2013. Acompanhamento da safra brasileira de grãos. Available at http://www.conab.gov.br/OlalaCMS/uploads/arquivos/13_11_08_09_29_24_boletim_graos_novembro_2013.pdf.

COSTA, L.B. Caracterização da tuberculose bovina em regiões de relevância econômica no Estado da Bahia. 2012. Dissertação (Mestrado em Ciência Animal nos Trópicos). Escola de Medicina Veterinária da Universidade Federal da Bahia. Salvador.

Embrapa Algodão. 2014. Available at: https://www.embrapa.br/algodao/apresentacao

Embrapa Caprinos e Ovinos. 2014. Available at: https://www.embrapa.br/caprinos-e-ovinos/apresentacao

Embrapa Mandioca e Fruticultura. 2014. Available at: https://www.embrapa.br/mandioca-e-fruticultura/apresentacao

Embrapa Semiárido. 2014. Available at: https://www.embrapa.br/semiarido/apresentacao

GUIMARÃES FILHO, C., 2013. Caprino-Ovinocultura no Semiárido Baiano – Alguns Caminhos Para Viabilização. Instituto Regional da Pequena Agropecuária Apropriada – IRPAA. Available at http://www.irpaa.org/publicacoes/artigos/clovis-dr-caprovinsemi-arido.pdf.

IBGE, Censo Agropecuário 1995-96. Available at: http://downloads.ibge.gov.br/downloads_estatisticas.htm

IBGE, Censo Agropecuário 2006. Available at: http://downloads.ibge.gov.br/downloads_estatisticas.htm

IBGE, Censo Demográfico 2010. Available at: http://downloads.ibge.gov.br/downloads_estatisticas.htm

INSA, Instituto Nacional do Semiárido. 2014. Available at: http://www.insa.gov.br/

Maia Neto, A.L. 2013. Gestão ambiental para a sustentabilidade dos Fundos de Pastos no Semiárido baiano. Bahia Agrícola, v.9, n.2, Mar. 2013. Salvador-BA, Brasil.

MAPA, 2013 – Dados do rebanho bovino e bubalino no Brasil (2012). Available at: http://www.agricultura.gov.br/arq_editor/file/Dados%20de%20rebanho%20bovino%20e%20bubalino%20do%20Brasil_2012.pdf.

MAPA. 2014. Available at: http://www.agricultura.gov.br/politica-agricola/seguro-rural

MIRANDA, L. 2013. A seca na Bahia. SEAGRI: Governo do Estado da Bahia.

OZAKI, V.A. 2013. Impact analysis of the PROAGRO in Brazil. Working paper, USP/ESALQ.

Primo Junior, J.F., Vasconcelos Dias, W.J., Andrade Santos, R. 2013. Assistência Técnica e Extensão Rural: novos caminhos para o desenvolvimento rural sustentável. Bahia Agrícola, v.9, n.2, Mar. 2013. Salvador-BA, Brasil.

RAMOS, R.C. O seguro rural no Brasil: origem, evolução e proposições para aperfeiçoamento. Informações Econômicas, v. 39, n. 3, 2009.

SALES et al. Títulos de anticorpos contra o vírus da doença de Newcastle em três diferentes sistemas de criação avícola na região de Feira de Santana – Bahia. (Antibody titers against Newcastle disease virus in three

different poultry management systems located in Feira de Santana – Bahia). Rev. Bras. Saúde Prod. An., v.8, n.4, p. 386-393, out/dez, 2007 http://www.rbspa.ufba.br

SEAGRI, L. 2013. Ações emergenciais e estruturantes para mitigar os efeitos da seca na agropecuária baiana. SEAGRI: Governo do Estado da Bahia.

SEAGRI/ SUAF. 2014. Assistência Técnica e Extensão Rural na Bahia é Definida em Lei. In: Agricultura Familiar na Bahia, 2014. Salvador-BA, Brasil.

Universidade do Estado da Bahia (UNEB). 2014. Available at: http://www.uneb.br/

Universidade Estadual do Sudoeste da Bahia (UESB). 2014. Available at: http://www.uesb.br/

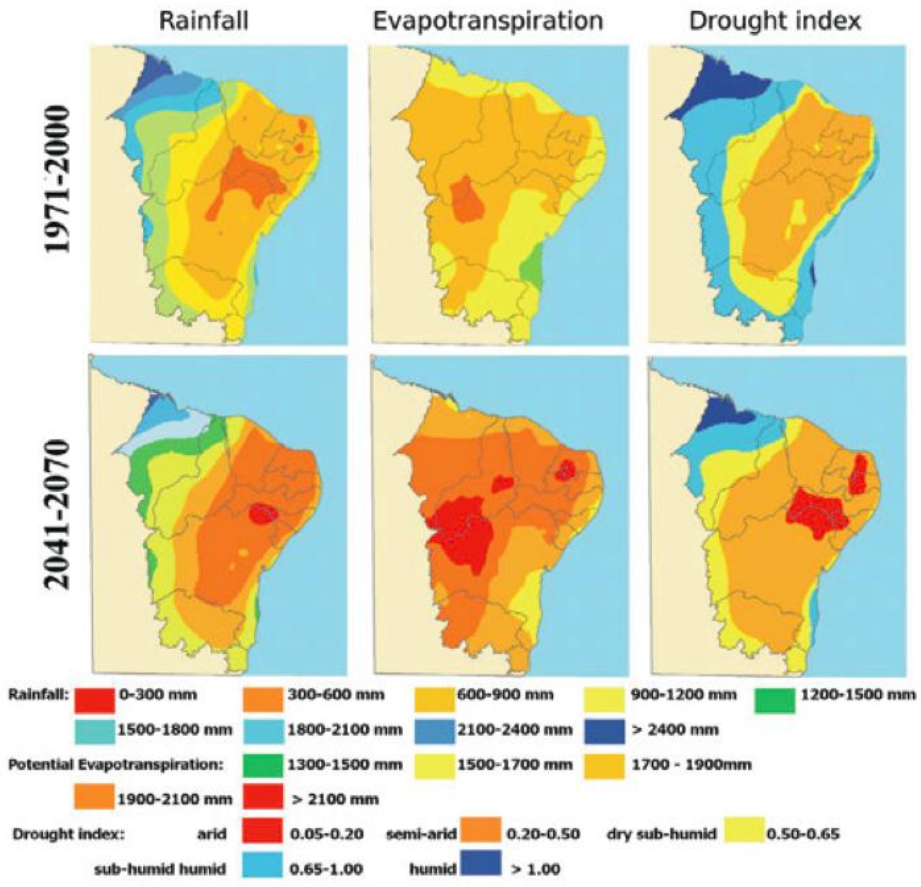
Universidade Federal do Recôncavo da Bahia (UFRB). 2014. Available at: http://www.ufrb.edu.br/portal/

ANNEXES

ANNEX 1: PROJECTED CLIMATE CHANGE IMPACTS ON AGRICULTURE IN NORTHEAST BRAZIL

1. It is considered probable that climate change will cause global increases in temperature by 2 to 5.4 degrees Celsius in a pessimistic scenario (IPCC A2) and by 1.4 to 3.8 degrees Celsius in the more optimistic scenario (IPCC B2).[67] In Northeast Brazil, this means that rainfall will likely be reduced by 15-20% under the pessimistic scenario (Figure A1-1). In the Semi-Arid region that covers most of Northeast Brazil, rainfall is already less than 800 millimeters per year and rainfall variability is among the highest in the world.[68]

Figure A1 - 1: Northeast Brazil Climate Predictions, 1971 to 2000 and 2041 to 2070



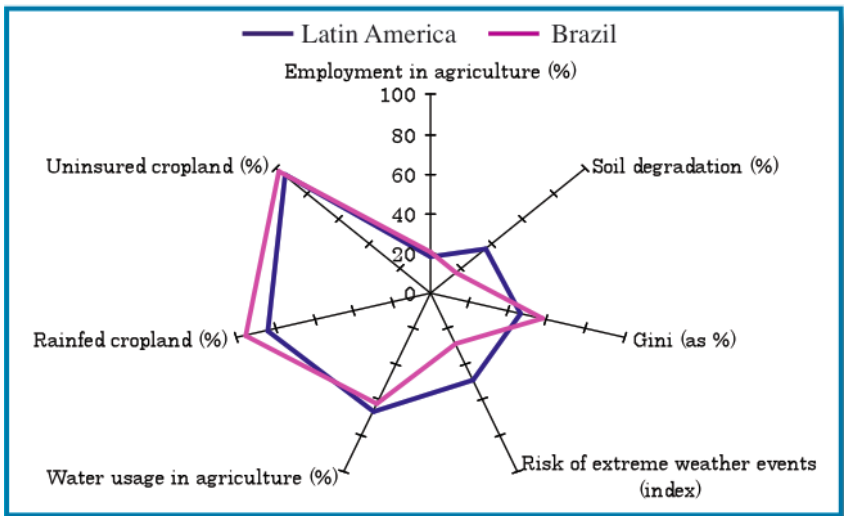
[67] The IPCC A2 scenario represents high carbon emissions; the B2 scenario implies low carbon emissions under the hypothesis that all countries sign the Kyoto Protocol.
[68] World Bank, 2013. Climate Change Impacts on Water Resources Management: Adaptation Challenges and Opportunities in Northeast Brazil.

Source: World Bank, 2013[69]

2. Possible impacts of climate change in Northeast Brazil include (i) increased frequency of dry spells and evaporation rates leading to lower soil moisture levels and reductions in water reservoirs, (ii) losses in natural ecosystems such as the caatinga, (iii) tendency towards aridization and desertification in the Semi-Arid Region, (iv) water scarcity, (v) climate induced migration to large cities, and (vi) impacts on human health.[70]

3. Figure A1-2 highlights seven indicators that convey vulnerability to climate change in Brazil as a whole. In the Northeast, the vulnerability scenario is more drastic: employment in agriculture, soil degradation, and the risk of extreme weather events indicators are all higher than the country average.

Figure A1 - 2: Climate Vulnerability Indicators



Source: World Bank, 2012[71]

4. In the Northeast, climate change will have significant impacts on the livelihoods of the poorest, those that rely on rain-fed agriculture. Climate change is seen as a migration "push" factor, and migration is projected to increase from the rural Northeast as the value of agricultural production declines due to climate risks.[72]

[69] Figure shows mean annual precipitation, mean annual evapotranspiration, and drought index (precipitation divided by evapotranspiration) for the periods of 1971-2000 and 2041-2070 (projected) using the MIMR climatic model under the B1 emission scenario. The more red coloration corresponds to increased drought, due to reduced rainfall and/or increased evapotranspiration.
[70] World Bank, 2009. Brazil: Country Note on Climate Change Aspects in Agriculture
[71] Employment in agriculture (percent of total employment), rainfed cropland (percent of total cropland), Gini, water usage in agriculture (percent of total annual fresh water withdrawals) from World Development Indicators 2007, 2000-2007 average. Uninsured cropland (percent of total cultivated land area) from IADB, IICA 2002/2003 figures. Soil degradation (percent of total land) from FAO AGL 2005. Risk of extreme weather events (index, annual average 1997-2006) from Germanwatch.
[72] Barbieri et al, 2010. Climate change and population migration in Brazil's Northeast: scenarios for 2025-2050. Population and Environment (2010) 31:344-370.

5. Climate change signifies shifts in temperature and rainfall regimes, which affect agricultural productivity by shifting suitable area for agricultural production, altering agricultural yields, changing water availability, and producing conditions that increase the likelihood of plant pathogens.

6. Reductions in area are projected for all but one of the major commodity crops in Brazil. Projected climate change impacts on all currently produced food grains will amount to US$4 billion by 2050. Soybeans are likely to be most affected by climate change, with the soybean sector alone accounting for almost 50% of these economic losses.[73] Margulis and Dubeux (2010) modeled the economic effects of climate change on Brazil's GDP and found that in the worst case, Brazil could lose about 2.5% every year due to the impacts of increasing temperatura (Tables A1-1 and A1-2).

Table A1 - 1: Impact of Climate Change on Current Low Risk Areas Suitable for Cultivation

Crops	Variation relative to current productive area (%)					
	SRES B2 (+1.4ºC to +3.8ºC)			SRES A2 (+2°C to +5.4ºC)		
	2020	2050	2070	2020	2050	2070
Cotton	-11	-14	-16	-11	-14	-16
Rice	-9	-13	-14	-10	-12	-14
Coffee	-7	-18	-28	-10	-17	-33
Sugar cane	171	147	143	160	139	118
Beans	-4	-10	-13	-4	-10	-13
Sunflower	-14	-17	-18	-14	-16	-18
Cassava	-3	-7	-17	-3	-13	-21
Maize	-12	-15	-17	-12	-15	-17
Soybean	-22	-30	-35	-24	-34	-41

Source: Margulis et al, 2010

Table A1 - 2: Economic Losses for Key Crops by 2050, Projected in Pessimistic Scenario

Crop	Reduction in "low risk" cultivation area (%)	Scenario A2 Annual Economic loss (Millions Reais)*
Rice	-12	530
Cotton	-14	408
Coffee	-17.5	1,597
Beans	-10	363
Soybean	-32	6,308
Maize	-15	1,511
Sugar cane	145	0

Source: Margulis et al, 2010

7. Projections from Assad et al (2012) highlight the severe risks of climate change's negative impacts on three principal agricultural activities in Northeast Brazil (livestock pasture, maize, and beans). However, even under a pessimistic scenario (IPCC Scenario A2), the area suitable for sugarcane in Brazil

[73] Assad and Pinto, 2008

could double by 2020. For some of the sugar-cane producing regions of the Northeast, this would offset some of the production lost from other crops. See Figures A1-3 to A1-5.

Figure A1 - 3: Projected losses in pasture productivity (%) relative to 2010 baseline under optimistic and pessimistic scenarios (2020 and 2030)

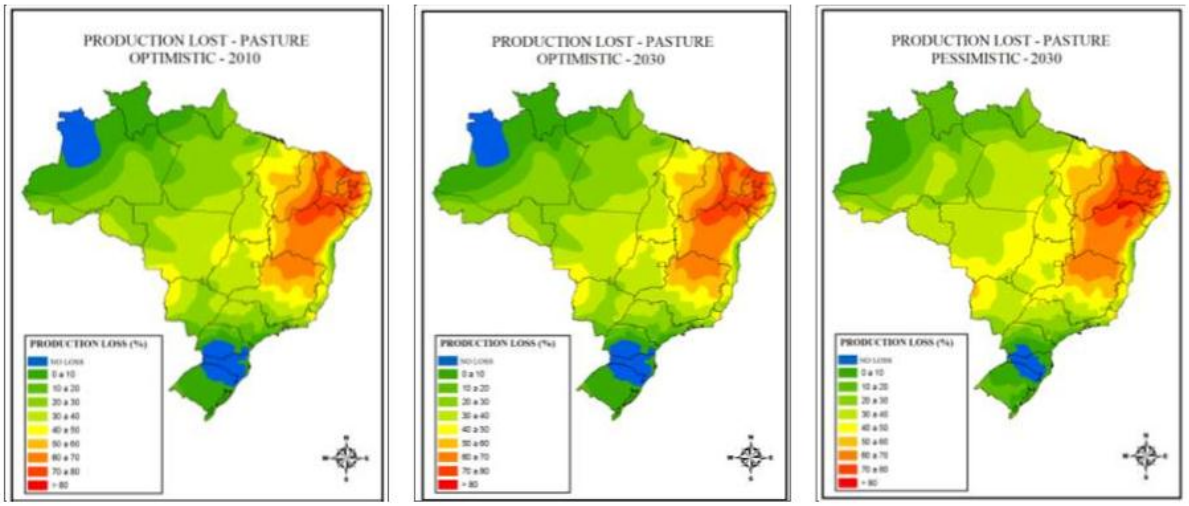


Figure A1 - 4: Impact of Climate Change on area suitable for maize (2010 baseline, 2030 optimistic and pessimistic)

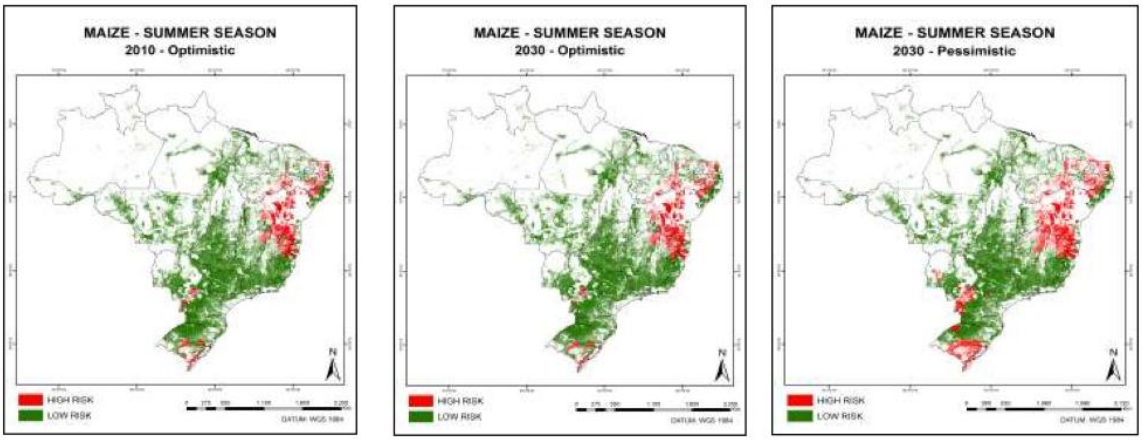
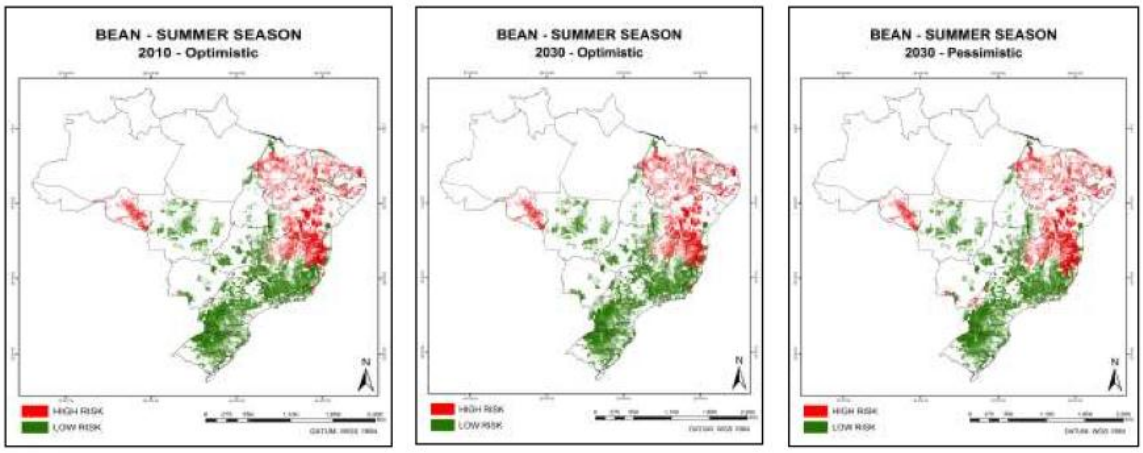


Figure A1 - 5: Impact of Climate Change on area suitable for beans (2010 baseline, 2030 optimistic and pessimistic)



8. Fernandes et al (2011) found that adaptation interventions (short/long cycle varieties, deeper rooted and drought-tolerant varieties, moderate irrigation at critical growth phases, shift in planting dates) can mitigate yield declines in all impacted crops. In combination with incentives and infrastructure for efficient water use, agriculture can evolve to become resilient to climate change, but a business as usual scenario ignoring climate change in the long run will lead to severe losses. Early adaptation planning and investments will save costs and can prevent significant damages.

ANNEX 2: VULNERABILITY IN BAHIA

1. Climate variability has long been considered a constraint to economic development and poverty alleviation in Northeast Brazil. Long-term impacts of repeated exposure to shocks bring household food insecurity, which is much higher in the rural Northeast than urban, and whose rural levels are amongst the highest in Brazil. Repeated shocks confine rural households into a poverty trap, exhausting savings and dissolving investments that would otherwise help propel the household ahead. The portion of the rural population living in extreme poverty, at 28.3%, is over triple urban rates (8.7%) in Bahia.[74] Expenditures on drought mitigation and emergency measures also divert municipal resources from longer-term investments in human capital and productivity.

2. The impacts of the aforementioned risks have greater consequences for human welfare among the individuals, communities, and regions of Bahia that are more vulnerable. A single risk such as drought has different effects on different systems of productions and producers. Vulnerability is the concept that explains this heterogeneity in impact. This annex explores drivers of heterogeneity in vulnerability in Bahia.

3. Vulnerability is "the likelihood that at a given time in the future, an individual will have a level of welfare below some norm or benchmark."[75] Common welfare indicators include poverty measurements, household expenditures, savings levels, and food security and nutrition measures (such as food consumption score and household dietary diversity). Though vulnerability depends on the severity of external shocks like climate, the likelihood of a drop in welfare depends on both people's context and capacity to act and react. Socio-economic assets and institutions play an important role in people's vulnerability.

4. Vulnerability is not the same thing as exposure to a shock, since many households can experience, say, a drought with different welfare outcomes. Vulnerability research emphasizes that both the settings and the asset levels of a household influence the livelihood strategies households choose.[76] Since vulnerability results from the combination of factors exogenous and endogenous to the individual, the same exogenous shock, like drought, affects individuals differently. In addition, if an individual or household is vulnerable to one exogenous shock, it does not follow that the household is vulnerable to all shocks. For example, a subsistence-oriented rural farming household may be vulnerable to drought and other possible climatic shocks like irregular and delayed rainfall, but may not be vulnerable to price shocks if the household is not commercializing its production.

[74] IBGE, Indicadores Sociais Municipais, Bahia, Censo 2010, Tabela 12.

[75] J. Hoddinott and A. Quisumbing. 2010. "Methods for Microeconometric Risk and Vulnerability Assessment." In *Risk, Shocks and Human Development: On the Brink,* edited by R. Fuentes-Nieva and P. A. Seck, 72. London: Palgrave Macmillan for United Nations Development Programme.

[76] Hoddinott, John. 2014. "Resilience: A Primer." 2020 Conference Brief 8, IFPRI.

5. Vulnerable households in Bahia respond to shocks by reducing household consumption, selling household and productive assets, and seeking income sources off the farm with diverse strategies including migration and even prostitution. Households depend on their own production for income as well as their food, so different factors that facilitate access to alternate sources of food and income are important coping strategies after a shock.

6. Thankfully, in the recent droughts in Bahia, there have been no reported deaths. Fifty years ago droughts triggered famine and mass migration. Because of a mixture of social safety nets and institutional responses, drought kills animals and crops, but not humans.

A. Vulnerability and Welfare Indicators

7. Vulnerability is of greater concern when the household's starting welfare levels are low, because a shock will push a household into even more precarious living conditions. Though technically vulnerability measures marginal changes in welfare of a household, for our purposes the concept is most useful when applied to groups that are already at the margin of decent welfare.

8. Poverty exacerbates vulnerability because a shock will have greater proportional effects on the welfare of a poor household than on a wealthier household. For this reason, it is worthwhile to look at socio-economic indicators in Bahia to characterize baseline poverty and asset levels.

9. Though poverty has been declining in the Northeast as in the rest of Brazil in the last decade, poverty in rural areas, where livelihoods concentrate on agriculture, remain high. While in Brazil in 2010 25.5% of the rural population was considered extremely poor, this rate was 35.4% for the Northeast's rural population. The Northeast essentially tied for last place with the North region (35.7%), and drastically behind all other regions of the country (10.2%, 6.8%, and 11.7% in the Southeast, South, and Center-West, respectively).

10. In Bahia, 28.3%[77] of the rural population is extremely poor (under R$70) and 50% is less than ¼ minimum salary (R$127.50).[78] In rural Bahia, the average income is R$218, less than half of the minimum salary, compared to R$576 in urban Bahia. Selecting only households with income, the averages become R$410 rural and R$949 urban.[79] See Table A2-1.

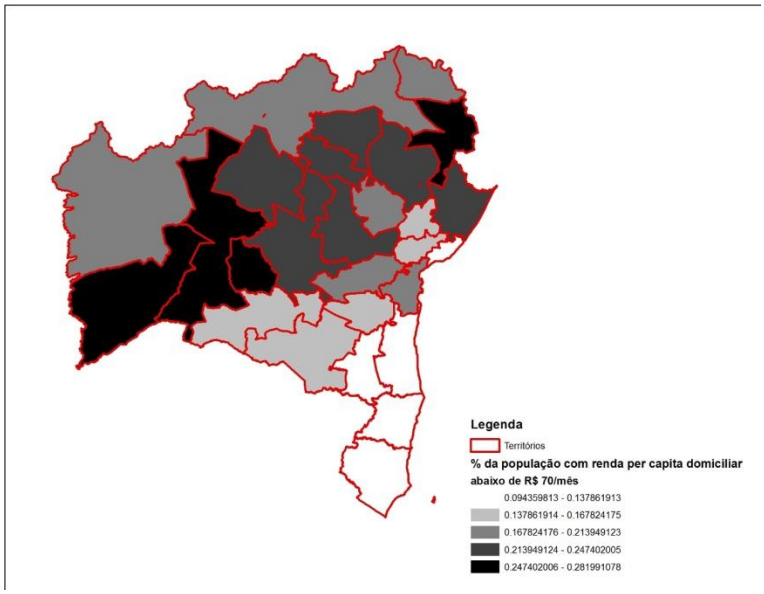
[77] Census 2010. Tabela 3.16.3.6.
[78] One minimum salary is R$510.
[79] Brazil does not have an official poverty line. In recent years, the R$70 and R$140 per capita per month, which are administrative poverty lines defined for the *Bolsa Familia* program and the *Brasil Sem Miseria* plan, have been increasingly used in place of official poverty lines. The international US$1.25 line is also used on occasion, notably in relation to the Millennium Development Goals (MDG). As a result of methodological differences in the computation of lines and income aggregates, there are sometimes small differences between government and World Bank estimates. However, trends are broadly consistent across methodologies.

Table A2 - 1: Nominal Per Capita Monthly Income, 2010

	Rural	Urban
Less than R$70	28.3%	8.7%
Less than ¼ minimum salary	50.0%	22.4%
Less than ½ minimum salary	78.2%	49.8%

11. The geographic distribution is represented visually in Figure A2-1 that follows, with extreme poverty mapped to the "territories of identity" defined for Bahia. Table A2-2 then compares several measurements of poverty for Bahia's territories of identity. Extreme poverty is defined as less than R$70 monthly per capita income and poverty as less than R$140. Multidimensional poverty is defined as poverty accompanied by the lack of access to a minimum number of assets in a package of assets including personal car, telephone, refrigerator and stove.

Figure A2 - 1: Percent of Extreme Poor in Bahia, 2010[80]



Source: IBGE.

[80] Lichand, Guilherme. Elementos para a focalização dos investimentos de inclusão produtiva e de água e saneamento do Projeto Bahia Produtiva. Unpublished background paper for Bahia Produtiva Project, World Bank.

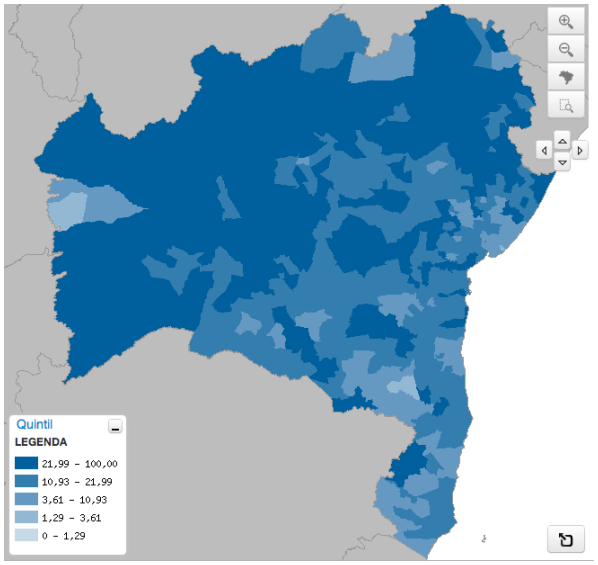
Table A2 - 2: Measures of Poverty, by Territory in Bahia, 2010

Territory	Extreme Poverty	Poverty	Multi-dimensional Poverty
Irecê	23.6%	43.5%	6.7%
Velho Chico	28.2%	47.0%	10.8%
Chapada Diamantina	24.5%	43.5%	8.1%
Sisal	24.5%	43.5%	10.2%
Litoral Sul	13.8%	30.9%	5.3%
Baixo Sul	19.2%	40.8%	11.3%
Extremo Sul	12.4%	26.7%	3.7%
Médio Sudoeste	11.5%	28.7%	2.6%
Vale do Jiquiriçá	20.7%	41.5%	6.3%
Sertão do São Francisco	21.0%	37.5%	11.1%
Oeste Baiano	21.4%	35.7%	8.9%
Bacia da Paramirim	26.9%	42.4%	7.3%
Sertão Produtivo	16.5%	33.1%	4.1%
Piemonte do Paraguaçu	24.7%	44.8%	9.6%
Bacia do Jacuípe	19.7%	38.8%	6.5%
Piemonte da Diamantina	23.9%	42.6%	10.1%
Semi-árido do Nordeste II	26.0%	46.2%	9.2%
Litoral Norte - Agreste Baiano	22.6%	40.4%	5.6%
Portal do Sertão	14.7%	29.5%	3.3%
Vitória da Conquista	16.6%	32.7%	5.6%
Recôncavo	16.8%	33.1%	2.8%
Médio Rio das Contas	16.3%	35.8%	6.4%
Bacia do Rio Corrente	26.5%	43.1%	8.8%
Itaparica	20.3%	36.4%	6.1%
Piemonte Norte do Itapicuru	23.9%	41.9%	9.1%
Metropolitana de Salvador	9.4%	18.0%	0.4%
Costa do Descobrimento	12.0%	26.9%	3.5%

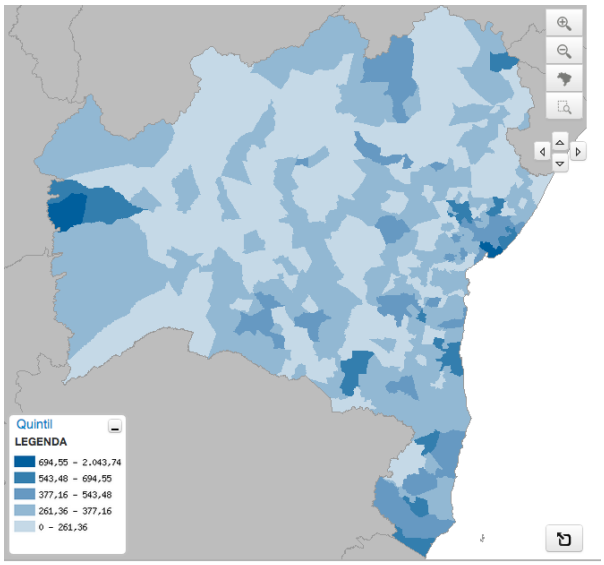
Source:IBGE.

Figure A2 - 2: Extreme Poverty and Income per capita, maps of 2010

Extreme Poverty, 2010



Income per capita, 2010



12. In 2004, Bahia had 1.37 million[81] people living with food insecurity. Though 27.9% of the population in Bahia is officially classified as rural (2010)[82], the number of food insecure households in rural areas contributes 34.5% of the total number of food insecure in Bahia,[83] making food insecurity disproportionately rural. See Table A2-3.

[81] http://www.sidra.ibge.gov.br/bda/tabela/protabl.asp?c=3000&z=pnad&o=9&i=P
[82] http://aplicacoes.mds.gov.br/sagirmps/idv/tela_uf_e_mun.php?
[83] Segurança Alimentar, PNAD 2004, Tabela 3000 http://www.sidra.ibge.gov.br/bda/tabela/protabl.asp?c=3000&z=pnad&o=9&i=P

Table A2 - 3: Food Security in Bahia, 2004 and 2009

	Overall (2009[84])	Overall (2004)	Rural (2004)	Urban (2004)
Prevalence of food secure households	58.8%	44.2%	40.4%	46%
Prevalence of light food insecurity	21.5%	55.8%	17.9%	20.3%
Prevalence of moderately food-insecure households	10.8%	19.5%	25.3%	21.1%
Prevalence of severely food-insecure households	8.9%	13.8%	16.4%	12.6%

When measuring vulnerability, it is important to focus on populations that are most at risk of falling beneath the poverty line, into food insecurity, or other measurement of human development and social welfare. To be systematic the set of measurements of interest should be determined in advance and prioritized in order to work to avoid the worst outcomes. For example, in the Sahel donors agreed upon a limited set of indicators of resilience-related livelihood outcomes and impacts: Reduction in Humanitarian Assistance Needs, Depth of Poverty, Moderate to Severe Hunger, and Global Acute Malnutrition.[85]

B. Vulnerability is Heterogeneous

13. To capture why vulnerability varies between individual to individual, household to household, vulnerability can be seen as the function of three factors: (i) sensitivity, (ii) adaptive capacity, and (iii) exposure.[86]

iv. **Sensitivity** is the degree of impact of the initial shock. Sensitivity can be thought of as the elasticity of household welfare (e.g. consumption levels) in response to a shock.

v. **Adaptive capacity** is the ability of the household to access ex-post coping strategies that helps the household return to pre-shock welfare levels.[87]

[84] PNAD 2009 http://www.ibge.gov.br/estadosat/temas.php?sigla=ba&tema=pnad_seguranca_alimentar_2009

[85] FEWSNET Technical Note on Measuring Resilience, USAID June 2013.

[86] Lindoso et al. 2012. "Indicators for Assessing the Vulnerability of Smallholder Farming to Climate Change: The Case of Brazil's Semi-Arid Northeastern Region." Instituto de Pesquisa Economica Aplicada. International Policy Centre for Inclusive Growth.

[87] Adaptive capacity is a subset of resilience. USAID defines resilience as the ability of people, households, communities, countries, and systems to adapt to and recover from shocks and stresses in a manner that reduces chronic vulnerability and facilitates inclusive growth.

vi. **Exposure** is the probability of the given shock materializing and affecting the household's assets.

14. Several indices have been constructed in Northeast Brazil to measure the socio-economic aspects of vulnerability of smallholder farmers (Figure A2-3). [88] Two examples are included here, with the first (Table A2-4) focused on the risk of drought and the second (Table A2-5) delves into depth on conditions of social vulnerability to contribute to economic ecological zoning for the state of Bahia, which otherwise focuses on physical/natural conditions.

Figure A2 - 3: IPEA Vulnerability Index

Indicators of the Three Attributes of Vulnerability of Smallholder Farming

	Attribute of Vulnerability	Indicator
Vulnerability of smallholder farming	Sensitivity (S)	Dependency of smallholder farm income on the crop and animal production (%)
		Municipal population occupied in smallholder agriculture (%)
		Establishments with access to water (%)
		Establishments with rainfed farming (%)
	Adaptive capacity (AC)	Smallholder system product diversification (%)
		Establishments in which the producer is the landowner (%)
		Establishments in which the administrator can read and write (%)
		Establishments in which the producer is a member of an association or union (%)
		Establishments that receive technical assistance (%)
		Agricultural establishments with access to electricity (%)
	Exposure (E)	Aridity Index (AI)
		Annual distribution of rainfall

Source: IBGE (SIDRA) and FUNCEME, 2011.

[88] Sensitivity, adaptive capacity, and exposure can each be measured through a number of indicators, and several vulnerability indices have been formulated to capture the heterogeneity of impacts of agricultural risk for farmers in developing countries. See Lindoso et al. 2012. Supplementary Material for "Integrated Assessment of Smallholder Farming's Vulnerability to drought in the Brazilian Semi-Arid: a case study in Ceará" for a more comprehensive review of the vulnerability index literature and comparison of various indices. Though there is growing consensus that vulnerability is defined by sensitivity, adaptive capacity, and exposure, consensus does not yet exist for what composite of variables should be measured to determine each of these factors.

Table A2 - 4: Social Vulnerability Indicators as defined by State of Bahia Ecological-Economic Zoning Coordination[89]

Analytical Variables	**Indicators**
1. Quality of Life Dimension	
Social Services	Inhabitants between 3 and 29 years of age per school
	Number of families per PSF team
Household Infrastructure	Households connected to water network
	Households with bathroom
	Households with trash collection
	Households with sewage system
	Percent of energy supply
	Housing Deficit
2. Living Conditions Dimension	
Social Exclusion	Death from external causes
	Infant mortality
	Number of children between 0 and 4 years of age
	Life expectancy at birth
	Number of illiterate people older than 15 years of age
	Number of people below the poverty line
	Adolescent pregnancy rate
	Household density
3. Economic Conditions Dimension	

[89] Diagnóstico da Vulnerabilidade Social. SEPLAN/SEMA Bahia.

Management Capacity	Municipal budget per capita
	Percent of municipal resources generated by the municipality
Work	Percent of PEA relative to population
Production	Diversification of the economy – Sectorial GDP
	GDP per capita
Income	Income per capita
	Concentration of income (Gini)
Land	Concentration of landholdings (Gini)
Population	Population growth

Table A2 - 5: Formula for Calculating Socio-Environmental Vulnerability[90]

Index of Socio-Environmental Vulnerability = (Aridity Index * Agricultural GDP) / (Municipal HDI * Basic Education Development Index)

15. This annex expands upon these relevant indicators and suggests measurements for analyzing vulnerability to drought, the most significant agricultural risk for small farmers in Bahia. A number of indicators for sensitivity, adaptive capacity, and exposure can be considered to characterize the vulnerability of farmers.

C. Sensitivity:

16. Sensitivity is the extent of change in a household's welfare (elasticity) induced by a shock.

17. A number of factors influence the sensitivity of a household to an agricultural shock like drought. Prolonged drought affects household incomes most directly by constraining agricultural and livestock yields. However, income diversification and productive diversification, along with ex-ante mitigation measures, can minimize household sensitivity. Measurements of sensitivity of a household should take into account:

[90] Santos. 2008. Vulnerabilidades socioambientais diante das mudanças projectadas para o semi-arido da Bahia. Doctoral Thesis, Universidade de Brasília.

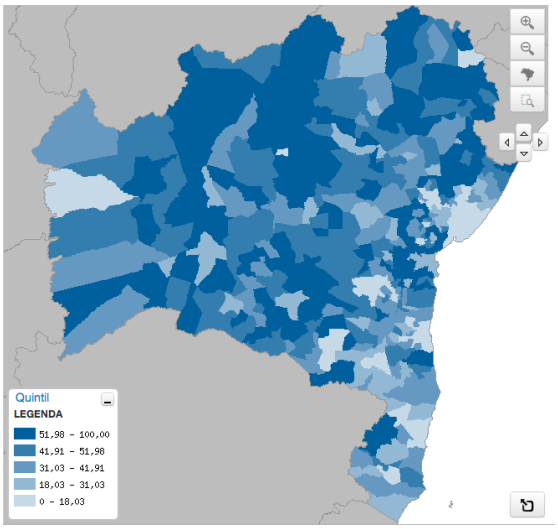
- Household revenue diversification, including access to income transfers (Retirement and disability stipends, *Bolsa Familia*)
- Agricultural/productive diversification
- Access to water resources for productive activities and human consumption
- Number of dependents

18. A household with diversified income sources, including non-farm income, and diversified agricultural production will be less sensitive to drought because their principal income sources will not all be affected in the same way. Access to water resources is important to minimize sensitivity because household consumption and production is less dependent on rainfall. Finally, a household with a larger number of dependents is likely to have a more elastic initial response to drought because finite household resources must be divided between more people that cannot contribute substantially to household revenues. However, this is somewhat offset by the fact that these dependents qualify the household to receive social transfers (*Bolsa Família* for children and retirement for adults), so the baseline of these households' revenues may even be higher than without dependents.
Fortifying these kinds of characteristics/assets help to mitigate the impact of a shock, reduce sensitivity, and reduce vulnerability.

a) Income Diversification

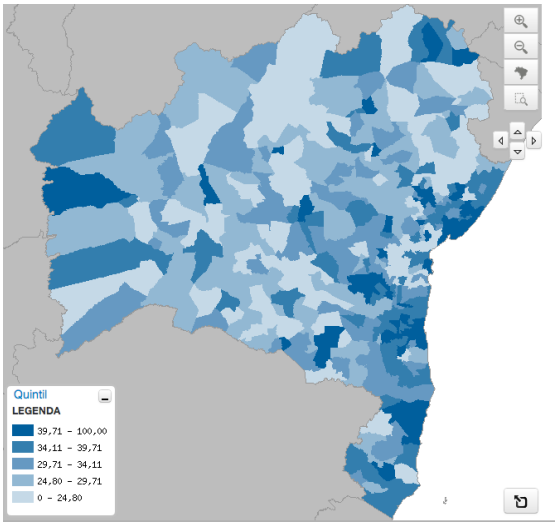
A farming household that has little or no income diversification is more sensitive to an agricultural risk than a household that has a stream of income from non-farm economic activities. In rural Bahia, like much of rural Northeast Brazil, agricultural activities are generally the dominant form of occupation. In many municipalities of Bahia, employment in agricultural activities is over 50% (Figure A2-4). The service industry is the second most important sector of work and often includes public employment (Figure A2-5).

Figure A2 - 4: Percent of people over age 18 employed in agriculture/livestock production



Source: IBGE.

Figure A2 - 5: Percent of people over age 18 employed in service industry



Source: IBGE.

19. However, data on sources of income shows that in reality, families' incomes rely to a large extent on income transfers and public employment. This situation has been referred to as the *novo mundo rural atrasado* – the "new backward rural world."[91]

20. In Bahia, about 18.7% of the average monthly family income relies on state transfers (R$353.63), compared to 22.5% average dependency on transfers for the Northeast and 18.5% for Brazil as a whole.[92] Over half of family income comes from work (61.6%) and 15.2% from non-monetary income (such as own-production).[93]

21. Retirement stipends from the National Institute for Social Security (INSS) provide of total monthly family income, on average, in Bahia, but for families with less than R$830 in monthly income (about 1.5 minimum salary), the INSS retirement pension reaches 16% of total income, an average of R$84.60 per month. The INSS pension is equivalent to one minimum salary (R$510) for one person; people in rural areas are eligible for retirement stipends at age 60 for men and 55 for women, as long as their income is less than ¼ minimum salary.[94]

22. *Bolsa Familia* and other federal level transfers are significant, but make up just 2.2% average total monthly family income in Bahia and 6.3% for the poorest group (less than R$830).

b) Agricultural Diversification

[91] Pedreira 2002
[92] Pesquisa de Orçamento Familiares, 2008. Sidra/IBGE.
[93] Though state-level data disaggregated by rural/urban is not available, for reference at the national level, 20.5% average monthly family income comes from transfers, 53.6% from work, and 18.7% from non-monetary income.
[94] http://inss.net/amparo-assistencial-ao-idoso.html

23. Households typically rely on a couple of temporary crops like beans, maize, and cassava, and complement this production with small-scale animal production as well as forest products like native fruit and nut trees. Two-thirds of family farmers produce temporary crops. Temporary crops are more vulnerable to drought and irregular rainfall, which can eliminate an entire harvest or make it impossible to plant. Native plants of the caatinga and cerrado are more resistant to dry spells and support food security in these times. However, these trees are sometimes used for firewood in times of drought when there is little fuel available, thereby eliminating a source of food and income in the longer term.

24. Though the traditional production system focuses on cassava, corn, and beans for subsistence and sale of surplus, livestock is an important component in the rural economy, particularly goats. Goats are known to be well adapted to the dry climate and provide meat and milk for producers.

25. Between 2010 and 2012, livestock production declined across municipalities hit by drought. Livestock suffer not only in the absence of water, but also in the absence of forage material. Typically goats and sheep forage through pasture for food, but in times of drought this vegetation dies and smallholders do not have the resources to purchase food for the animals. Many farmers in dry areas rely on collective pasture (called *fundos de pasto* for goat/sheep livestock, more common in drier areas, and *fecho de pasto* for cattle) for animal forage. These communal pasturelands often rely on collective action to avoid environmental degradation.

26. Households can also diversify agricultural production and incorporate adaptive or drought-resistant crops. A new breed of drought- and pest-resistant cactus (*palma*) recently developed by agricultural research agencies is being disseminated. Storage facilities for animal forage help provide feed for animals during drought months when vegetation is limited.

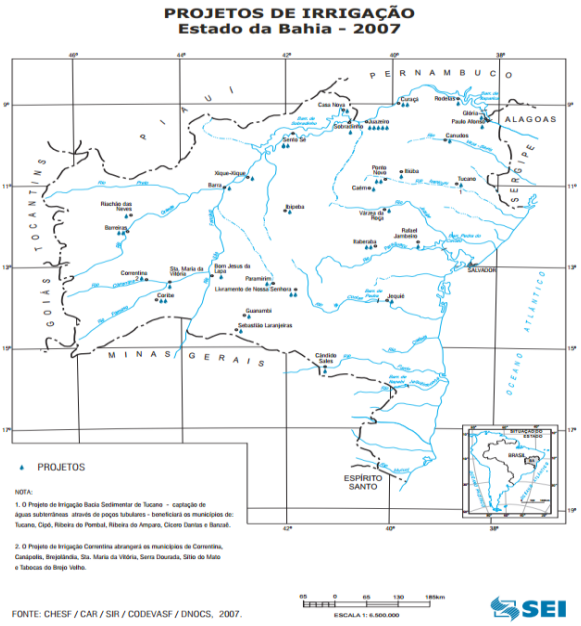
27. Other adaptive and good agricultural practices can bring significant reductions in sensitivity to drought. Soil conservation and the integration of organic matter are important to retain soil moisture.

c) Water Access

28. Despite severe droughts, Bahia is not devoid of water resources and has important rivers and bodies of water. The federal government through the program Water for All (*Agua para Todos*) in partnership with state and municipal government also builds water storage infrastructure like cisterns, wells, and small dams – principally for home consumption, but also on a smaller scale for crop irrigation and animal drinking water.

29. Still, water and sanitation are significant hurdles for rural families especially during drought. Only 3.7% of all rural families have adequate access to sanitation, compared to 63% of the urbans ones. Northeast, Center-North, and the São Francisco Valley all have high dependency on rainfall or emergency "carro-pipas" – trucks that distribute water for human use. See Table A2-6, and Figures A2-7 and 8, on following pages).

Figure A2 - 6: Irrigation Projects in Bahia



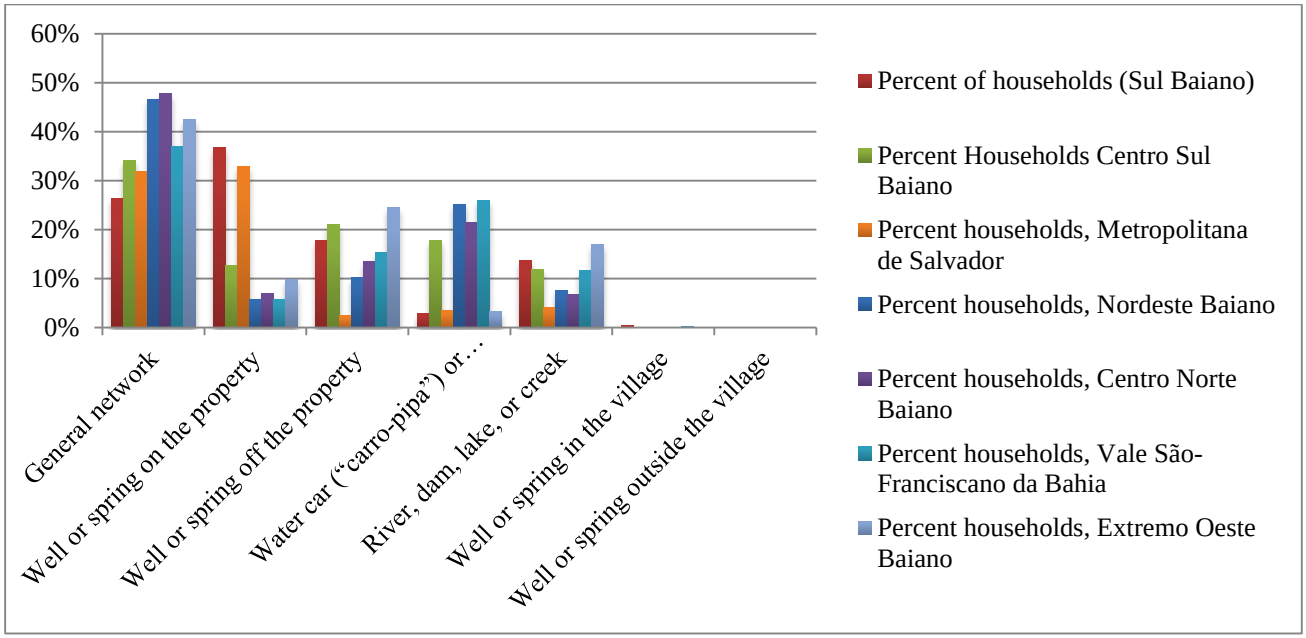
Source: SEI.

Table A2 - 6: Water sources for Bahia's Rural Population

	Number of households	Percent total rural households
General network	412.195	38.9%
Well or spring on the property	148.045	14.0%
Well or spring off the property	179.245	16.9%
Water car (*carro-pipa*) or rainwater	178.370	16.8%
River, dam, lake, or creek	105.199	9.9%
Well or spring in the village	592	0.1%
Well or spring outside the village	2	0%

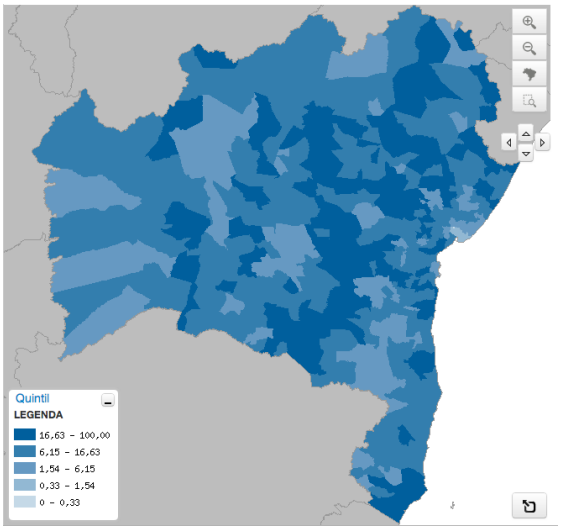
Source: IBGE.

Figure A2 - 7: Rural Water Access in the Mesoregions of Bahia



Source: IBGE

Figure A2 - 8: Percent of People in Households with Inadequate Access to Water and Sanitation

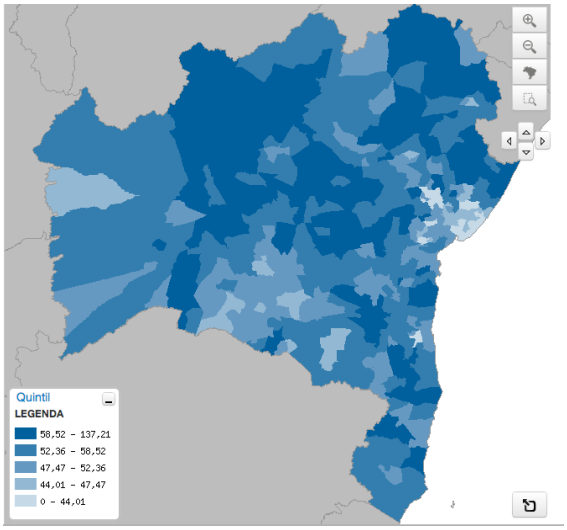


Source: IBGE.

d) Dependency

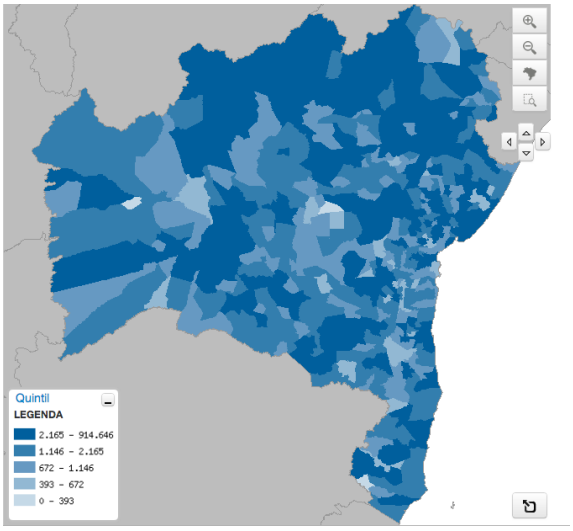
30. Finally, another important aspect of sensitivity is the number of dependents per household. Rural Bahia, like much of the rural Northeast, has experienced rural out-migration over the last decades whereby the economically active population leaves rural areas. The dependency ratio (ratio of population less than 15 and more than 65 to the population between 15-65 years of age) is very high throughout the state, especially scattered through the semi-arid center (Figures A2-9 and A2-10).

Figure A2 - 9: Dependency Ratio



Source: IBGE.

Figure A2 - 10: Number of People Over Age 65



Source: IBGE.

D. Adaptive Capacity:

31. Households' access to ex-post coping strategies is closely linked to poverty, social marginalization, and access to public policies. Ex-post coping strategies are diverse. Migration and off-farm work has long been a coping strategy in the Northeast to compensate for loss of production/livestock due to drought; communities and social networks often emerge to help one another in times of need; and

state and federal governments have a variety of emergency measures to help families maintain welfare levels during drought like cash, animal feed, and seed transfers.[95]

32. Measurements of adaptive capacity in Bahia should include the following components:

- Literacy/education level
- Social inclusion
- Land title for security of tenure, including pasture land, and to access PRONAF credit
- Social capital ("horizontal" and "vertical" ties, including membership in producer organizations and patronage arrangements)
- Access to technical assistance and research/technology transfer
- Access to markets
- Access to emergency coping services (distribution of food, seed, fertilizer)

33. These are each forms of capital that facilitate recovery after a shock. Interventions to increase adaptive capacity can consider investing in these categories. The concept of intersectionality applies in this context, meaning that overlapping disadvantages (e.g. someone with more than one historically marginalized identity like gender and ethnicity) typically present greater social exclusion than someone with just one disadvantage.

34. Conversely, many of these categories reinforce one another. Social capital can support access to markets and technical assistance; extension agents are more likely to work with organized groups of producers, and group organization can facilitate access to markets.

a) Land Tenure

35. Secure land tenure is an important asset that enables access to coping strategies (Figure A2-11). Title is required to access PRONAF credit, among other forms of credit, in addition to conveying security of ownership. Property ownership is also important to retain possession of land in times of hardship; people renting land may lose access to land when they cannot produce the resources to pay for rental, either cash or through sharing a portion of agricultural production with the owner (sharecropping). In rural Bahia, 87.4% of establishments have legal title.

36. Secure tenure is particularly important for grazing livestock. In times of drought, a critical coping strategy is moving the herd to pasturelands that have retained vegetation. Whether or not a rancher has access to pasture reserves is an important factor of adaptive capacity. Collective action to preserve communal pasture land is important, but rarely are these lands titled and ranchers must be able to prevent outsiders from using their land, which is not always possible especially in times of drought when

[95] Small farmers in the Northeast do not have access to true risk transfer mechanisms, which could also be considered as a strategy for adaptive capacity. *Garantia Safra* is not a "true" insurance but rather a fund. Premiums are not calculated by an actuary to reflect risk; every participating farmer pays the same premium and receives the same payout if the index is triggered.

competition for resources is high. Other ranchers, miners, and land-grabbers also threaten ownership of common lands. See Figure A2-11.

Figure A2 - 11: Schematic Cycle of Land Tenure and Vulnerability for Semi-Arid Ranchers[96]

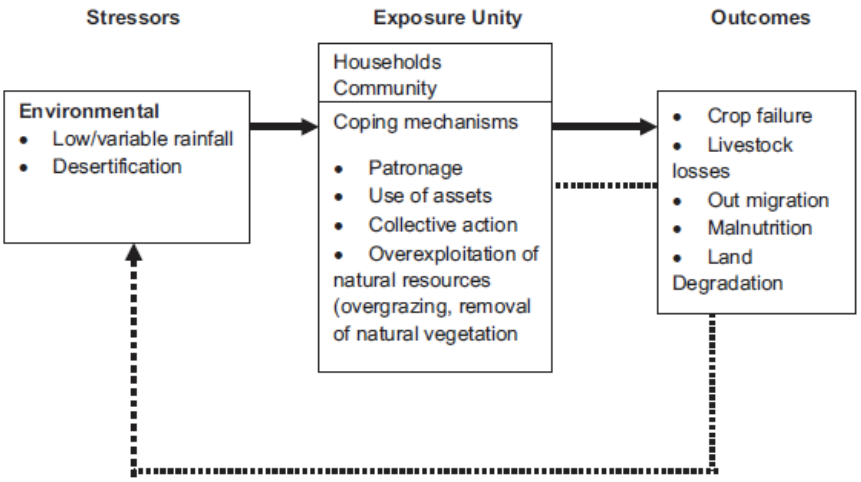


Figure 2. Structure of vulnerability in the Brazilian semi-arid zone.

Source: Toni et al.

37. It is more common to raise goats on common pasturelands because they require less investment in fodder than bovines and are lower-value than cows. Fabiano and Holanda (2008) conclude that ranchers who use common pasturelands are less vulnerable to droughts because goats are better adapted to very dry conditions and require fewer resources to maintain.

a) Literacy and Education Levels

38. Literacy and education levels play an important role in adaptive capacity because they mediate the kinds of non-farm employment a person can access, including their level of access to information and self-esteem. Literacy and education also serve as a proxy for a person's general capacity to connect to a wide range of coping strategies to drought.

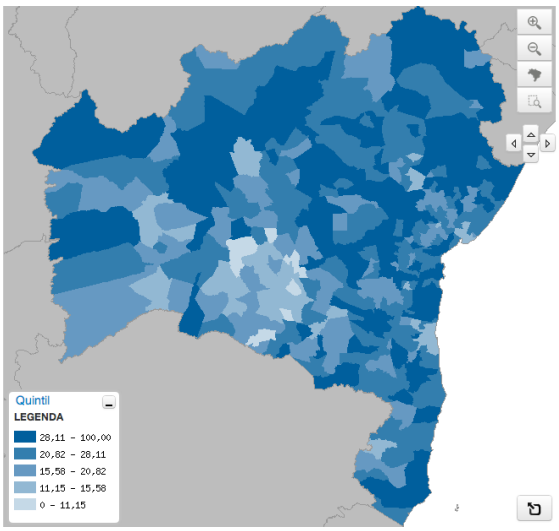
39. Amongst households with all members at least 10 years of age, 72% are literate in rural Bahia, compared to 89% in urban areas. The Northeast Bahia mesoregion has the lowest literacy rates at 69.4%.

40. Women with low levels of education that are heads of households with small children are surprisingly common in Bahia (Figure A2-12), surpassing 28.11% of all households in many municipalities of the state. The heavy demands on the single parent's time of children make it more difficult to seek alternative employment and adaptive strategies. It is not possible from this data to say,

[96] Toni, Fabiano and Evandro Holanda. 2008. The effects of land tenure on vulnerability to droughts in Northeastern Brazil. Global Environmental Change 18, 575-582.

though, if these families are receiving remittances from a male partner who has migrated or if the female household head is a single mother.

Figure A2 - 12: Percent of household heads that are women who have not completed fundamental education and have children less than 15 years of age



Source: IBGE.

b) Social Inclusion

41. Members of historically marginalized social groups like women, quilombolas, indigenous, have particular barriers to accessing adaptive strategies.

42. Female heads of households are typically disadvantaged in terms of seeking adaptive strategies. Bahia has a long history of disproportionate male out-migration, leaving women behind to tend the farm and the family.

43. The majority ethnicity in rural Bahia is *parda*, almost two-thirds of the rural population. Whites make up the next largest group, 21.2% of the rural population, and blacks are sizeable especially relative to the rest of the Northeast at 13.2%. Indigenous and *negra* groups, historically discriminated, may face obstacles to adapt after a shock, but further investigation is needed. See Table A2-7.

Table A2 - 7: Ethnicity in Rural Bahia and Northeast

	Percent of Rural Population	
Ethnicity	**Bahia**	**Northeast**
White	21.2%	24.6%

Black (*Negra*)	13.2%	8.4%
Parda	64.1%	65.2%
Amarela	1.0%	1.1%
Indigenous	.5%	0.7%

Source: IBGE.

c) Social Capital

44. Social capital is an important factor for resilience to risks. Social capital can be both horizontal (between people with the same relative power within a community) and vertical (patronage or clientele relationships between differential powers).

45. Social relationships between community members are important as communities with strong social ties may pool resources in times of hardship.97 However, formal membership in associations was described as weak in qualitative interviews in Bahia, as people noted that there is not a strong tradition of associativism in the Northeast as compared to other places like the South. However, others noted that incentives to organize must exist, since social organization is unlikely to happen spontaneously; with limited public technical assistance available and resources distributed without the need to be organized, incentives to organize are limited. Councils for Sustainable Rural Development represent producer associations and municipal government representatives to discuss municipal development planning, but experts noted that participation can be erratic since representatives are not compensated for transportation costs or time.

46. Patronage arrangements have a long history in the Northeast and facilitate access to public services including investments and emergency responses. "Patronage continues to be the dominant tool for survival," and extreme competition exists over access to scarce state services.98 The industria da seca is a phrase that characterizes the business of drought mitigation and emergency efforts in exchange for political support.

d) Access to Markets, Technical Assistance, and Public Services

47. Drought is a covariate shock, rather than idiosyncratic, meaning that it affects entire communities, municipalities, and territories. While with idiosyncratic shocks, such as the death of a family member, affected households can often turn to their social networks and community organizations for support coping, covariate shocks like drought in areas where there is limited economic diversification affects the resource upon which everyone depends. Typical *agricultura familiar* in the Semi-Arido involves a system of staple crops like cassava, corn, and beans, along with herds of goats and sheep. Rural families consume

[97] Meinzin-Dick, Ruth. 2014. Social Capital for Resilience. IFPRI Resilience Conference Brief.
[98] http://www.tandfonline.com/doi/pdf/10.1080/1366879022000020194

some of their production and sell surpluses. Cash transfers and remittances from off-farm income supplement household revenues.

48. The lack of diversification between farmers reduces coping capacity of whole regions and increases competition for limited resources, like water and pasture or forage material for animals. Coping strategies are often very similar and the homogeneity turns the system less resilient: when farmers seek to sell their animals, as a last resort, many others are attempting to do the same. While there may be cases of collective action to commercialize animals, more commonly, the bump in supply of animal meat exceeds demand and presses down prices. (see my comment on the paragraph above, this is another reason to use food resources at home).

49. Distance from markets and infrastructure for supply chains are also very limited. Agricultural producers – especially for milk and meat – face challenges marketing their product in the absence of cold storage facilities and distance to markets.

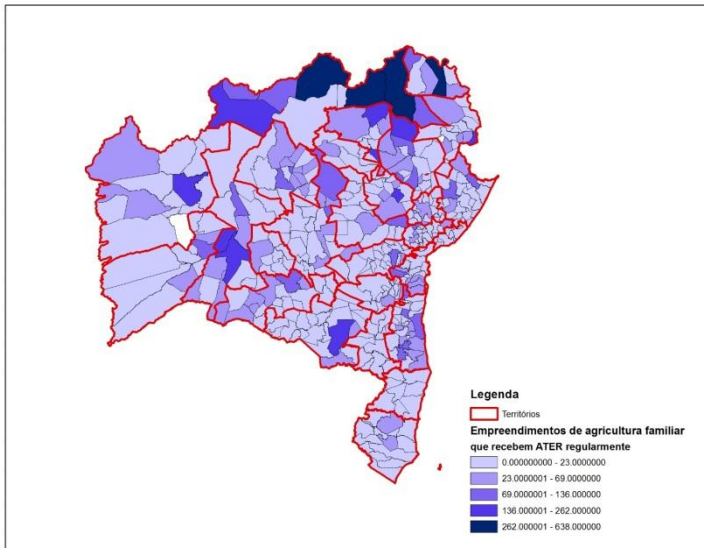
50. A number of productive inclusion projects, including Produzir Bahia, exist at the municipal level[99] that provide investments in small farmers or guaranteed markets, as in through Food Acquisition Program from smallholders (PAA) for different crops and milk.

51. A number of municipal, state, and federal level relief services exist to support rural populations during drought (See Stocktaking of Projects and Programs related to Agricultural Risk Management in Bahia in Annex), including *Cesta Básica* (food distribution) to traditional populations,[100] Water for All program (investments in emergency water infrastructure), *Garantia Sa*fra (for municipalities that lose over 50% of agricultural production due to drought). Access to these programs often requires farmers to register as a family farmer, submitting a DAP (Declaration of Aptitude for PRONAF) at a local EBDA office.

52. Technology transfer is sporadic and limited in Bahia, and agricultural research faces a bottleneck at the stage of application to the producer since EBDA has been on strike for several months. As indicated in Figure A2-13, most municipalities have 23 or fewer family farming establishments that regularly receive technical assistance.

[99] http://aplicacoes.mds.gov.br/sagi/RIv3/geral/index.php#
[100] http://aplicacoes.mds.gov.br/sagi/RIv3/geral/relatorio.34%php#Políticas relacionadas ao Acesso à Alimentação Adequada

Figure A2 - 13: Family Farming Households that Regularly Received Technical Assistance



Source: IBGE.

E. Exposure:

53. Exposure is discussed in the climate section of this report in greater detail, but the main message is that the Semi-Arid is not homogenous in climate (Figures A2-14 and A2-15). Aridity indices are often used to measure this aspect of vulnerability. Vulnerable small farmers in the humid coast of Bahia are obviously less exposed to the shock of drought, though they deal with other risks as discussed previously.

Figure A2 - 15: Delimitations of the Semi-Arid Region in Bahia

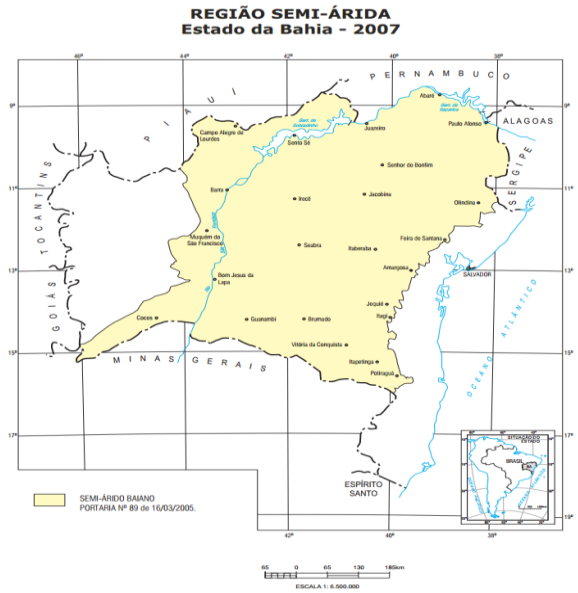
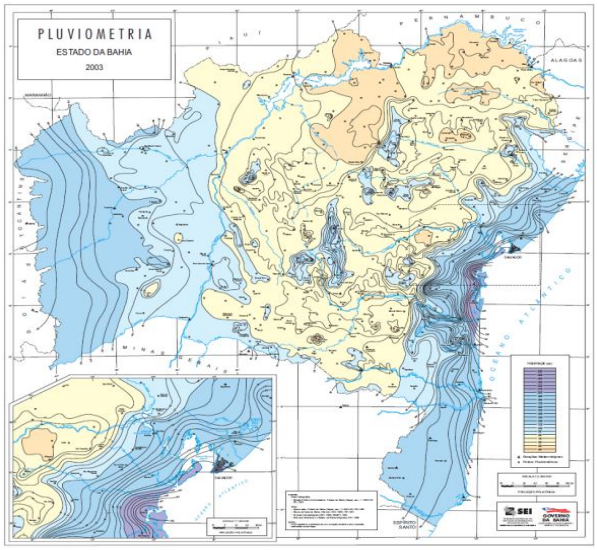


Figure A2 - 14: Rainfall Index, Bahia



Source: SEI.

F. Scales of Vulnerability Analysis

54. In this section, the focus was on vulnerability of the household. However, vulnerability can be measured at different scales of analysis: the individual, household, community, municipality, region, and so on.

55. Commonly, it is assumed that households share resources equally and ownership is collective within the household. In reality, ownership of many household assets is not shared and it is rare that decision-making is joint between heads of households.[101] In a region with a history of male out-migration, women-headed households are fairly common and respondents noted that gender roles allow women to participate actively in agricultural production and important risk-management activities like water use.

[101] IFPRI Gender Assets and Agriculture Project (GAAP)

ANNEX 3: BAHIA - STOCKTAKING OF PROJECTS AND PROGRAMS RELEVANT FOR AGRICULTURAL RISK MANAGEMENT

Name of Project/Program	Year Initiated	Objective and target group	Components and key activities	Executing Units	Cost
FEDERAL PROJECTS AND PROGRAMS					
Garantia Safra[102]	2002	Crop insurance for families with family income less than or equal to 1.5 minimum salary, living in the area under responsibility of Superintendency of Development of the Northeast (Sudene)	Farmers enrolled in Garantia Safra that pay a monthly premium receive indemnity if they live in municipalities that lose 50% or more of their harvest.	Ministry of Agrarian Development	R$101.3 million 25% Federal Government, 12.5% Bahia State government, (paying for the 3.75% and 1.25% required usually of municipalities and producers, respectively)
Water for All[103]	2011	Expand access to water for poor rural populations living in extreme poverty without access or with limited access to water. Must be registered in the Single Social Cadaster of the	Installation of water facilities (cisterns, irrigation kits, small dams) for human consumption and production purposes, as	Ministry of National Integration	

[102] http://www.brasil.gov.br/observatoriodaseca/garantia-safra.html
[103] http://www.integracao.gov.br/web/guest/entenda-o-programa

Name of Project/Program	Year Initiated	Objective and target group	Components and key activities	Executing Units	Cost
		Ministry of Social Development	part of *Plano Brasil Sem Miséria*.		
Emergency Water Infrastructure projects of Drought Observatory		Provide emergency water services to areas affected by drought and install water infrastructure to mitigate impact of drought in Northeast Brazil	Operation Water Truck (*carro-pipa*) [104] distributes emergency water for human consumption; construction of cisterns for human consumption and production; perforation and recuperation of wells; groundwater dams	Ministry for National Integration, National Secretary for Civil Defence, with the Brazilian military, in partnership with State Government	
Emergency Credit[105]	2011	Provide R$3.45 billion in credit for rural producers affected by drought in municipalities declared to be in emergency situations as recognized by the National Secretary of Civil Defence. Must live in the area under responsibility	Credit between R$2,500 to R$100,000, with interest rates from 1% to 3.5% per year. In Bahía, 58,247 operations were contracted with total value of R$337 million	Constitutional Fund for Financing of the Northeast (FNE) through Banco do Nordeste Ministry of Finance	R$337 million in credit

[104] http://www.brasil.gov.br/observatoriodaseca/operacao-carro-pipa.html
[105] http://www.brasil.gov.br/observatoriodaseca/linha-de-credito.html

Name of Project/Program	Year Initiated	Objective and target group	Components and key activities	Executing Units	Cost
		of Superintendent of Development of the Northeast (Sudene)			
Bolsa Estiagem[106]	2004	Cash transfer to family farmers living in municipalities declared to be in emergency situations as recognized by the National Secretary of Civil Defense.	Families receive R$80 monthly for up to 5 months (R$400 total). The Federal Government allowed the ceiling to be raised to R$720 total per family.	Ministry of National Integration, Ministry of Agrarian Development, Ministry of Social Development	Monthly cost of R$95.1 million
Insurance for Family Farming (SEAF)[107]	1991	Family farmer crop insurance for producers that receive PRONAF	Farmer pays 2% of total insured value and Federal Government pays rest of premium. Farmers with 30% of production lost	Ministry of Agrarian Development	
Subsidized Sale of Maize[108]		Purchase maize from family farmers and sell at subsidized price maize for animal feed of family	Subsidized sale of maize from CONAB stocks for animal feed at price	CONAB through Venda em Balcão program, in	

[106] http://www.brasil.gov.br/observatoriodaseca/bolsa-estiagem.html
[107] http://portal.mda.gov.br/portal/saf/programas/seaf/2259694
[108] http://www.brasil.gov.br/observatoriodaseca/venda-de-milho.html

Name of Project/Program	Year Initiated	Objective and target group	Components and key activities	Executing Units	Cost
		farmers in regions affected by drought	between R$18.12 and R$24.60.	partnership with State of Bahia	
Renegotiation of Rural Debt		Negotiated new terms of repayment for PRONAF credit for producers in SUDENE region.	Producers whose income drops 30% can renegotiate payment of credit	Ministry of Agrarian Development	
Minimum Price Guarantee Policy (PGPAF)[109]	2006	Support family farmers that access PRONAF credit in case of price volatility	Farmers receive discount on credit financing if market price of product drops	Ministry of Agrarian Development	
Program for Price Guarantee Policy (PEP, PEPRO, AGF)	2006	Rural producer or cooperative receives subsidy or can directly sell production to Federal Government when market price is below the Reference	Equalizing Subsidy Paid to Producer (PEPRO)[110], Subsidy for the Distribution of Product (PEP)[111], Acquisition of Federal Government (AGF)[112]		

[109] http://portal.mda.gov.br/portal/saf/programas/pgpaf
[110] http://www.conab.gov.br/OlalaCMS/uploads/arquivos/f96401d39edbdc51b3c0d399086e0ea9..pdf
[111] http://www.conab.gov.br/OlalaCMS/uploads/arquivos/be89e510efd3cef55fdd7687215b1dcc..pdf
[112] http://www.conab.gov.br/OlalaCMS/uploads/arquivos/f70c4d5eb82e352a8922ca0854ec5270..pdf

Name of Project/Program	Year Initiated	Objective and target group	Components and key activities	Executing Units	Cost
		Value price or minimum price for certain crops.			
National School Feeding Program (PNAE)[113]	2009	Support family farmers by purchasing their production for local school meals	At least 30% of federal resources provided for school meals must be used on the purchase of food from family farmers, giving priority to family farmers in the same municipality as the school	National Fund for the Development of Education (FNDE) and Ministry of Agrarian Development	US$ 37.5 million
National Program for Acquisition of Food from Family Farmers (PAA)	2003	Promote access to food to people facing food insecurity, promote social and economic inclusion in the rural areas by strengthening family agriculture	Purchase with Immediate Donation (CDS), Support for the Formation of Stocks (CPR-ESTOQUE), and Direct Purchase from Family Farming (CDAF)	Ministry of Social Development and Fight Against Hunger and State Secretariat for Agriculture, Land Reform and Aquaculture, and Secretariat for Social Development and Fight Against Poverty – (SEDES)	US$ 3.75 million

[113] http://comunidades.mda.gov.br/portal/saf/programas//alimentacaoescolar

Name of Project/Program	Year Initiated	Objective and target group	Components and key activities	Executing Units	Cost
Unified System of Agricultural and Livestock Health (SUASA)[114]	2006	National unified system for sanitary inspection allows commercialization anywhere within Brazil once approved.	Municipalities have to apply to adhere to the system.	Ministry of Agrarian Development in coordination with state and municipal governments	
Institute for the Semi-Arid (INSA) Projects	2012	Coordination, research, and outreach for Brazilian Semi-Arid region	Promotion of innovation and applied research on themes of desertification, water resources, biodiversity and sustainable use, production systems, development and social technologies, and information management.	Ministry of Science, Technology, and Innovation	
Programa de Formação e Mobilização Social para a	2003	Support the construction of participatory processes for rural development in the Brazilian Semi-Arid to promote food	One Land Two Waters (P1+2)[115] and One Million Cisterns (P1MC) support sustainable income generation. *Articulação do Semi-*	Semi-arid Articulation - *Articulação do Semi-Árido*	

[114] http://portal.mda.gov.br/portal/saf/programas/suasa
[115] http://www.asabrasil.org.br/Portal/Informacoes.asp?COD_MENU=1151

Name of Project/Program	Year Initiated	Objective and target group	Components and key activities	Executing Units	Cost
Convivência com o Semiárido		sovereignty and security through sustainable income generation.	*Arido* (ASA) represents close to 1,000 NGOs in the Northeast.		
Enterpreneur of the Sertão - *Sertão Emprendedor*[116]		Over 1000 municipalities in the Semi-Arid region of 9 Northeastern states	Support for projects of water conservation, production and conservation of animal forage.	SENAR, SEBRAE	
STATE PROJECTS AND PROGRAMS					
State Committee for Emergency Actions to Combat the Effects of Drought (in process of conversion into program – PAE)		Coordinate activities to face the effects of drought and support affected populations in Bahia	Initiate projects to reduce damage caused by drought, monitor and evaluate assistance related to drought, coordinate with other organizations involved in drought relief/mitigation.	Coordinated by the State Government with participation of SEAGRI, SDS, SDU, SEMA, SDIR, SRI	
Programs to Facilitate Animal Transit (Emergency	2012	Facilitate transport of animals being herded between locations in search of remaining	Suspension of interstate tax for livestock between signatory states	SEAGRI, SEFAZ	

[116] http://www.senar.org.br/programa/sertao-empreendedor

Name of Project/Program	Year Initiated	Objective and target group	Components and key activities	Executing Units	Cost
Pasture Resource, Offline emission of Animal Transit Guide)		pasture in times of drought			
Use of ICMS[117] Credit for Milk Purchase		Purchase of milk from neighboring states to stabilize milk supply and sustain the milk industry in Bahia	Interstate commercial credit (ICMS) converted into credit for state purchases.	SEAGRI, ADAB	
Program for Food Security for Family Farming Animal Herds		Establish field production sites to plant and transfer animal forage plants (pest-resistant cactus with dense planting) to family farmers	By 2013, 467 "Didactic Technical Units" were established to train and distribute cactus for animal feed with complementary kits.	State of Bahia, State Fund for Fighting and Eradicating Poverty (FUNCEP), EBDA	R$2.7 million
Emergency Purchase of Family Farming Goats and Sheep		Purchase meat from family farmers affected by drought and increase demand for an oversaturated market	Purchase 105,000 animals through PAA, freeze and distribute to public institutions	SEAGRI, CONAB, EBDA, IRPAA	R$1 million

[117] ICMS - *Imposto sobre Operações Relativas a Circulação de Mercadorias e sobre Prestações de Serviços de Transporte Interestadual, Intermunicipal e de Comunicação*: Tax on circulation of goods and services between States, and/or Municipalities, ando n Communications.

Name of Project/Program	Year Initiated	Objective and target group	Components and key activities	Executing Units	Cost
Streamlining Land Fund to Prioritize the Semi-Arid	2012	Prioritize land regularization processes in municipalities affected by drought so that producers gain land title needed to access PRONAF credit lines	12,000 titles were granted to smallholders	CDA, SEAGRI	
Project Bahia Produtiva	Pipeline	Promote sustainable rural development and participatory governance through grant financing to producer associations in every territory of the state for agricultural and water/sanitation investments	416 municipalities and 150,000 families to be reached	SEDIR, CAR, World Bank	US$260 million
SOS Drought: All Producers United		Campaign to generate donations of grains from agribusiness to family farmers for animal feed	Close to 1,000 tonnes of food donated and distributed to small-scale livestock producers	SEAGRI	
Semeando: Distribution of		Distribution of maize and bean seeds to family farmers receiving Garantia Safra, family	154,816 producers benefited with 1,548,160 kg of seeds	SEAGRI, EBDA	R$98 million

Name of Project/Program	Year Initiated	Objective and target group	Components and key activities	Executing Units	Cost
Seeds to Family Farmers[118]		farmers as indicated by the Municipal Councils for Sustainable Rural Development, agrarian reform settlers, traditional populations (quilombolas and indigenous),			
Resources from CHESF		Donation from CHESF to committee of state agricultural secretaries in the Northeast	Certification of goat and sheep herds, irrigation kits for family farmers, and tank systems for aquaculture.	National Council of Secretaries of Agriculture, Hydroelectric Company of São Francisco (CHESF)	R$1.25 million
State Program for Agriculture/Livestock Defense		Program to register, inspect, and enforce sanitary conditions for the production and circulation of agriculture and livestock	Responsibility of the autonomous Agency for Agricultural/Livestock Defense (ABAD)	ABAD	

[118] http://www.seagri.ba.gov.br/content/programa-produ%C3%A7%C3%A3o-agr%C3%ADcola

Name of Project/Program	Year Initiated	Objective and target group	Components and key activities	Executing Units	Cost
State Program for Plant Sanitary Defense		Program to prevent, monitor, control, and eradicate plant pests, with focus on several priority crops: banana, citrus, grape, sugar, and forage cactus	Maintenance of pest free area, monitoring and sanitary control, transit enforcement, and pesticide use. Responsibility of the autonomous Agency for Agricultural/Livestock Defense (ABAD)	ABAD	

ANNEX 4: OUTLINE OF WEATHER RISK MANAGEMENT RELATED PROGRAMS AND PROJECTS

1. The **MINISTRY OF AGRICULTURE, LIVESTOCK AND SUPPLY (MAPA)** is responsible for the Agricultural Climate Risk Zoning (ZARC), which aims to minimize the risk related to weather phenomena, and allows identify the best moments for planting in selected municipalities considering different types of soil and crop cycles. The parameters of weather, soil and crop cycles are analyzed based on a methodology validated by the Brazilian Company for Agriculture and Livestock Research (EMBRAPA). In this context, the weather risk associated with farming losses is quantified. Based on these parameters it is estimated that 2 out of 10 years face considerable losses when the planting is done on the advised period. The ZARC started in 1996 for the wheat crop and nowadays it includes 40 crops, 16 of annual cycle and 24 permanent crops, covering 24 states (BRACALE, 2012).

2. The **FEDERAL GOVERNMENT** created by Law nº 5969, from December 11th 1973, the Agriculture and Livestock Activity Guarantee Program (PROAGRO - *Programa de Garantia da Atividade Agropecuária*) (Table 1). The program aimed to compensate the rural producer for the occurrence of adverse weather phenomena, plagues and diseases afflicting crops and livestock. The PROAGRO is a public insurance operated by the financial institutions. Its management is under the responsibility of the Central Bank of Brazil (BACEN - *Banco Central do Brasil*), which articulates permanently the Ministries of Finance (MF), Planning, Budget and Management (MPOG), Agriculture, Livestock and Supply (MAPA) and Agrarian Development (MDA). The main attributions are: i) elaborate, disseminate and oversee regulation; ii) manage financial resources; iii) publish financial reports; and, iv) request funds from the Federal Government. The revenue of the PROAGRO is constituted in its majority by the Federal Government funding. On the other hand, payment of coverage (indemnity) constitutes the biggest portion of the expenses. The claim adjustment to confirm the losses are done by technical assistance institutions. The farms eligible for PROAGRO are the ones which are associated with agricultural costing, funded or not, and the they should necessarily follow the ZARC recommendations, except the properties which are associated to the National Program for Strengthening of Family Farming (PRONAF) and the ones located in states not covered by the ZARC. The maximum liability per agent of the PROAGRO is US$ 130,434 (Resolution nº 4,111/12). The insurable risks are: a) Excessive rainfall, frost, hail, drought, excessive temperature oscillations, strong winds, cold winds, and disease and plagues without methods of control; b) on livestock costing credit operations: losses incurred by diseases without methods of prophylaxis. The compensation of the program may range from 70% to 100% of the coverage limit. In case where there is irrigation in the farm the compensation will be 100% of the coverage. The PROAGRO premium rates are: i) 1% for irrigated farms; ii) 2% for the farms associated to PRONAF, except irrigated farms; iii) 3% for the others; and, iv) 5% for the non-funded farms (OZAKI, 2013);

3. The **FEDERAL GOVERNMENT**, through the resolution nº 3,234/04, created the Agriculture and Livestock Activity Guarantee Program for the Family Farmers (PROAGRO MAIS - *Programa de Garantia da Atividade Agropecuária da Agricultura Familiar*) aiming to compensate the Family Farmers for the occurrence of adverse natural phenomena, plagues and diseases (BANCO CENTRAL, 2014). The difference between PROAGRO, also known as TRADITIONAL PROAGRO, and the PROAGRO MAIS, is the target public. The PROAGRO MAIS focuses only on the Family Farmers and the TRADITIONAL PROAGRO aim the remaining farmers. The PROAGRO MAIS is regulated according to the Traditional PROAGRO, including the ZARC rules. The most important rules regarding the program are: (i) Obligation of associating to the program when obtaining agricultural costing credit from PRONAF; (ii) The coverage is equal to 100%; (iii) It is possible to insure up to 65% of the expected net revenue; (iv) The trigger for receiving the compensation is the gross revenue, that is, if the gross revenue obtained is less than 70% of the expected gross revenue then the farmer is compensated; (v) The risks covered are: excessive rainfall, frost, hail, drought, excessive temperature oscillations, strong winds, cold winds, and disease and plagues without methods of control; (vi) The premium rate is 2%. The rate is 1% for irrigated farms located in the semiarid region, the rate is 1%.

Text Box A4. 1: Operational results of PROAGRO TRADICIONAL (PT) and PROAGRO MAIS (PM)

From the crop year 1998/99 to the crop year 2009/10, the total number of contracts of PT and PM presented relative growth until the crop year 2006/07, when it started to decrease because of the relative increase of the private crop insurance (Figure 1).

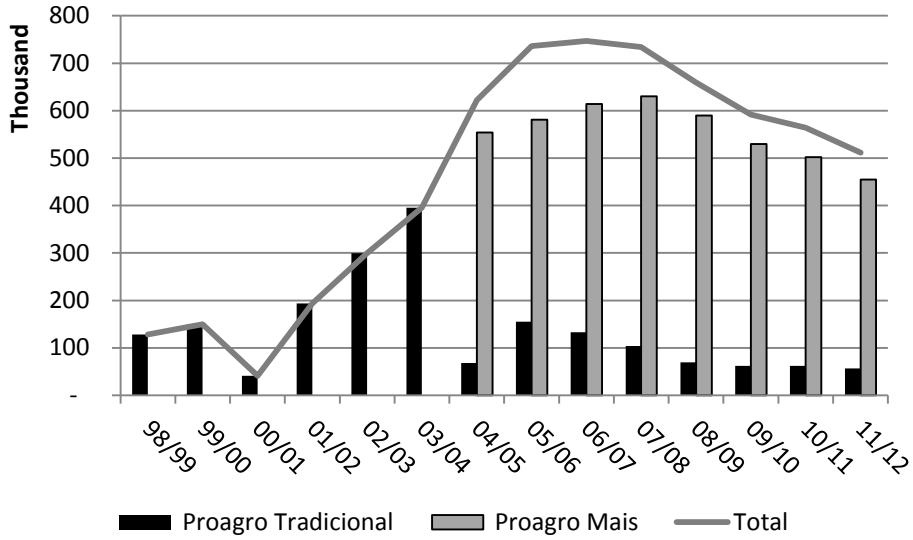


Figure 1. Amount of operations hired from TRADITIONAL PROAGRO, PROAGRO MAIS and total, from crop year 1998/99 to 2011/12, in thousands.

Source: Central Bank of Brazil (2014)

Another important variable in the program is the liability that shows how much is being insured each year. In both programs, the liability increased until the crop year 2008/09, when it started to decrease.

Considering only the PT, until the crop year 2004/05 the liability was, on average, equal to US$ 339 million. From 2005/06 to 2011/12, the average number increased to US$ 1 billion. After the creation of PM, the liability of both programs increased to US$ 1.8 billion, on average. (figure 2).

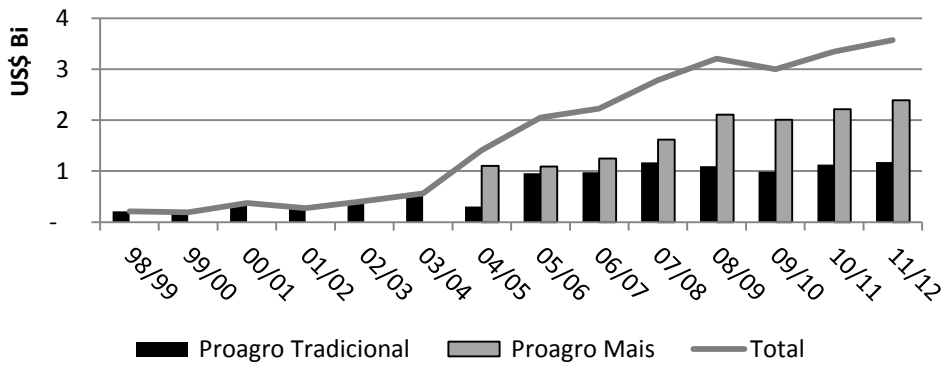


Figure 2. Liability in the PT, PM and total operations from 1998/99 to 2011/12, in US$ billion.

Source: Central Bank of Brazil (2014)

The Figures 3 and 4 show, respectively, the quantity of claims and the total indemnity for the PT and PM, in the period from 1998/99 to 2011/12. Four considerable peaks can be noticed: 2004/05, 2005/06, 2008/09 and 2011/12, with respectively (in thousands) 282.3, 184.4, 101.8 and 123.4. In these four years, the PM was responsible for respectively, 96%, 82%, 83% and 90% of the total claims.

Regarding the total indemnity, the crop year 2011/12 presented the highest value, summing a total close to US$ 434 million (figure 8). The crop years 2004/05, 2008/09 and 2005/06 also presented high values. The total indemnity paid in the period accounted for a little over US$ 1.6 billion.

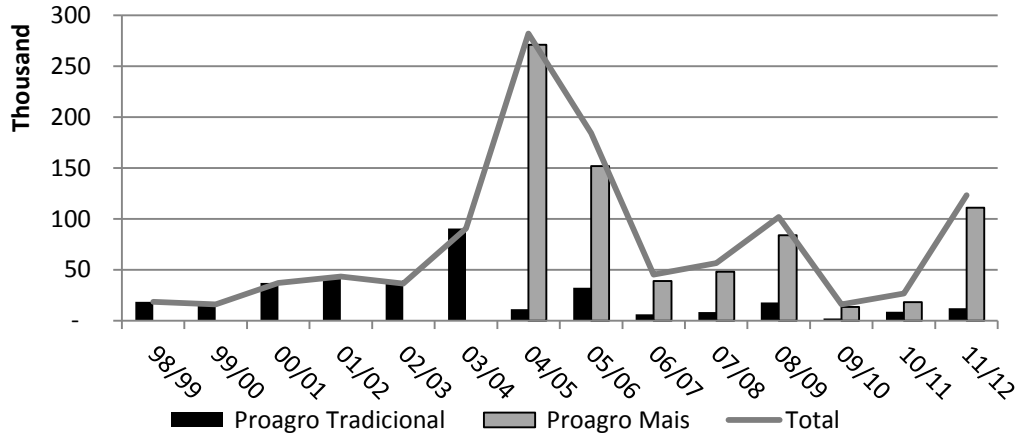


Figure 3. Amount of claims in the PT, PM and total, from 1998/99 to 2011/12, in thousands.

Source: Central Bank of Brazil (2014)

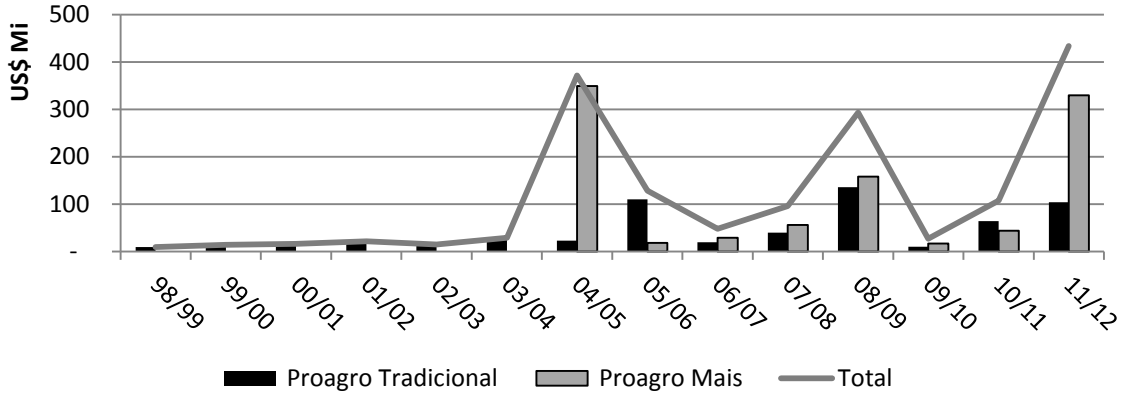


Figure 4. Total indemnity in the PT, PM and total, and total, from 1998/99 to 2011/12, in US$ million.

Source: Central Bank of Brazil (2014)

From the crop year 2004/05 to 2011/12, considering the average number of contracts, the most important crops were corn (43.6%), soybean (18%) and coffee (8.7%). Regarding the territorial concentration, the south region of Brazil presented considerable importance. In average values, the region was responsible for 67.5% of the contracts, followed by the northeast region (13.6%) and southeast (14.9%). In the south region, the state of Rio Grande do Sul (36%) is the most important, followed by Paraná (19%) and Santa Catarina (12%). The Bahia state is ranked as the second in the Northeast region behind the Maranhão state.

Accounting for the average indemnity in the analyzed period, the corn crops represented almost 48.2%, and average value equal to US$ 100 million, followed by the soybean (29.1%) and wheat (15.7%). Besides the short average participation on the total number of contracts, the wheat crops have relatively high importance on the average indemnity. The south region accounted for almost 91.9 % of the total indemnity. The state of Rio Grande

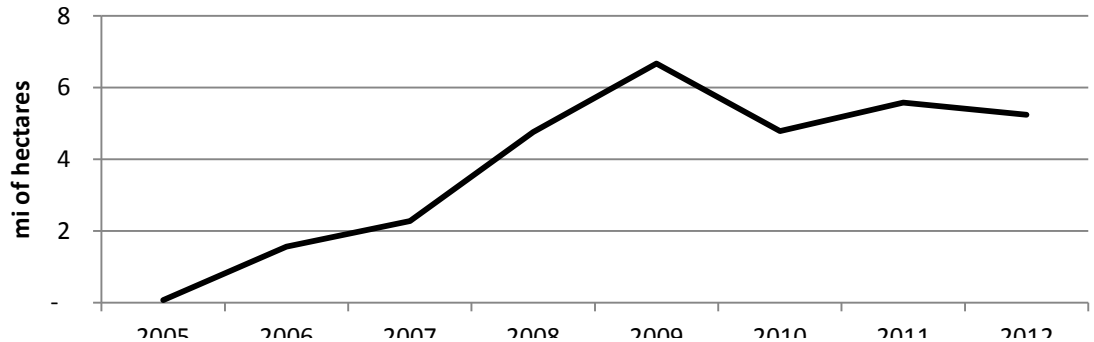
do Sul was responsible for about 48.2%, Paraná, 33.6% and Santa Catarina, 10.1%. The northeast region accounted for 5% of the total indemnity. In the region, Bahia (2%), Sergipe (1%) and Ceará (1%) were the most important states. Among the risk covered, in the period analyzed, drought accounted for over 86% of the total indemnity.

4. The **MINISTRY OF AGRICULTURE, LIVESTOCK AND SUPPLY** (MAPA) is responsible to operate the Rural Insurance Premium Subsidy Program (PSR - *Programa de Subvenção ao Prêmio do Seguro Rural*) created by the Law 10823/03 (Almeida, 2007; Ramos, 2009). The insurance companies accredited by MAPA operate the subsidy. In general, the program consists of establishing percentages of subventions for each modality of insurance and crops. This percentage corresponds to the liability taken by the government. For instance, if the total premium is equal to US$ 10 thousand and the percentage of subsidy is 50%, the farmer is responsible for US$ 5 thousand and the Federal government the remaining premium. The limit for the subvention in the agricultural modality, per farmer and year, is US$ 41.740. The farmer will be able to receive subsidy for more than one crop, since the total does exceed the maximum value. For the modalities of livestock, forests and aquaculture insurance, the limit is US$ 13.900 per modality (Resolution nº 26/12).

Text Box A4. 2: Operational results of PSR

Since the beginning of the PSR, in 2005, until the year of 2009, there was a relative growth. In 2005, the total area insured by PSR was close to 68 thousand hectares and reached the maximum area in 2009, covering almost 6.7 million hectares. From 2009, the total area decreased and stabilized in 2012, covering approximately 5.2 million hectares (figure 5).

Figure 5. Evolution of the total insured area in PSR, from 2005 to 2012, in million hectares.



Source: MAPA (2014).

The causes for the reduction of the growth rate in PSR are related to the budget constraints and operational difficulties. Up to 2008, the resources available for the PSR were sufficient to the insurance companies to operate the subsidy program. In that year, out of US$ 70 million available, US$ 69 million were effectively spent. However, this scenario changed in 2009, when the demand exceeded the total budget available in US$ 39 million. That is, the government owed money to the insurers.

In December 2009, the government approved a bill for extra resources to cover the dept. However, according to the PSR regulation, the subvention resources must be used in the same year of its availability. Since there was no use for the same year, the insurance companies did not receive the resources.

At that time, the government signaled that part of the budget for 2010, in total US$ 104 million, would be used as payment for the US$ 39 million debt from 2009. This situation stressed the market. Besides not having increased the amount of resources to the PSR, the budget decreased in US$ 39 million. However, in May 2010, the government approved the law 12,241 giving additional credit of US$ 39 million for that year's budget. Despite of this fact, the problem reoccurred in the second semester of 2010, and all the following years.

Nowadays, the insurance companies authorized to operate in the PSR are: Allianz Seguros S.A., Essor Seguros S.A., Fairfax Brasil Seguros Corporativos S/A, Grupo BBMapfre (Companhia de Seguros Aliança do Brasil e

Mapfre Seguros), Nobre Seguradora do Brasil S.A., Porto Seguro Companhia de Seguros Gerais, Sancor Seguros do Brasil S.A. and Swiss Re Corporate Solutions Brasil Seguros S.A (MAPA, 2013).

The reinsurance companies operating rural insurance are: Austral Re, Catlin Brasil Serviços Técnicos Ltda, Everest RE Group Ltda, Hannover Re Escritório de Representação no Brasil Ltda, Instituto de Resseguros do Brasil – IRB, Lloyd`s Escritório de Representação no Brasil Ltda, Mapfre Re Assessoria, Münchener do Brasil Serviços Técnicos Ltda, PartnerRe Escritório de Representação no Brasil Ltda, Scor Brazil Ltda, Swiss Re Brasil Serviços e Participações S/C Ltda and XL Re Holding.

According to SUSEP's data, in the crop year 2012/13, the Insurance company Aliança do Brasil accounted for 58.4% of the total premium of the sector, followed by Mapfre Seguros Gerais, accounting for 10.2%, Nobre Seguradora do Brasil, 7.5%, and Allianz Seguros, 6.4%. The five companies together accounted for 83% of the market. The participation of the first two mentioned accounted for approximately 70%.

In 2012, the grains insured, such as soybean, wheat, corn, rice and others, represented almost 91% of the total insured area, almost 75% of the subvention paid, 73% of the total premium collected and 73% of the global liability. The soybean was responsible for 40% of the total liability and of the total premium collected, 57% of the total insured area and 37% of the subvention paid.

Regarding the regional concentration, in 2012, the south region demanded the highest quantity of resources of the PSR, accounting for approximately 61% of the total. The states of Paraná and Rio Grande do Sul were demanded over 50%. The Central West and Southeast regions accounted for 18% each. Considering the total liability, collected premium and insured area, the results are similar. There is relative concentration in the states of Paraná and Rio Grande do Sul (Figure 6).

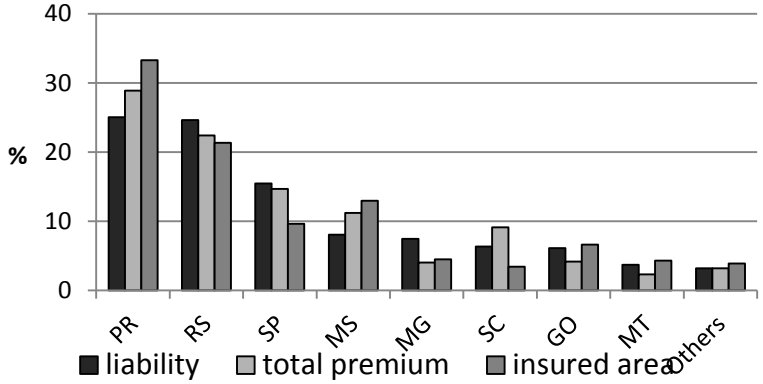


Figure 6. State participations on total liability, total premium and insured area. Values in %.

Source: MAPA (2014)

5. The **MINISTRY OF AGRARIAN DEVELOPMENT (MDA)** operates the program *Garantia Safra* (GS) since 2002, and seeks to guarantee minimum conditions of survival of the rural family farmers of municipalities located in the area which the Superintendence of Northeast development (SUDENE) works on and are also affected systematically to losses due to drought or excess rainfall (Law nº 10,420/02 and 4,962/04). The family farmers may receive a benefit on the occurrence of drought or excess rainfall that causes at least 50% of loss on productions of beans, corn, rice, cassava or cotton crops.

6. The **MINISTRY OF NATIONAL INTEGRATION (MI), MINISTRY OF AGRARIAN DEVELOPMENT (MDA) AND MINISTRY OF SOCIAL DEVELOPMENT AND FIGHT AGAINST HUNGER (MDS)**, manage the program "Drought Benefit" (BE) created by the Law nº 10,954 from September 29th 2004. The program aims to support families of agricultural workers, which receive a limit of an average of two minimum wages monthly as income and are located in municipalities that have suffered a disaster or emergency situation recognized by federal government. The criteria for being eligible are: i) Being

a Family farmer with a declaration of aptitude to PRONAF (DAP[119]); ii) Being registered to the "Single Registration for Social Programs of the federal government"; iii) Not being associated to the GS program. The associated worker receives US$ 76,00 per family.

7. The **BRAZILIAN COMPANY FOR AGRICULTURE AND LIVESTOCK RESEARCH (EMBRAPA)** developed an agrometeorological monitoring system (AGRITEMPO), which allows access of meteorological and agrometeorological information for all the Brazilian territory, on an aggregated level. Since 2002, the products available are drought maps, water available in soil, rainfall, agricultural drought areas, necessity of reposition by rainfall and accumulated rainfall. There are also regional bulletins for the 5 Brazilian regions. The AGRITEMPO also allows the consultation of information from the weather stations, although there are limitations for data access.

8. THE **NATIONAL INSTITUTE FOR SPACE RESEARCH (INPE/CPTEC)** supplies weather monitoring information regarding drought, frost, soil moisture and weather forecast for all Brazilian territory with applicability to agriculture and livestock. Among the available products are the maps of: (i) soil water availability; (ii) irrigation necessity; (iii) soil management conditions; (iv) phytosanitary treatment conditions. The CPTEC also allows the consultation of information of weather stations, although there are limitations for data access.

9. The **WORLD BANK, MINISTRY OF NATIONAL INTEGRATION (MI), THE NATIONAL WATER AGENCY (ANA) AND STATE INSTITUTIONS** are conducting the technical assistance named "Preparation for drought and resilience to weather changes", because of the long lasting droughts in 2012 and 2013. The goal is defining specific instruments for drought management, in a proactive manner, and it is based on the concept of risk for all the northeastern region. One of the goals is to develop a framework of the northeast region reoccurring droughts aiming to follow weather indicators and verify their impacts on both urban and rural areas, developing three case studies as well. The drought monitor is based on two indexes named SPI (standardized precipitation index) and SPEI (standardized precipitation evapotranspiration index).

[119] PRONAF Capability Statement - *Declaração de Aptidão ao PRONAF*.

ANNEX 5: STOCKTAKING OF SANITARY AND PHYTOSANITARY PROJECTS AND PROGRAMS

1. The following is a list of animal and plant health programs run by ADAB and other institutions:

2. Plant protection. Permanent programs:
   - Inspection of the transit of plants and plants parts, in 42 fixed barriers and several mobile barriers deployed in the areas of sanitary risk distributed strategically on the road network of Bahia;
   - Issuance of the Origin Phytosanitary Certification (CFO - *Certificado Fitossanitário de Origem*), specific for the crops with traffic restrictions;
   - Epidemiological surveillance;
   - Registration and inspection of farms;
   - Issuance of the Plant Transit Permissions;
   - Sanitary education;
   - Monitoring trade and use of pesticides;
   - Monitoring the system for returning the empty pesticide containers.

3. Plant protection. Specific programs:
   - Pineapple plant project. There are 9,700 hectares planted with pineapple culture in every state, especially in the territory of Piedmonte da Chapada, in the semi-arid region, where the city of Itaberaba and its surrounding, Itaetê, Boa Vista do Tupim, Ipirá, Rui Barbosa, Iaçu, Macajuba, Andaraí, Utinga, Wagner and Lagedinho have 3,000 producers spread over a planted area of 5,600 hectares, with an average annual production around 60,000,000 fruits. ADAB has geo-refered the areas in all municipalities where pineapple plantations are found, aiming to support the systematic control of Fusarium gutiforme, causal agent of Fusarium wilt, the major pest of pineapple in Bahia. This fungus causes rot in tissues with exudation of gummy substance in the affected region, losses can reach 80% of production. The pest is controlled by using resistant varieties.
   - Prevention and control of carmine scale (cochonilha do carmim). In Northeast Brazil there are approximately 500,000 hectares of *palma forrageira* (Opuntia ficus-indica Mill). This plant is the main source of food for cattle, goats and sheep, specially on family agriculture. In Bahia is also used as human food, in some regions. The carmine scale is a pest that severely attacks the cactus, reproduces quickly, weakening the plant. Losses associated with this pest may reach 100%, by killing the plants. The state of Bahia is free of this pest, however phytosanitary defense actions should be applied consistently to prevent its introduction. These actions consist in controlling the transit of plants, through inspections in fixed and mobile barriers, application of phytosanitary surveys, registration of producers and sanitary education. In addition, the ADAB in partnership with EMBRAPA Semi-arid, has encouraged the formation of production areas of resistant varieties seedling, in order to be used in a program to substitute the present cropped varieties by resistant ones.
   - Control of the fruit flies (mosca das frutas). The program activities include monitoring the fruit-producing areas, especially ones targeting the international market, like (i) monitoring the eventual introduction of the mosca da carambola; (ii) characterization of the area of low prevalence of fruit flies in the Vale do Rio Brumado; (iii) implementation of the systems approach to melon; and (iv) identification of species Anastrepha. occurring in Bahia. The phytosanitary surveillance activities, such as monitoring, surveillance and control are performed to ensure exports to demanding markets in quarantine security, ensuring the best market quality of fruits and minimum use of pesticides. The identity territories included in this project are: Sertão do Francisco, Sertão Produtivo, Vitória da Conquista, Piemonte do Paraguaçu, Extremo Sul and Semiárido Nordeste II, monitoring an area of approximately 7,000 ha. The detection of mosca da carambola is held in port, airports, bus terminals and free markets. This quarantine pest does not occur in Bahia, yet it is a threat to all fruit-growing state for having a wide host range. ADAB develops a joint project with the United

States Department of Agriculture - USDA / APHIS[120] in order to demonstrate the feasibility of Systems Approach deployment to the melon crop in the municipality of Ribeira do Amparo, targeting the pest Anastrepha grandis, aiming to fulfill the quarantine requirement of importing countries, particularly the United States of America. The Systems Approach is the integration of practices in the pre and post-harvest used in the production, harvesting, packaging and transport of a commodity to meet the requirements for export.

- Prevention of the *Moniliasis* of Cocoa[121]. Bahia is the first national producer of cocoa, with a cultivated area of 410,000 hectares and a production of 168,000 tons (2010-2011 harvest), involving more than 26,000 farmers. Cocoa production is very important in generating employment and income in Bahia, but also the cocoa production system called *cabruca*, is essential for the protection of remaining Atlantic Forest and its biodiversity. The cacao *moniliasis* (Moniliophthora roreri) may cause losses of up to 100% of the fruit produced and raise production costs for its control if it arrives in Brazil. Although Brazil remains as the only country in the Americas free of the disease, it is necessary to take preventive measures to prevent or delay the introduction of this pest, since the attempts of eradication or containment of the disease were unsuccessful in other countries. The activities under the scope of this program are:
    - Surveys and monitoring of the cocoa producing areas, cupuaçu and peach palm, for the early detection of an eventual introduction of the *moniliasis*;
    - Inspection and registration of new areas with banana crops and heliconias, which are alternative hosts to the fungus;
    - Inspection of *pupunha* seeds imported to Bahia, coming from northern Brazilian states and from countries in South America;
    - Sanitary Education Project aiming at raising the awareness of the main actors in the cocoa production chain.
    - Training of personnel of the sanitary and technical assistance sector for prevention and detection of the disease;
    - Survey of risk routes and new pest entry ways;
    - Support for research for the prevention and integrated management of the pest;
    - Technical cooperation, information and experience exchange with plant protection institutions of the cocoa producing states.
- Cotton Phytosanitary Program. The general objective of the Program is the continuous development of sanitary actions, consistently held throughout the crop cycle and following the most update and adequate technology, to contribute to the sustainability of the cotton production chain. The major activities of this program are: Inspection of the production and use of cotton certified seed; Inspection of the limit for planting date and the sanitary vacuum; Inspection of pests control and use of pesticides; Inspection of the destruction of remaining cotton plants after harvest and voluntary cotton plants, during the sanitary vacuum legal period.
- Control of papaya viruses. Papaya agribusiness in Bahia presented an expansion in planted area, over different regions. However, there has been a drop in sales in some regions, such as the Extreme South of Bahia, due to the viruses of papaya. Western Bahia has established itself as a new pole of papaya plantation, as plantation in this region is less susceptible to viruses. Producing areas of Bom Jesus da Lapa, Santa Maria da Vitoria and Barreiras have approximately 2,400 ha planted with this crop, being the production traded on the domestic market or exported to the European Union. In Itaberaba (Chapada Diamantina), ca. 300 ha of papaya are cultivated and may be another alternative region in the state. In all these regions the georeferencing of production units has finished and enforcement of sanitary actions are being carried out.
- Integrated pest management of Annonaceae pests. The main objective is the prevention and control of pests of Annonaceae of economic importance to Bahia maintaining the status of the state as the largest domestic producer of *pinha* and the world leader in *graviola* production. The Annonaceae

[120] Animal and Plant Health Inspection Service.

[121] The related legislation is: Instruction No. 13 of 17/05/2012 (Plano de Contingência de Monilíase (Moniliophthora roreri) do Cacaueiro - Procedures Manual - Contingency Plan for Moniliophthora roreri); Instruction No. 26 of 22/04/2002 (ARP for pupunha seed import).

are expanding in the state of Bahia, currently accounting for of 6,500 hectares, mainly graviola and pinha. The municipality of Presidente Dutra stands out with the largest pinha production in the state, and the Itabuna region reached a production of about 1,400 hectares of graviola, making Bahia the world largest producer. These crops, exploited by small farmers, have significant social and economic importance in the regions where they are grown. Pests that attack Annonaceae causes damage to the crops, even reachin losses of up to 100%. The continued actions of health protection for coexistence with the main pests that attack the Annonaceae are conducted through surveys on producing properties of these cultures. It is also important to certify that the production meet the phytosanitary requirements of importing states. Integrated control measures for coexistence of the plagues of Annonaceae are implemented.

- Prevention of the introduction of Black Sigatoka and Moko (Bananas diseases). Bahia is ranked as second among Brazilian banana producing states, with a cultivated area of 97,25 thousand hectares and an annual production of 1,407,741 tons, spread throughout its territory and grown round the year. It is an important crop for the generation of income for small scale producers. The main objectives of this program are (i) prevent the entry and the establishment of Sigatoka Negra and Moko da Bananeira of the State of Bahia; and (ii) Certify the State of Bahia as Free Area of Moko. The main actions are: Phytosanitary surveys and monitoring of production areas of banana and heliconias, both commercial and non-commercial, including urban areas and margin of roads; Inspection and registration of new areas with banana crops and heliconias; Transit and supply centers inspection and issuance of Phytosanitary Certification of Origin; Phytosanitary Education Program including implementing the ADAB Projects in School, implement the Education Project for truckers, and capacitation and seminars for defense professionals, agricultural sciences personnel and farmers.
- Asian soybean rust management. The soybean planted area in Bahia on last season was ca. 1.3 million hectares with an average yield of 2,860 kg per hectare, and a total production of 3.7 million tons (CONAB, 2013). During this season, cultivated areas in Bahia recorded a low soybean rust inoculum presence. The low incidence and severity of the disease is mainly attributed to the efficient inspection to assure the observation of the sanitary vacuum. A network of laboratories for quick identification of infested plants was implemented, in partnership with the private sector, under the supervision and coordination of ADAB. The information about rust detection and occurrences are confirmed by the technical team of ADAB and made available by phytosanitary warnings issued to the growers. As soon as the first detection occurs, growers are instructed to monitor their own farms and follow the instructions to control the soybean rust.
- Tobacco blue mold. The Bahian Reconcavo stands as the second largest producer of tobacco (Nicotiana tabacum) in Brazil, contributing to rank Brazil as the second largest producer and world's leading exporter. The tobacco blue mold caused by Peronospora tabacina is the main pest of tobacco farming, having quarantine status to several countries, but absent from Bahia. This recognition will encourage the export of tobacco produced in Bahia for countries that require free area for import. The program monitors the tobacco blue mold in order to issue the required certification.
- Plant health program of the citrus. Bahia is the second largest Brazilian citrus producer, with two major poles located in the Reconcavo Baiano and North Coast concentrating 80% of the production. A pest monitoring program and the inspection of seedling nursery is conducted, to assure the seedlings are clean of pests before distribution to the growers.

4. Animal Health Programs. The transit control of live animals and animal products are performed in conjunction with the Plant Protection transit barriers, as mentioned above. Other specific programs are conducted at ADAB, as follow:

- National Program of Swine Health (PNSS). This is a national program, led by MAPA. ADAB is responsible for the program in Bahia, with the aim of keeping Bahia free of the Classical Swine Fever without vaccination, as certified by the International Organization for Animal Health (OIE). The surveillance focus on the control of the legal transit of swine, since this is exclusively allowed for animal slaughter. Besides Classical Swine Fever (CSF) surveillance, other objectives of the Program are: (i) Assure the production of swine meat products at high quality grade; (ii) Swine health monitoring, including shipping materials and farms; and (iii) Control and eradicate major

diseases that affect pigs. The main activities on this program are: Technical assistance for pig farms regarding sanitary requirements; Sanitary inspection and supervision of slaughter; Control of intra and interstate transit of pigs; Registration and inspection of pig farms; Monitoring the trade of therapeutic and veterinary products, specially vaccines and antibiotics; Verify suspected health risk events; Veterinary Health Education at the state level; Epidemiological surveillance; Sanitary control of animals in events like fairs and expositions; and Coordinate the state committee of swine health.

- National Health Program Goats and Sheep (PNSCO). Bahia has the largest goat herd and the second largest sheep herd in the country. The major diseases that might infect goats and sheeps are FMD, Caseous Lymphadenitis, Arthritis Encephalitis of the goats, Contagious Ecthyma, Maedi Visna, Brucellosis, Tuberculosis, Scrapie and Herbivores Rabie. This program has the following objectives: Ensure the productions chains attain the health security requirements necessary for their access to markets and for food security; Reduce the risk of spreading infectious disease risks of goat and sheep; Protect the herds against the entry of exotic diseases in the State; and Contribute to the promotion of public health and environmental conservation. The major activities of this program are: Registration and maintenance of the digital database of breeding properties; Control and monitoring of transit of goats and sheep; Sanitary supervision of exhibitions and weekly markets; Attention to suspicious health events; Monitoring the occurrence of the major diseases of socio-economic impact; Participation in the sectorial board of *caprinovinocultura*; and Conduct epidemiological and health surveillance for diseases of goats and sheep in the state of Bahia.
- National Avian Health Program (PNSA). Currently the poultry park has a roster of nearly 20 million birds, being rated among the 10 largest producers in the country. In a recent technical assessment performed by a federal audit, the state of Bahia was rated C, considered as a satisfactory sanitary level for commercial poultry production. The objective of the program is to provide poultry products on the market with reliable quality through control and / or eradication of existing poultry diseases and the prevention of entry of exotic diseases. The major actions of this program are: Registration of industrial poultry, ostrich, live birds vendors and risk points; Epidemiological surveillance; Control of the transit of avian animals and its products; Monitoring sites of migratory birds; Monitoring the matrizeiros (bird nurseries); Farms registration both for slaughter and egg production; Coordination of the Avain GEASE which is the Emergency Group for Poultry Farming; Permanent cadastral update consisting of the annual registration with georeferencing of properties, businesses and areas of risk related to the poultry sector, held in partnership with the private sector; Permanent Veterinary Health Education, specially in cities where there are landing sites of migratory birds and on poultry properties, along with professional update for the technical assistance; Passive surveillance actions, including the compulsory notifications for mortality over 10% in poultry production facilities; Active surveillance consisting of sampling in subsistence birds, registration of properties in landing site for migratory birds of Mangue Seco, and the disposal of chicken from breeding enterprises; Simulated exercise for Avian Influenza detection and control; Implementation of audit and technical supervision teams specific to the Avian Health Program.
- National Program of Equine Health (PNSE). The National Program for Equine Health aims to control and eradicate infectious equine diseases such as Equine Infectious Anemia and Glanders. BAHIA is considered as free area of equine Mormo, the most important of equine diseases. ADAB performs serological surveys by municipality and positive cases require testing all the equine herd and reactive animals for contagious diseases are sacrificed. Other actions conducted on this program are: Interdiction of properties with equine diseases focus; Outbreaks sanitation; Event (fairs, expositions) surveillance; Epidemiological surveillance.
- National Program for the Eradication and Prevention of Foot and Mouth Disease (PNEFA). Bahia was a pioneer state in combating FMD, starting in 1968 with animal transit control and vaccination, executed by the Executive Group for the Eradication of Foot and Mouth Disease - GERFAB. Recent developments allowed the OIE certification of Bahia as a FMD free area with vaccination. Actions conducted in this program are: Registration and re-registration of all livestock susceptible to FMD, in addition to properties and producers; Realization of annual seroepidemiological investigation to support the lack of evidence of viral activity; Operation of animal transit control on 42 fixed sanitary barriers besides several mobile barriers, located on strategic spots of the state;

Registration and maintenance of the cadastral base of farms, with ca. 264,000 entries; Issuing of Animal Transit Guide - GTA in electronic format.

- Program for Prevention and Control of Rabies of Herbivores and Other Encephalopathies (PNCRH). Rabies is considered one of the most important zoonosis in public health, not only for its dramatic and lethal outcome, but also due to its high social and economic cost. The objective of this program is to reduce the incidence of rabies in herbivores in the State of Bahia, mitigating its impacts on public health. Actions conducted under the scope of this program are: Control of the population of the vector bat, Desmodus rotundus; Epidemiological studies using geo-referencing tools for the characterization of risk areas and location of shelters for vampire bats; Educational activities, such as the characterization of risk for BSE and rabies in herbivores and intensification of PNCRH activities in epidemiological silence areas in the state;
- Spongiform Encephalopathy (BSE) surveillance.
- National Program of Health of Aquatic Animals (PNSAA). The international requirements regarding the Aquatic Animal Health Protection are very restrictive because of the risks to the public health. The Program aims to increase the actions in order to maintain a high status of health in aquaculture, thus contributing to provide qualified products and food safety. ADAB maintain a database of productions sites, in order to inspect the whole production chain.
- National Program for Bee Health (PNSAp). The Bee Health Program (PESAp) aims to strengthen the beekeeping supply chain through surveillance and animal health protection actions, in order to prevent, control and eradicate diseases of bees. Major diseases attacking bees are: American foulbrood; European foulbrood; Varroatosis; Acarapisosis; Tumida infestation (hive beetle); Infestation by mites Tropilaelaps spp. The main actions executed by this program are: Sanitary health education; Control of the transit of bees and bee products; Registration, sanitary inspection and certification of production and processing facilities; Intervention upon suspected notifiable disease.
- National Program for Control and Eradication of Brucellosis and Tuberculosis (PNCT). The aim of the program is progressively reducing the prevalence and incidence of new brucellosis and tuberculosis outbreaks, leading to its eradication and promote the health quality of animal products offered to consumers. This program involves the following actions: Sanitary Health Education to improve the awareness of the importance of the control and eradication of brucellosis and tuberculosis of their flocks; Inspection of the mandatory vaccination of cattle and buffalo females; Control of animal transit, inspection and imposition of animal health standards for participation in exhibitions, fairs, auctions and other animal agglomerations; Training official veterinarians in diagnostic methods of brucellosis and tuberculosis; Epidemiological survey of animal tuberculosis; Certification of properties under active health surveillance, which are monitored using risk management procedures for brucellosis and tuberculosis.

ANNEX 6: STOCKTAKING OF RESEARCH, EXTENSION AND COOPERATION PROGRAMS AND POLICIES

Name of Project/ Program	Year Initiated	Objective and target group	Components and key activities	Executing Units	Cost
FEDERAL PROJECTS AND PROGRAMS					
Institute for the Semi-Arid (INSA) Projects	2012	Coordination, re-search, and outreach for Brazilian Semi-Arid region	Promotion of innovation and applied research on themes of desertification, water resources, biodiversity and sustainable use, production systems, development and social technologies, and information management.	Ministry of Science, Technology, and Innovation	
STATE PROJECTS AND PROGRAMS					
PROATER (Technical Assistance and Rural Extension Program)	2012	Boost production and profitability of rural families, through the systematic access to technological information and public policies that stimulate sustainable development. All the 27 territories of the State of Bahia.	- Encourage and support the preparation of municipal ATER plans. - Training of rural extension workers. - Enable and monitor public institutions and social organizations in the implementation of ATER projects. - Carry out public calls for ATER projects. - Determination of procedures for analysis, contracting, execution and monitoring of ATER projects.	SEAGRI, with participation of MDA, CEPLAC, ATER-NGOs, FUNCEP[122], Municipalities, CODEVASF, PETROBRAS	R$ 978 million for 2012-2015[123]
Semeando Program	2007	Production and dis-tribution of seeds and seedlings. 270,000 families being benefitted in 2013/14.	-Production of seeds and seedlings by EBDA (40%). - Agreements with co-operatives and farmer associations for seed and seedling production (60%).	SUAF/SEAGRI, EBDA	R$ 66 million since the beginning in 2007

[122]State Fund for Poverty Combat and Eradication - *Fundo Estadual de Combate e Erradicação da Pobreza*.
[123]Total resources of *Vida Melhor* Program, which finances PROATER.

Name of Project/ Program	Year Initiated	Objective and target group	Components and key activities	Executing Units	Cost
		2.7 million kg. of seeds distributed in 2013-14.	- Distribution of seeds and seedlings to family farmers, prioritizing those who receive technical assistance.		
RENIVA Project	2012	- Identify the cassava varieties better adapted to local conditions; -produce genetic material free of diseases; -spread the genetic material produced. 150 producers of cassava cuttings (maniveiros) 3 million of cuttings delivered to the maniveiros	- Selection by EBDA and cooperatives of the varieties to be spread. - EMBRAPA makes the phytosanitary control and decontamination of the varieties. - Instituto Biofábrica reproduces the vegetative material to be deli-vered to the producers of cassava cuttings (manivas), which will then be distributed to farmers in the second phase.	EMBRAPA SUAF/SEAGRI, EBDA Instituto Biofábrica de Cacau Cooperatives	R$ 8.9 for the 1st phase of the project, financed by SEAGRI and CAR
State Plan of Beekeeping Development	2012	Increase the production and productivity of hives in three years. 10,000 beekeepers.	-Distribution of bee-hives and beekeeping kits. -ATER through community agents (an agent every 50 beekeepers). -Honey processing units. (Casa do Mel)	Government of Bahia / Ministry of National Integration (MI)	R$ 24.2 million (until 2014)
Genetic Improvement of Goat Herds (with Sertao Produtivo and Vida Melhor Programs)	2009	Rebuild and improve herds after droughts. 20,000 families receiving 101,000 female and 2,400 male goats (2009/10 and 2013/14)	- Distribution of 5 female goats by family and 1 male goat every 5 families. - Distribution of 1,000 palma forrageira seed-lings by family, to expand the area of forage production.	SUAF/SEAGRI, EBDA ADAB CAR	Financed by Gov.of Bahia / MI/ Codevasf
Program for Food Security for Family Farming Animal Herds	2012	Establish field production sites to plant and transfer animal forage plants (pest-resistant cactus with dense planting) to family farmers	By 2013, 467 “Didactic Technical Units” were established to train and distribute cactus (palma forrageira) for animal feed with complementary kits.	State of Bahia, State Fund for Fighting and Era-dicating Poverty	R$2.7 million

Name of Project/ Program	Year Initiated	Objective and target group	Components and key activities	Executing Units	Cost
				(FUNCEP), EBDA	
Project Bahia Produtiva	2014	Promote sustainable rural development and participatory gover-nance through grant financing to producer associations in every territory of the state for agricultural and water/sanitation investments	416 municipalities and 56,000 families are expected to benefit directly from the Project	CAR/SEDIR, World Bank	US$260 million
Resources from CHESF	2013	Donation from CHESF to committee of state agricultural secretaries in the Northeast	Certification of goat and sheep herds, irrigation kits for family farmers, and tank systems for aquaculture.	National Council of Secretaries of Agriculture, Hydroelectric Company of São Francisco (CHESF)	R$1.25 million
Sustainable Rural Development Project for Bahia Semiarid Region (Pró-Semiárido)	2015	Contribute to the reduction of rural poverty through the sustain-able development of the production, the generation of employment and income in agricultural and non-agricultural activities, and the development of human and social capital. 70,000 families and 30 municipalities in the semiarid are expected to benefit from the Project.	The project will organize its activities through the central concepts of productive development, development of human and social capital and management. The main tools for the implementation are technical assistance, the financing of productive and environmental investment, the sensitivity to gender and generation, and access to public policies.	CAR/SEDIR, IFAD	US$ 100 million
State Program for Agriculture/Livestock Defense		Program to register, inspect, and enforce sanitary conditions for the production and circulation of agriculture and livestock	Responsibility of the autonomous Agency for Agricultural/Livestock Defense (ABAD)	ABAD	
State Program for Plant Sanitary Defense		Program to prevent, monitor, control, and eradicate plant pests, with focus on several priority	Maintenance of pest free area, monitoring and sanitary control, transit enforcement, and pesticide use. Responsibility of the autonomous Agency for	ABAD	

Name of Project/ Program	Year Initiated	Objective and target group	Components and key activities	Executing Units	Cost
		crops: banana, citrus, grape, sugar, and forage cactus	Agricultural /Livestock Defense (ABAD)		

ANNEX 7: PREVALENT PLANT PESTS AND DISEASES AND ANIMAL DISEASES IN BAHIA

AGRI-INDUSTRIAL COMMERCIAL AGRICULTURE IN THE WEST OF BAHIA

1. Attack of pests (diseases, insects, nematodes) in the West region of Bahia (Cerrado) follow a relatively stable pattern between years, with possible augmentation under certain climatic conditions, like for instance fungal diseases (e.g. soybean rust), or the intensity of the attack of caterpillars. The newly introduced species H. armigera is apparently more aggressive on drier years, while the lagarta falsa medideira appears to be more aggressive on rainy years.

2. The predominant production system is the intensive use of arable land, with crop succession in the same growing season, like soybean/maize or soybean/cotton, sometimes later followed by beans. This condition created the opportunity for an evolution and adaptation of some major pests, especially insects, nematodes and weeds, which became generic pests of the whole production system, losing their previous status of a unique pest of a single crop. It is specially the case for caterpillars, bugs or whiteflies, which have lost their specificity and became polyphagous and widely adapted pests.

3. According to this new ecological condition, the main phytosanitary risks associated with these crops are the caterpillar falsa medideira and the caterpillar helicoverpa (soybean and cotton), the lagarta da espiga (maize) and the bicudo do algodoeiro (cotton). As insect pests of moderate impact can be listed the percevejo marrom (soybean), and the mosca branca, that despite being polyphagous, cause greater losses in beans where it acts as a vector of viruses. Among the diseases, antracnose and cancro da haste (soybean) besides mancha de ramulose (cotton) cause minor damage, while larger impacts are associated with ferrugem da soja (soybeans), nematodes (soybean and cotton) and mosaico dourado (beans).

4. Agricultural pests are under satisfactory management in the region although involving high costs for their control. Control is performed by different techniques, such as chemical, biological, cultural or genetic control. In the latter case, there are varieties which incorporate a toxin expressed by the bacterium Bacillus thuringiensis in plant tissues of maize, soybeans and cotton (called Bt varieties), being highly effective against major caterpillars pests. The largest perceived risk is the loss of effectiveness of this technology, due to non-compliance of the requirements for using this advanced technique by the growers, as it is the case of using a refuge consisting of a susceptible variety, in order to reduce the risk of developing resistance to the treat.

5. Another phytosanitary risk is associated to transgenic varieties resistant to a large spectrum herbicide, called RR (Roundup Ready) varieties, which incorporate a gene conferring resistance to the herbicide glyphosate. When a grower uses a RR variety (cotton, soybean or maize), the herbicide sprayed all over the crop kills the weeds, but do not affect the crop itself. The unwanted externality is the development of resistant weeds, which makes more difficult their control, increasing competition with crop and causing reduced productivity. The risk of developing glyphosate-resistant weeds is very recent, but its importance will increase in the coming years, with major financial impact.

6. There is also the risk of maize becoming a “weed” on soybean fields, due to the emergency of voluntary plants from seeds falling to the soil during maize harvest. As the maize is as resistant to glyphosate as soybeans, spraying this herbicide on the field will not result in controlling the voluntary maize plants, which will compete with soybeans and reduce its yield. Another risk is associated with RR cotton varieties, as the law imposes that cottons plants must be destroyed after harvesting (sanitary vacuum), in order to avoid that cotton plants remaining in the field allow the building up of consistent bicudo populations, that will infect the cotton on next season, with earlier and more intense attacks.

Commercial Fruitculture

7. Grapes, mangoes and bananas (in the middle São Francisco region), are susceptible to frequent attack of insect pests like cochonilhas (grape, mango) and the occurance of fungal diseases (grape). Modern control techniques, which include biological and cultural control and the use of pesticides are common practices, resulting in losses of lower mounts. However, the costs to control fruit flies (grape and mangoes) generate moderate impact on its production cost. Citrus plantations (in the Reconcavo) are often attacked by fruit flies specially the mosca negra dos citrus and viral diseases, with low impact on production. Other diseases of citrus as the CVC (clorose variegada dos citrus) are less frequent but cause moderate impacts. In this region, the main pest risk for pineapple production is the fusariose, a widely spread disease with moderate impact.

8. In the southern coastal area ther is the cocoa region, centered on the axis Itabuna - Ilhéus. The main phytosanitary risks of the crop are the *vassoura de bruxa* and *podridão parda* diseases, responsible for moderate impacts due to their frequent appearance on the farms. Also in the extreme south of Bahia there is the production of papaya, partially directed for export. The dominant system is entrepreneurial though there are several smallholders producing papaya for the domestic market. The dominant production chain is comprised of medium and large producers, using modern techniques for the sake of monitoring and control the pests. The main risks to papaya production are the viruses, appropriately managed by monitoring their vectors and using cultural practices. These viruses are of frequent occurrence but with low impact due to the mitigation practices used by growers through monitoring and controlling their vector by means of cultural practices, including the use of insecticides.

9. Coffee production is restricted to the central highlands of Bahia, where climate and topography are the most adequate for this crop. The major phytosanitary risk to the coffee plantation is the broca do café, attacking the plantation every other year, causing moderate impacts, and being adequately controlled with the use of pesticides.

10. Besides pests presently attacking the most important fruits species in Bahia, quarantine pests are important threats, represented by exotic diseases such as HLB (Huanglongbing), the black sigatoka of bananas, and the pink mealybug which attacks mango and grape. These pests are already present in other regions of Brazil, but have not been recorded in Bahia. The eventuality of the introduction in Bahia would result in high adverse impacts to fruit production, affecting fruit yield and quality and imposing more control costs to the growers. In this context, the exotic pest of major importance is the moniliasis of cocoa, not yet registered in Brazil. Its eventual introduction into the Bahia cocoa region is ranked as a very serious threat by CEPLAC (Executive Planning Commission for the Cocoa Crop), responsible for research and technical assistance regarding cocoa plantations. In the case of entry of this disease in the future, it has been estimatd by CEPLAC that the impact will be far greater than that observed with the vassoura de bruxa in the past. The reason is that currently the cocoa production occurs on small farms and agrarian reform settlements, whose owners do not have the financial capacity to withstand the impact of the entry of an aggressive disease expected to cause extensive production losses, requiring not only more sophisticated technological tools, but also will represent reduced yield and higher production costs.

Commercial Horticulture

11. Tomatoes are cultivated in the coastal region where the major risks are nematodes and a fungal disease (requeima), of low impact, although of high probability of appearance. The insect pests traça do tomateiro and mosca branca are also frequent and causes moderate impacts, along with diseases caused by virus. Control of the fungal diseases and insect pests are made by specific pesticides or by using resistant varieties.

12. Onions are grown largely on the farms close to the borders of the Sobradinho Lake, on the Medio Sao Francisco Basin, being generally irrigated along its growing cycle. The crop is frequently attacked by

nematodes and fungal diseases like mildio and mancha púrpura, which are adequately managed by fungicide spraying.

13. Potatoes are a temperate to cold weather crop, so its production is concentrated on the highlands of Chapada Diamantina. The major pests for this crop are fungal diseases (requeima) and nematodes, along with several viruses of low impact. Nematodes, which attacks directly the potato are also frequent and results in moderate impacts. Pesticides are commonly used to control these pests

Family Agriculture

14. Family farmers in the Semi-arid produce cassava, beans and maize, largely for self consumption. Both beans and maize are attacked by caterpillars, and beans are the preferred host of the whitefly, which causes direct damage and is also a vector of the virus disease known as mosaico dourado. These pests regularly appear in crops, with relatively small impact. Cassava is frequently attacked by a set of viruses, reducing the yield, therefore aggravating the family access to food. Although less common podridão da raiz (cassava) can also cause losses of low impact. However, because of the great and destructive recurrent drought scenario dominating the Semi-arid region, it was observed on the interviews that phytosanitary risks are not considered important by smallholder family farmers. Some of these risks, such as nematodes or root diseases, or other pests whose symptoms are not very apparent, are even not perceived by the farmers. The continuous growing of the same genetic material, meaning that new manivas (plant stakes) come from the recurrent previous cropping, tend to perpetuate the viruses on the cassava plantation. Moreover, the impact of the pests is in effect low because the plants in the Semi-arid tend to be less palatable to insect, thus reducing its incidence. Only a minority of farmers use pesticides and cultural practices to control pests on their crops, either due to ignorance, because the practices represent a cost, or because of the high risk of production losses caused by drought.

Livestock Production Chains

15. According to MAPA (2013), the bovine herd in Bahia accounted 11,440,834 heads, in 2012. Goats and sheeps are estimated by Guimarães (2013) to be 5.8 million heads, located on the Bahia semi-arid region. Bahia is free of the most important animal diseases, which gives a significant economic and trade advantage to the producers and exporters.

16. In 2001, Bahia was certified by the World Animal Health Organization (OIE) as free of Foot and Mouth (FMD) disease with vaccination. Starting in 2014 the vaccination schedule has been modified and adult animals are vaccinated only once a year while animals less than two years old will continue to be vaccinated twice a year. The goal is to stop vaccinating and be certified as free of FMD without vaccination in the next future. In May 2014, other Northeastern states (Alagoas, Ceará, Maranhão, North Region of Pará, Paraiba, Pernambuco, Piauí and Río Grande do Norte) were also certified as free of FMD, reducing the risk of re-introduction of the disease in Bahia, where the last outbreak of FMD occurred in 1997. It has also to be considered that it is in place a strict national program to control movement of animals and animal products in the country, which provides additional protection to prevent the entrance of this disease.

17. No BSE cases were recorded in Bahia and, according to OIE, the Brazilian risk status for BSE is Negligible, the safest of all. For the prevention of this disease the State has a surveillance program which follows the orientations of the MAPA Federal Program. Bahia is currently free of Highly Pathogenic Avian Influenza (HPAI), Asiatic Types, as the whole country is. However, the risk still persists for the possibility of spread by wildlife as it has occurred in other parts of the world. Bahia is not on the route of migratory birds, which reduces the risk of the introduction of the disease from abroad. In order to prevent entrance of the disease, Brazil has a plan of action that calls for training of professionals and producers to detect the disease. Bahia is incorporated in the plan of action and has a surveillance system in place, including the wild life, to detect any possible outbreak of the exotic type of HPAI. The very recent outbreaks of the H2N5

virus type of the HPAI in Netherlands, Belgium and Canada indicate the need to reinforce the surveillance to avoid the introduction of the HPAI. Newcastle Disease Virus (NCDV) is also included in the Federal Program of Avian Health coordinated by MAPA. Bahia has been rated as C, which means that the state has medium capacity to execute the program. Epidemiological studies in Bahia, by Sales et al. (2007), indicated that there are not active outbreaks and the immunological state of the different modalities of production is acceptable. The Classical Swine Fever (CSF) disease has been eradicated in 49% of the Brazilian territory, 54% of the properties and 81% of the swine population of the country. A free area has been established by MAPA, which includes the states of the South, South East and South Regions, and the states of Bahia, Tocantins, Sergipe and Rondônia. In Bahia CSF surveillance is part of the National Swine Health Program coordinated by MAPA and executed by ADAB. A survey will be necessary to have definite information on the absence of this disease and to get the OIE certification as free of CSF.

18. Bovine brucellosis due to *Brucella abortus* is endemic and the most prevalent Brucella infection in Brazil. There is in place the National Program for Control and Eradication of Brucellosis and Tuberculosis Animal coordinated by MAPA, since 2001.

19. Regarding Food Safety, there are very good Federal and State control and inspection services in Bahia, for livestock products. Actions are also underway to execute a project to decentralize the slaughtering which will improve the municipal system. This includes the construction of slaughter houses and intermediate processing units according to the needs of the municipalities. The goal is to have a unified system following the MAPA/SISBI orientations.

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