

NO POVERTY

CONTRIBUTIONS OF EMBRAPA

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Technical Editors



**Brazilian Agricultural Research Corporation
Ministry of Agriculture, Livestock and Food Supply**



Sustainable Development Goal 1

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Chapter 4

Increasing resilience of the poor and reducing their vulnerability to disasters

Joanne Régis Costa

Patricia da Costa

Introduction

Climate change is the biggest challenge of the 21st century and is at the center of the global political debate (Giddens, 2010). The intensification of extreme weather events, one of the expected effects of global climate change, will affect everyone, especially peoples and populations that are already vulnerable to access to basic rights (Olsson et al., 2014). Poverty is considered the main factor contributing to the increase in population vulnerability to the effects of climate change, helping reduce their adaptive capacity (Plano..., 2016). As factors that contribute to social vulnerability to climate change, we can add: gender, color, race, and traditional and specific population groups issues, inserted in a context of social, regional and structural inequalities (Subsídios..., 2011).

Target 1.5 of the Sustainable Development Goal 1 (SDG 1) addresses building the resilience of the poor and vulnerable people and reducing their exposure and vulnerability to climate-related extreme events and other economic, social, and environmental shocks and disasters by 2030. Next, the technological solutions developed by Embrapa related to climate change that can help achieve this target are presented.

Agropensa: the construction of future scenarios

The Strategic Intelligence System of Embrapa (Sistema de Inteligência Estratégica da Embrapa, [Agropensa](#)) seeks to present to Embrapa and to society prospective studies to help explore possible future scenarios. The studies conducted by Agropensa have the important function of supporting the continuous reflection on, and possible revision of, Embrapa's research, development, and innovation (PD&I) agenda, besides providing knowledge and information to the different actors and agents of agricultural and livestock production chains.

GuiaClima – Web service

[GuiaClima](#) is an agroclimatic monitoring system that provides real-time information on weather conditions (temperature, air humidity, etc.) and warnings (low air humidity, strong winds, frost, etc.) that can be used to assist in decision making. The system can be accessed through the Embrapa Western Agriculture Unit Portal, both by computer and smartphone. Currently, more than 100 visitors access GuiaClima a day. People from all over Brazil and even from abroad consult GuiaClima.

Development of management decision support systems

Embrapa has developed software, applications, information systems, information and communication technologies, databases, maps, among others, to evaluate scenarios using technologies, analyze the impacts of technology use in the field and optimize the use of technologies (see SDG 11).

Rede Saltus

Embrapa, through Embrapa Forestry and partner institutions, fostered the formation of the [Rede Saltus](#) to generate information on the dynamics of greenhouse gas emissions and carbon stocks in natural and planted Brazilian forests. The goal is to bridge the gaps in the subject, as well as to advance on the use of mathematical simulation and remote sensing techniques in the estimates of greenhouse gas emissions/removals of greenhouse gases (GHG) in the country, and economic evaluation of mitigating alternatives. Current scenarios, both political and scientific, show that Brazil will soon have to enter into a phase of preparing and publishing national inventories and monitoring actions to reduce GHG emissions, starting to publish more frequently audited inventories. Thus, it is necessary to develop and improve technical and scientific indicators related to GHG emissions and removals from forests, as well as to master technological tools that allow greater integration of national information.

Sustainable use of natural resources in critical Brazilian regions

Embrapa develops studies on the sustainable use of natural resources. In *Agricultura tropical: quatro décadas de inovações tecnológicas, institucionais e*

políticas (Albuquerque; Silva, 2008), published by Embrapa, the sustainable use of natural resources is addressed in Volume 2. Many natural resources have already been incorporated into the production process, but others still rely on specific knowledge for their use. From the semiarid region to the Amazon Forest, through the *Cerrado*, the Coastal Tablelands, and the *Pantanal*, problems must be faced, and diverse solutions must be found. Demographic pressure, urban expansion, environmental preservation, demands for welfare, and demands for quality and quantity must be considered when it is necessary to use the available resources to benefit the different segments of Brazilian society in a sustainable way. The book *Agricultura tropical: quatro décadas de inovações tecnológicas* (Albuquerque; Silva, 2008) provides an inventory of useful challenges and options, and an opportunity to evaluate the results and think about the future prospects to transform agriculture in the tropics.

Protocol to measure and estimate biomass and forest carbon

Among the research carried out by Embrapa on the subject, it is important to highlight *Protocolo de medição e estimativa de biomassa e carbono florestal* (Higa et al., 2014), in which the procedures for collecting information, estimating biomass above and below the ground, plant litter, and necromass of natural forests, planted forests, and integration systems involving the forest component. This work considers the main carbon reservoirs in forest formations in Brazil for measurement (Figure 1).

Impacts and vulnerabilities of Brazilian agriculture to climate change

Studies by Embrapa and its partners have evaluated the main impacts of greenhouse gas emission scenarios. It is important to mention the studies published in the book *Modelagem climática e vulnerabilidades setoriais à mudança do clima no Brasil* (Teixeira et al., 2016). This book analyzes, in addition to agriculture, Brazilian biomes vulnerabilities and the sectors of water resources, renewable energies, health, and Brazilian biodiesel production. Other studies on impacts and adaptation measures in cities, metropolitan regions, and states in Brazil indicate how the changes will affect the regions from physical, economic, and social points of view, especially in the city of Rio de Janeiro. The Ministry



Figure 1. Measurement of diameter at breast height (DBH) of eucalyptus to estimate carbon stocks in aerial biomass in delimited plots in the eucalyptus forest, a remnant of a mixed ombrophilous forest and ICLF system, conducted by Embrapa Forestry, to estimate carbon stocks in biomass in these land use systems.

of Science, Technology and Innovation (MCTI, currently Ministry of Science, Technology, Innovations, and Communications) launched the book, as a result of studies developed by researchers from Embrapa, the Rede Clima (Climate Network), in partnership with the National Institute for Space Research (Inpe) and the Centro Nacional de Monitoramento e Alertas aos Desastres Naturais (National Center for Natural Disaster Monitoring and Alerts – Cemaden).

Actions to fight desertification

Embrapa has developed several actions to combat desertification. It is a member of the [Comissão Nacional de Combate à Desertificação](#) (National Commission to Combat Desertification – CNDC), which discusses initiatives for coping with drought in Brazil, especially in the semi-arid region. The work developed by

Embrapa Goats & Sheep with actions to reverse desertified areas in Irauçuba, near Sobral, state of Ceará has stood out. This is the region of Ceará that is most affected by desertification, and Embrapa's work has shown that it is possible to reverse the degradation process through available technologies.

Among the technologies already studied and made available by Embrapa and its partners that contribute to the fight against desertification, must be highlighted: Riparian forest recovery; Reforestation; Production backyards; Agroforestry Systems (AFSs); Underground dam; Successive dams; Barraginha/Barreiro; Barreiro trench; Rainwater harvesting; Banding; Pre-planting furrow; Post-planting furrow; Barred furrow; Flat plowing and planting; Boardwalk cistern; Shallow wells; Contouring stone strings, among others. For further information about projects, technological solutions, publications, and others, see the Embrapa Thematic Space on [Coping with Droughts](#).

Evaluation of extreme events and their impacts

Embrapa has conducted studies on extreme events in Brazil. It is important to highlight a short-term extreme hydrometeorological events (EHE) study carried out by Embrapa Soils (Monteiro, 2014), which have been considered one of the most frequent and most impactful on society in the climate change scenario. This study highlighted the need for greater emphasis on prevention strategies such as land management, strengthening of rural communities, slope containment, improvement of alert systems, and other adaptation measures that increase the resilience of rural communities to extreme hydrometeorological events.

Agricultural Zoning of Climate Risk (Zarc)

The [Zoneamento Agrícola de Risco Climático](#) (Agricultural Zoning of Climate Risk – Zarc) turned 20 years in 2016. It is one of the main organization tools of Brazilian agricultural production and was developed by the Ministry of Agriculture, Livestock and Food Supply (Mapa), by Embrapa and partner research institutions to offer benefits to both farmers and financial sector.

The [first Zarc](#), published in 1996, was on wheat. Subsequently, 59 cultures and 80 different culture systems were studied in a research involving approximately 80 professionals from 21 Embrapa Units.

Two government programs use Zarc information to frame its operations: the Programa de Garantia de Atividade Agropecuária (Agricultural Guarantee Program – Proagro) and the Programa de Subvenção ao Prêmio do Seguro Rural (Rural Insurance Premium Grant Program – PSR). By using this tool, it is possible to reduce risks and improve family income and production. The system allows the banking system to make more precise use of credit and rural insurance systems.

Final considerations

In addition to the contributions mentioned to SDG1 target 1.5, Embrapa has several other contributions that have subsidized policies to eradicate and reduce poverty and hunger and which contribute to reducing regional asymmetries, such as the Zero Hunger Program and Brazil Without Misery Plan, and policies to mitigate climate change. Other international and regional contributions include: the participation of Embrapa in events and international documents on climate change, poverty, and related issues; studies on management, inventory, and dynamics in Brazilian biomes carbon flow; development of models and methods to estimate GHG emissions; analysis of climate scenarios and risk estimates for agriculture; development of low carbon agriculture systems and other technologies for climate change adaptation and mitigation; identification of biome potential due to climate change; research with plant species managed by local populations that resist environmental stresses, with potential for use in climate change adaptation programs; in addition to the development of [AgritempoMóvel](#) – a mobile agrometeorological monitoring app that creates date recommendations for planting. On the other hand, there are several local contributions that deserve mention, such as the Geoviticulture Multicriteria Climate Classification System; the Climatic Macro zoning for Irrigated Rice in Rio Grande do Sul; the [climatic zoning of coffee cultivation](#); [projections of water demand for melon irrigation in the Submédio São Francisco under climatic changes scenarios](#); the [climatic agricultural zoning of corn and soybean](#); the [calculation of the fire risk index for the Nhecolândia subregion based on the climate data information system](#); the [agroclimatic aptitude map for the cultivation of *Coffea arabica* in the cities of Rio de Janeiro](#); the [agroclimatic zoning for citrus crop](#). Thus, Embrapa demonstrates its alignment with local realities and the global agenda related to the resilience of the poor and vulnerable populations to climate-related extreme events and other economic, social, and environmental shocks and disasters.

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