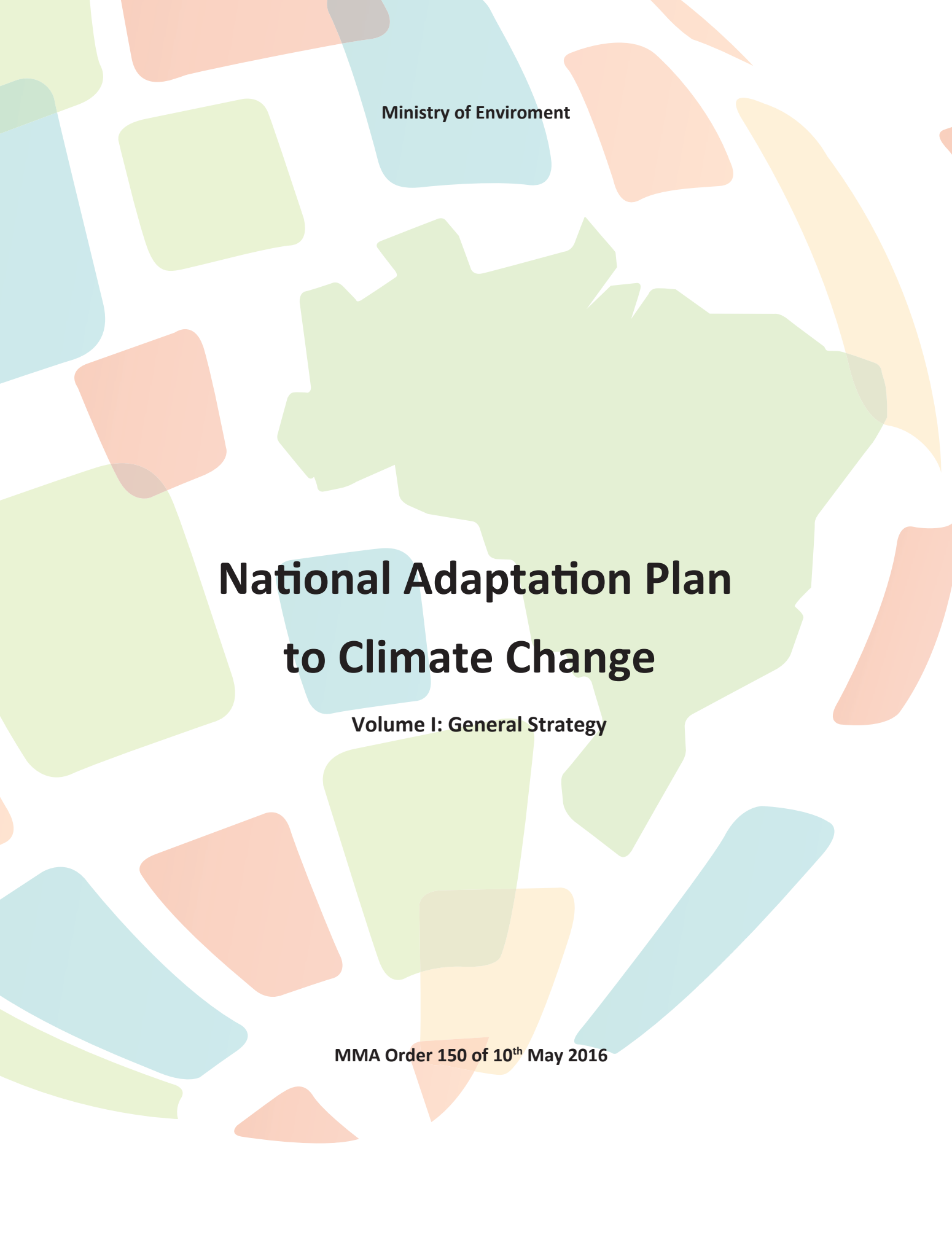


National Adaptation Plan to Climate Change

General Strategy

VOLUME I





Ministry of Environment

National Adaptation Plan to Climate Change

Volume I: General Strategy

MMA Order 150 of 10th May 2016

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Cemaden	National Centre for Monitoring of Natural Disasters	MRE	Ministry of External Relations
EMBRAPA	Brazilian Agricultural Research Corporation	MME	Ministry of Mines and Energy
FBMC	Brazilian Forum on Climate Change	MDA	Ministry of Agrarian Development
FUNAI	National Indian Foundation	MDS	Ministry of Social Development and Combating Hunger
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INPE	National Institute for Space Research	MS	Ministry of Health
MAPA	Ministry of Agriculture, Livestock and Food Supply	MT	Ministry of Transport
		SFB	Brazilian Forestry Service
		CPRM	Geological Survey of Brazil

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Credits of Images: ASCOM/MMA, Paulo Hilst

International Publication Catalogue Data - CIP

B823p Brazil. Ministry of Environment.
National Adaptation Plan: Volume I: general strategy : MMA Order 150 of 10th May 2016 / Ministry of Environment – Brasilia : MMA, 2016 . 2. v
44 p., il. (some colour.)
ISBN: 978-85-7738-271-2
1. National Adaptation Plan. 2. Climate risk. 3. Climate change. 4 Sectoral plans. 5. Mitigation and adaptation. I. Secretariat for Climate Change and Environmental Quality. II. Title.

CDU: 551.583(083.9)

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Introduction

The purpose of the Brazilian Federal Government's National Adaptation Plan, hereinafter referred to as the National Adaptation Plan (NAP) is to guide initiatives for management and reduction of long-term climate risks, as established in Ministry of Environment (MMA) Order 150 of 10th of May 2016, published in the Official Gazette (DOU) of 11th May 2016. The Plan was drawn up by the Executive Group of the Inter-ministerial Committee on Climate Change (GEx-CIM) between 2013 and 2016, as provided for in the National Policy for Climate Change (PNMC- Law 12.187/09) and its enabling decree (Decree 7.390/10). The NAP was drawn up in consonance with the National Plan for Climate Change, with sectoral mitigation and adaptation plans, and with decisions on adaptation undertaken by Brazil within the framework of the Conference of the Parties (COP) on Climate Change.

The drafting of this plan received contributions from thematic networks comprised of experts from various sectors and included extensive public participation by means of a public call for inputs and a public consultation process.

Also considered were reference documents representing the current status of knowledge, such as: the First National Assessment Report of the Brazilian Panel on Climate Change; recommendations of the Third National Environment Conference, attended by over 115,000 people, the theme of which was "Climate Change"; and a report entitled "Inputs for drafting of the National Adaptation Plan to Human Impacts of Climate Change", prepared by the Brazilian Forum on Climate Change (FBMC).

Impacts of climate change can already be observed. The Brazilian Panel on Climate Change (PBMC) has systematized data and information indicating that the characteristic climates of the various regions of Brazil are already experiencing change. It forecasts that these changes will affect Brazil's natural, human, infrastructure and productive systems, in non-uniform ways. Rises in temperature may lead to an increase in the frequency of extreme events in various regions of Brazil, as well as changes in rainfall patterns, with greater frequency of occurrence of droughts, heavy rainfall, flooding, landslides, and consequent population displacement in the affected regions. Such changes will have serious consequences for society, ecosystems and various sectors of the economy.

Risk management associated with climate change will require coordination and cooperation among the three levels of government, sectors of the economy, and civil society, since the impacts of climate change will occur on a local level, but measures for facing up to them will depend upon actions coordinated and deployed through a variety of sectoral or thematic strategies.

This Plan proposes actions, strategies and guidelines for management and reduction of climate risk in Brazil, with a view to facing up to the adverse effects of the social, economic and environmental dimensions of climate change. It also proposes institutional mechanisms for concerted deployment among states and municipalities, economic sectors and the general public, and for scheduled implementation of structural measures to overcome gaps observed in the national context.

The NAP is presented in two volumes. Volume I – General Strategy – features and details structural components of the plan: its legal framework, objectives, goals and governance. Volume II – Sectoral and Thematic Strategies – discusses Brazil’s main vulnerabilities in face of climate change, and proposes guidelines to include risk management associated with climate change, with a view to increasing the climatic resilience of 11 thematic sectors, namely: Agriculture, Biodiversity and Ecosystems, Cities, Disasters, Industry and Mining, Infrastructure (Electric Power, Transport and Urban Mobility), Vulnerable Populations, Water Resources, Health, Food and Nutritional Security, and Coastal Zones.

1 Context

The National Policy for Climate Change (PNMC - Law 12.187, of 29th December 2009) provides the legal framework for preparation of the National Adaptation Plan (NAP). Article 4, inset V of the PNMC establishes the need to implement measures to promote adaptation to climate change by the three levels of government.

Equally important, the Sectoral Plans for Mitigation and Adaptation to Climate Change, formalized by Decree 7390 of 2010, seek to guide actions that promote resilience of sectors in facing up to the adverse impacts of climate change, taking into account the specificities inherent to each plan. In various cases, in addition to risks arising from an increase in the frequency of extreme events, changes in climate patterns can negatively affect the routine activities of specific sectors. Thus, in consonance with guidelines laid down in this NAP, sectoral plans need to strengthen the strategic agenda for adaptation, in convergence with planned mitigation actions, when appropriate, without prejudice to other sectoral policy instruments for adaptation to climate change.

A relevant example of existing synergies between initiatives for adaptation to climate change provided for in this Plan and the national risk-management framework for natural disaster warnings is the National Civil Defence and Protection Policy, instituted by Law 12.608, of 10 of April 2012. The relevance of this relationship becomes even more evident in scenarios of increasing occurrence of extreme events, foreseen in climate-model projections. It is therefore incumbent upon the Federal Government, the states, the Federal District and municipalities to adopt all measures necessary to reduce disaster risks, including empowerment of municipalities and collaboration among public and private entities and society in general.

Furthermore, the National Civil Defence and Protection Policy also provides for implementation of risk reduction and risk prevention measures. It is thus in alignment with strategies for adaptation to climate change, with a focus on expansion of adaptive capacity and reduction of vulnerability, for purposes of climate risk management.

On an international level, the United Nations Framework Convention on Climate Change (UNFCCC), to which the Brazil is a Party, is the main global response to the challenge presented by climate change. The Convention places a number of commitments upon the Parties, among them, the drafting of plans for adaptation to climate change.

The Conference of the Parties (COP) of the United Nations Framework Convention on Climate Change (UNFCCC) recognized that national planning for adaptation can assist developing and less developed countries in preparing

their assessments of vulnerabilities, to incorporate climate-change risks into their national policies, and promote adaptation. The COP also acknowledged that climate-change risks intensify development challenges, and that there is the need to address planning for adaptation, within a broader context of sustainable development.

Brazil's commitment to promoting adaptation was reaffirmed at the Conference of the Parties (COP 21) in Paris, by means of submission of its proposed

2 Observed and projected climate change

The need for adaptation becomes more pressing as evidence mounts of impacts associated with the climate change. Such impacts may have positive or negative repercussions on natural, human, productive and infrastructure systems, affecting biodiversity, coastal zones, water resources, power generation, industry, transport, cities, urban mobility, agriculture, food and nutritional security, vulnerable populations and disaster risk management.

When promoting adaptation to climate change, it is important not only to observe current exposure to climatic events, but also to assess future exposure. This can be achieved through the use of various techniques and tools, such as building of scenarios and application of climate models.

Scientific observations have revealed increases in average global air and ocean temperature levels, widespread melting of snow and icecaps and overall rises in sea levels. Such phenomena are unequivocal evidence of global warming.

Moreover, average global temperatures are forecast to rise by almost 2° C by the end of this century. Such an increase is unprecedented, and higher than any recorded since pre-industrial times, according to the Intergovernmental Panel for Climate Change (IPCC, 2014).

Possible impacts of climate change in Brazil and South America include: extinction of habitats and species, mostly in tropical regions; replacement of tropical forests by savannahs, and of semi-arid vegetation by desert; an increase in water stress in various regions, i.e., lack of sufficient water to fulfil demands of the population; increases in agricultural pests, and of diseases such as dengue fever and malaria (PBMC, 2013); and displacement and migration of populations.

Reports of the PBMC and IPCC in the context of Working Group II (WGII) have been unanimous in revealing that South America and Brazil are already facing changes foreseen in climate models:

Rises in temperature of up to 2.5°C in coastal regions of Brazil between 1901 and 2012;

Increase in the number of days with rainfall above 30 mm in Brazil's Southeast region;

Rises in sea temperatures and changes in salinity in the South Atlantic;

Increased frequency, intensity and influence of El Niño Southern Oscillation (ENSO) events in the continental climate (Equatorial eastern-Pacific El Niño, La Niña and Central-Pacific El Niño).

Climate change associated with global warming may change the frequency, intensity, spatial distribution, duration and periodicity of extreme events, resulting in unprecedented extreme conditions (IPCC, 2012). Changes in average, variance and/or distribution of the probability of such events, and changes in the behaviour of seasonal series, may also lead to changes in the frequency of occurrence of extreme events.

In recent years, an intensification of extreme events has been observed in Brazil, alongside a shorter recurrence interval of such extreme events. Such changes are consistent with the forecasts of global climatic models and attributable to increased concentrations of greenhouse gas emissions. However, a lack of reliable and consistent historical data series covering the entire Brazilian landmass is indicative of the need to expand and systematize the availability of knowledge and of information sources for monitoring climate change throughout Brazil.

Climate models that represent the climate system and its interactions with external forces (such as the Sun, aerosols, gases, etc.) seek to provide answers as to how the climate will behave in various emissions scenarios. The Fifth IPCC Assessment Report (2014) proposed four new emissions-level scenarios, known as Representative Concentration Pathways (RCP 2.6, 4.5, 6.0 and 8.5). For these projections, each scenario considers various factors, including greenhouse-gas emissions, different energy-generation technologies, and information on land-use patterns.

The RCP 2.6 scenario assumes that the Earth system will store an additional 2.6 watts per square metre (W/m^2) of energy, and represents a gradual reduction of greenhouse-gas emissions, reaching zero emissions around 2070. At some point, gas absorption processes may outweigh emissions and, when that happens, expected average temperature rises will

amount to between 0.3°C and 1.7°C from 2010 to 2100, with sea levels rising between 26 and 55 cm. This scenario is considered “very optimistic” and is rejected by most climate-projection analysts.

The second scenario, RCP 4.5, assumes storage of 4.5 W/m² and represents a stabilization of greenhouse-gas emissions soon after 2100. It foresees rises in terrestrial temperatures of between 1.1°C and 2.6°C, and a rise in sea levels of between 32 and 63 cm. This is one of the most commonly accepted scenarios.

The RCP 6.0 scenario assumes storage of 6.0 W/m² and stabilization of greenhouse-gas emissions soon after 2100. It foresees a rise in terrestrial temperatures of between 1.4°C and 3.1°C, and a rise in sea levels of between 33 and 63 cm.

The RCP 8.5 scenario, considered the most “pessimistic”, features an unmitigated rise in emissions without stabilization, i.e., emissions continue to rise over time as do greenhouse-gas concentrations. This scenario foresees storage of 8.5 W/m² and, according to the IPCC, warming of the Earth’s surface could range between 2.6°C and 4.8°C during this century, causing sea levels to rise by between 45 and 82 cm.

Brazil has played a prominent role in development of regional and global climate models. To develop a model capable of generating climate-change scenarios of relevance for the entire country, researchers of various institutions, members of the Research Program on Global Climate Change of the Sao Paulo Research Foundation (FAPESP), the Research Program on Global Climate Change (*Rede Clima*), and the National Science and Technology Institute on Climate Change (INCT-MC), have prepared the Brazilian Earth System Model (BESM) under coordination of INPE (NOBRE et al., 2013). It is the first Brazilian global model to be incorporated into the IPCC models, and enables Brazilian climatologists to perform climate-change studies specifically for Brazil.

INPE developed a regional version of the ETA model (PESQUERO et al., 2009; CHOU et al., 2012) used to generate climate simulations for studies of impacts and vulnerabilities, adapted for use in Brazil and South America. The ETA model was used during preparation of the Research Program on Global Climate Change (MCTI, 2016) to detail simulations of two global climate models, namely: the English HadGEM2-ES; and the Japanese MIROC5 models; under two emission scenarios (RCPs 4.5 and 8.5) with a horizontal resolution of 20 km and a coverage area encompassing

South America, Central America and the Caribbean. These regionalised downscaling simulations encompass four periods from the present to the end of the 21st century: 1961-2005; 2006-2040; 2041-2070; and 2071-2100. The 1961-2005 period adopts current CO₂ equivalent concentrations, while periods from 2006 onwards adopt CO₂ equivalent concentrations corresponding to the RCP 4.5 and 8.5. scenarios.

No numeric model can accurately simulate a future climatic event, in view of uncertainties as to emissions levels; natural climate variability and modelling uncertainties (of global, regional and impact models). These factors, termed “uncertainties” by the scientific community, are common to all climate-change projections. That is why it is important to consider the effects of the

above-listed uncertainties with respect to the magnitude and/or patterns of climate change. One way to account for these is to prepare or use sets of simulation models in different emissions scenarios, preferably those that point to different projected average global temperature rises, by means of which the effects of different sources of uncertainty can be analysed.

Figures 1 and 2 show changes in temperature and rainfall levels for two seasons of the year, southern-hemisphere summer and winter, over 30-year periods: from 2011 to 2040; from 2041 to 2070; and from 2071 to 2100, as simulated by the ETA model (CHOU et al., 2014a; CHOU et al., 2014b). The lower and upper change thresholds stemming from these simulations indicate possible intervals of change derived from these regionalised simulations.

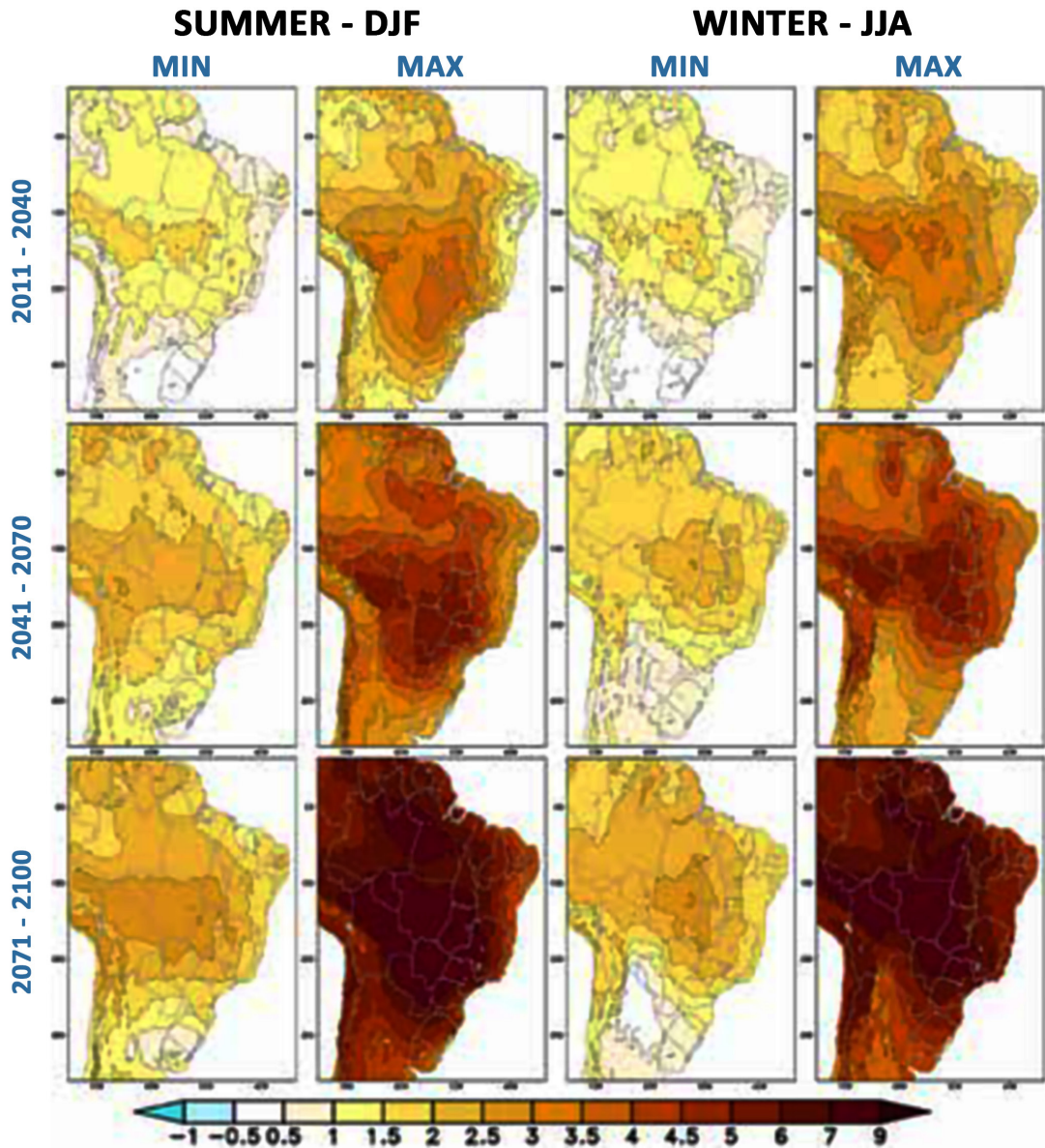


Figure 1. Regionalised temperature-change projections (°C) between the present and different future periods. The lower (MIN) and upper (MAX) change thresholds are taken from the four ETA model simulations, nested in HadGEM2-ES and MIROC5 models, for two Representative Concentration Pathway scenarios (RCP 4.5 and 8.5), for December-January-February (DJF) and June-July-August (JJA).

Warming is foreseen for the whole continent in all emission scenarios. The highest warming levels are foreseen for the Central-West region, in all seasons

of the year. Such maximum warming will extend to the North, Northeast and Southeast regions of Brazil by the

end of the 21st century, by which time, maximum average warming levels may range between 2°C and 8°C in some areas

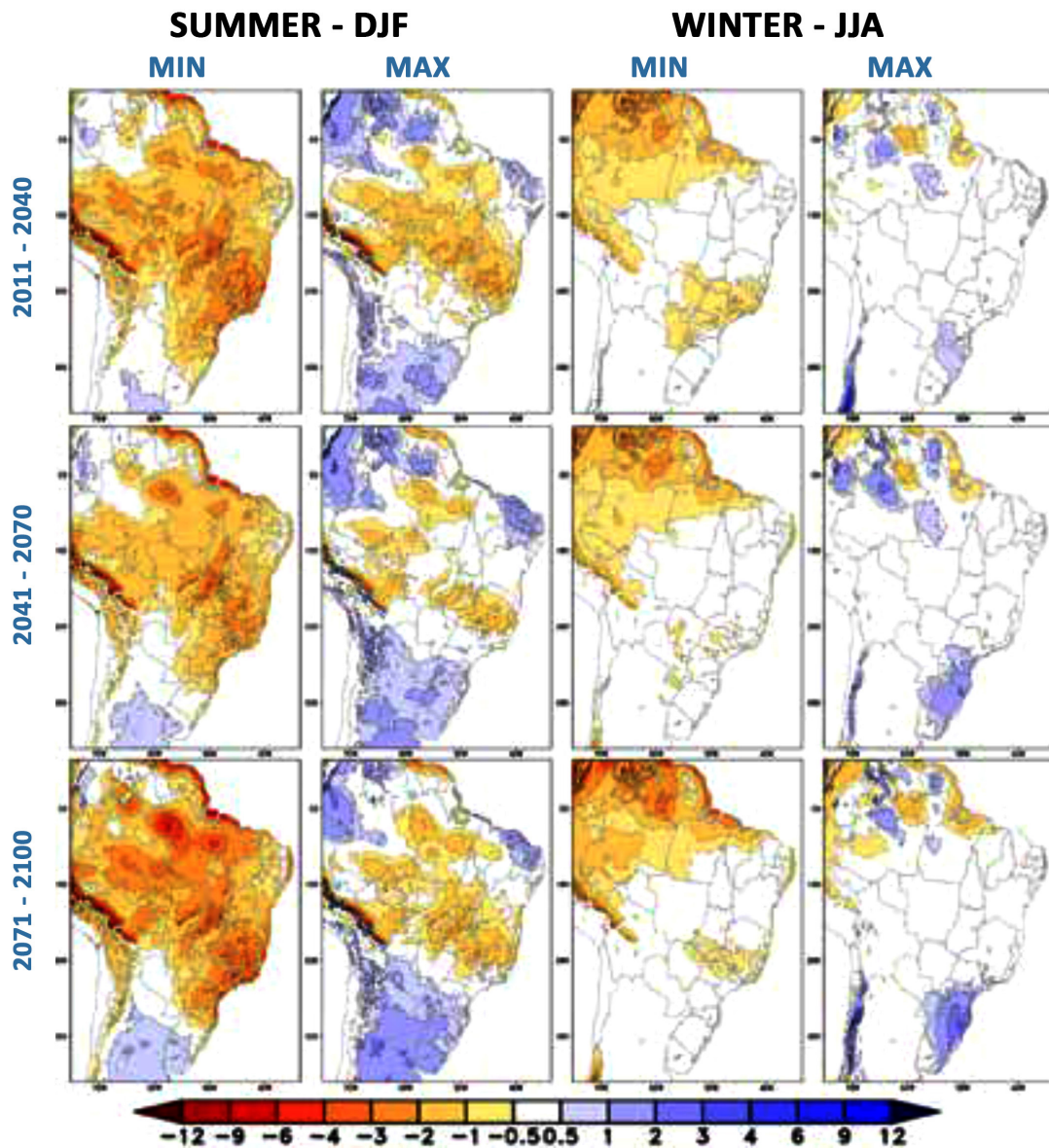


Figure 2. Regionalised rainfall change projections (mm/day) between the present and different future periods. The lower (MIN) and upper (MAX) change thresholds, taken from four simulations of the ETA model nested in the HadGEM2-ES and MIROC5 models, for two Representative Concentration Pathway scenarios (RCP 4.5 and 8.5), for December-January-February (DJF) and June-July-August (JJA)

It can be observed that, during the summer, the centres of maximum rainfall reduction are positioned over Brazil's Central-West and Southeast regions, in areas under the influence of the South Atlantic Convergence Zone (SACZ) phenomenon, which causes accumulation of rainfall. The centres of maximum rainfall reduction extend into parts of the Amazon region. In the north-eastern most part of Brazil's Northeast region, projections suggest a possible reduction or increase in rainfall during the summer. These simulations also foresee increased rainfall in the South region under the various scenarios. Such increases in rainfall over the South region, extending into the southern part of the Southeast region occur more prominently in summer (DJF) and in spring (SON). Increases in rainfall are foreseen for 2011-2040, becoming more intense toward the end of the century.

It should be noted that Brazil's Southeast region is an area of transition, the rainfall regime of which, during the summer, depends strongly upon the SACZ precipitation bands. Moreover, rises or falls in average rainfall levels may represent

variations in the frequency of occurrence of extreme events, i.e., there may be a reduction in accumulated rainfall over the year in a certain area, with a concurrent increase and/or intensification of strong or very strong rainfall in another. Positioning of the band further to the north or to the south may result in positive or negative rainfall anomalies, causing further difficulties for conduct of simulations for the region. There is great uncertainty in climatic projections for Brazil's Southeast region, the climatic predictability of which is acknowledged to be low.

Temperature time series show that warming trends are greater in simulations nested in HadGEM2-ES than in those nested in MIROC5 but that, in all simulations, the increase in the inter-annual variability extends up until the end of the century, i.e., the difference between extreme highs and extreme lows increases. More intense rainfall levels are projected for the centre-south of Brazil up until the end of the century. Within the four simulations, mixed signals of changes in rainfall are to be found in an area between the South and Southeast regions. Moreover, increases in the number of

consecutive dry days in Brazil's Northeast region and fewer consecutive wet days in the Amazon region are commonly found characteristics of these simulations.

Annual temperature and rainfall cycles do not suggest changes in the regime of rainy and dry periods. There is some indication in the projections of extended periods of drought in the North and Northeast regions. However, these simulations should be considered as inputs for studies of the impacts of climate change on different sectors, and it should be remembered that they stem from scenario projections containing uncertainties.

Though the results presented above do not exhaust all possibilities of analysis, they illustrate future exposure for Brazil's national territory. It is important that information stemming from climate projections be used for management of risks arising from climate change. In part, this process is linked to identification of current vulnerabilities of systems and of the population to the impacts of climatic events and changes already observed in the behaviour of extreme events.

3 Objective

The **general objective** of this Plan is to promote reduction and management of climate-risk considering the effects of climate change, by taking full advantage of emerging opportunities, avoiding losses and damages, and building instruments to prepare natural, human, productive and infrastructure systems to adapt to climate change.

Effective adaptation implies that the strategy to be deployed must integrate appropriate climate-change risk management into current public-sector and thematic planning, policy making, and national development strategies. The aim is to influence public-policy instruments and/or governmental programmes, by providing cross-cutting guidelines and instruments foreseen in the National Policy on Climate Change and in this Plan, with a view to broadening the coherence of adaptation strategies among public policies.

The bodies responsible, at the three levels of government must have access to appropriate methodologies and the basic information necessary to perform vulnerability analysis and risk management and to develop adaptation measures.

The Ministry of Environment website (www.mma.gov.br/clima/adaptacao) displays methodological guidelines and provides tools and information to facilitate adaptation planning.

The **vision** underlying this Plan, for the next four-year horizon, is that all government-policy sectors considered vulnerable to impacts of climate change must have climate-risk management strategies in place.

The Plan aims to ensure satisfactory and coordinated deployment of sectoral and thematic risk-management strategies, especially in the fields of food and nutritional security and of water and electric power, taking into account synergies and the cross-cutting nature of these themes throughout different sectors of the economy. Adaptation measures must likewise be aligned to stimulus for the productive sector, while ensuring fairness of the transition for society, in line with national goals for socioeconomic development and reduction of regional inequalities, through the coordination of public policies at the federal, state and municipal levels.

From a long-term perspective, by 2040 (the scientific timeframe for impact modelling) the NAP will have contributed to augmenting Brazil's capacity to adapt, and to a systematic reduction of climate risks.

The NAP, the integration of climate-change risk-management into

current public policies and thematic and sectoral plans, and the national development strategies targeted at reducing vulnerability to climate change, shall observe the following **principles**, taking into account the characteristics and peculiarities of each sector or theme:

Establish vertical governance guidelines and adaptation measures at the three levels of government, taking into account specificities of the territorial impacts of climate change, setting complementary, coordinated, synergistic and coherent strategies;

Establish horizontal governance for formulation of adaptation responses, ensuring an integrated understanding of vulnerabilities among sectors and promoting interactions and synergies, respecting their particularities and institutional and social dimensions;

Approach adaptation from a sectoral and thematic standpoint and, when applicable, from a territorial standpoint, respecting the needs and peculiarities of each sector or theme;

Encompass social, cultural and economic dimensions for promoting adaptation, with particular attention to more vulnerable groups and populations, such as indigenous, *quilombola* and riparian populations, that require multi-sectoral, regionalised and priority approaches, including application of gender-sensitive and racial/ethnic criteria;

Implement adaptation and mitigation measures from the standpoint of co-benefits;

Promote integration and strategic alignment of adaptation with development-planning, consolidating adaptation through a strategy for promoting the productive sector while ensuring a fair transition for workers and economic growth aligned with strategies for reducing poverty, regional and socioeconomic disparities, and including observance of prevention and precaution principles;

Base adaptation initiatives on scientific, technical and traditional knowledge, with the aim of drafting and implementing appropriate adaptation measures, while respecting territorial, institutional, legal and technical particularities;

Promote and integrate a crosscutting Ecosystems-based Adaptation (EbA) methodology for all sectors, for use of ecosystem services as an alternative and/or complementary adaptation strategy;

Promote South-American regional cooperation among Adaptation Plans and Strategies, with a view to promoting exchanges of best practices, expansion of regional knowledge, and identification and treatment of the direct and indirect impacts of trans-boundary climate change.

4 Goals

This chapter presents the specific objectives of the NAP, a priority agenda for its implementation over the next four years, and guidelines and recommendations for public bodies and society in general.

4.1 Specific objectives

Activities of the Federal Government to promote adaptation to

climate change need to provide structure for a sustainable development process that provides resilience from various sectoral and thematic perspectives. Based upon observation of current domestic and international best practices and through dialogue with society, governmental bodies and the private sector, the following specific goals of the NAP were assigned as responsibilities of the Federal Government:

1. Guide the expansion and dissemination of scientific, technical and traditional knowledge in support of the production, management and dissemination of information on climate risks, and develop capacity-building measures for governmental bodies and society in general;
2. Promote coordination and cooperation among public bodies for climate-risk management, by means of public-participation processes, with a view to fostering continuous improvement of climate risk-management actions;
3. Identify and propose measures to promote adaptation to and reduction of climate risk.

4.2. Sectoral and thematic strategies

Eleven sectors and themes are encompassed by the NAP, namely: Agriculture* , Biodiversity and Ecosystems, Cities, Disaster Risk Management, Industry* and Mining*, Infrastructure (Electric Power, Transport and Urban Mobility*), Vulnerable Populations, Water Resources, Health*, Food and Nutritional

Security, and Coastal Zones. These were defined based on a comprehensive discussion process within the scope of the GEx-CIM. Alongside legal aspects relating to sectoral themes, criteria for sharing of responsibilities at the federal level and priorities and urgency in relation to vulnerabilities were considered.

Volume II presents guidelines for the development of adaptation measures and inclusion of a climate-change adaptation component into the planning instruments

* Sectoral Plans for Mitigation of and Adaptation to Climate Change are contemplated by Law 12187, of 2009 and Decree 7390, of 2010.

of each sectoral and thematic strategy.

Emphasis should be placed upon the systemic nature of adaptation approaches for attaining objectives foreseen in the NAP, both from the standpoint of vulnerabilities and impacts, and that of the need for responses and adaptation measures.

4.3 Goals and guidelines of the NAP

With a view to deploying specific objectives 1 and 2 of this Plan, structural goals for their implementation are presented. These goals, shown in Table 1, are to be attained within a four-year timeframe, as of publication of this Plan. Achievement of these goals will result in fostering of the essential requisites for effective adaptation, thereby facilitating attainment of the specific objectives and promotion of synergies between sectoral and thematic strategies. These

same goals also feature in the 2016-2019 Multi-Year Plan.

With the aim of attaining specific objective 3, the goals of those sectors that possess an accumulation of historical knowledge or actions relating to climate change, and that have attained a degree of institutional maturity enabling them to participate in discussions for setting of their own specific goals, are presented.

4.4 Details of the NAP goals

Table 1 presents goals of the NAP, broken down by specific objective, listing the main initiatives, agency responsible, impacts, and monitoring indicators. Further details of these goals will be presented in their implementation plans, which are to be displayed on the MMA website within the first year of the NAP's coming into effect.

Table 1 . Description of the goals of the National Adaptation Plan, broken down by specific objectives

Objective 1. Expansion and dissemination of scientific, technical and traditional knowledge: production, management and dissemination of climate-risk information	Goal 1.1	Initiatives	Responsible
	Draw up and implement a strategy to enhance the quality of climatic projections, as inputs for public policies for adaptation.	Drafting of climatic projections for the present and future based on integration of Global Climatic Models (GCMs), with regionalised views on a scale of 20Km X 20Km or of 5Km X 5km, using regional models;	MMA/ MCTI
		Development of the ETA model to incorporate the INLAND and NOAH-MP dynamic vegetation models, with regionalised views on a scale of 5Km X 5Km;	
		Climatic projections to be drafted from integration of the 27 Global Climatic Models, with regionalised views on a scale of 20Km X 20Km, using statistical methods.	
	Indicator/Monitoring:	Progress of the development of enhanced climatic projections.	
	Impact:	The goal expands scientific knowledge on climatic projections on a regional scale based on use of dynamic and statistical models using different Global Climatic Models (GCMs);	
		Enables definition of the best regionalisation method to be adopted for different sectoral challenges. Improves the quality of climatic projections relating to impact on vegetation cover for each of the Brazilian biomes;	
Expands scientific knowledge on climatic projections on a regional scale based on a large number of GCMs in view of their computational efficiency, providing a range of products with greater spatial resolution and at low cost for sectoral users.			

Objective 1. Expansion and dissemination of scientific, technical and traditional knowledge: production, management and dissemination of climate-risk information	Goal 1.2	Initiatives	Responsible
	Draft a Plan of Action on Technology Needs for Adaptation (TNA) ² .	Conduct mapping and evaluation of Technology Needs for Adaptation (TNA) through partnerships with national key players;	MCTI
		Identify priority sectors and technologies for adaptation;	
		Draw up a roadmap for identified priority technologies. Prepare the Technology Plan of Action on demand for technology transfers with the United Nations.	
	Indicator/Monitoring:	Progress in drafting of the TNA plan of action.	
	Impact:	Information qualified (climate technologies panorama) made available as inputs for decision making and the efficient application of investments.	
	Goal 1.3	Initiatives	Responsible
	Development and delivery to society of an online platform for management of knowledge on adaptation.	Develop a platform to share knowledge on adaptation to climate change, with a focus on its impact on Brazilian society and on adaptation measures and initiatives;	MMA
		Delivery of the platform online.	
	Indicator/Monitoring:	Progress in development of the platform (%).	
Impact:	Availability of information on an official platform, transparency of actions, exchange of information and experiences among governmental bodies and sectors.		

2 Technology Needs Assessment (TNA) – a set of actions in which countries identify and determine their technology needs (new equipment, techniques, services, skills and competencies) for implementation of mitigation strategies for reducing greenhouse gas emissions, reducing the vulnerability of sectors and livelihoods to climate change. (http://unfccc.int/ttclear/templates/render_cms_page?TNA_home).

Objective 1. Expansion and dissemination of scientific, technical and traditional knowledge: production, management and dissemination of climate-risk information

Goal 1.4	Initiatives	Responsible
Establish and deploy a strategy to expand and strengthen the Brazilian Research Network on Global Climate Change (<i>Rede Clima</i>).	Mapping of new players in the Network;	MCTI
	Induce and support the development of research on the following climate-change related themes: impacts, vulnerability, adaptation and development of technologies for adaptation.	
Indicator/Monitoring:	Progress reports on deployment of the strategy;	
	Publications;	
	Reports on Activities of <i>Rede Clima</i> .	
Impact:	Support for development of tools and generation of knowledge as inputs for climate-change mitigation and adaptation strategies;	
	Expand understanding of interactions among ecological and social systems and of the functioning of the Terrestrial System;	
	Foster generation of inputs for formulation of public policies targeted at mitigation, adaptation and reduction of vulnerability to climate change.	
Goal 1.5	Initiatives	Responsible
Prepare and deploy a data-integration project for monitoring and observation of the impacts of climate change- SISMOI.	Develop an online platform for sharing data on the impact of climate change, with a decentralised and integrated approach, with the aim of identifying, monitoring and understanding the effects of climate change for the priority module.	MCTI
Indicator/Monitoring:	Progress reports on development and implementation of SISMOI.	
Impact:	Foster availability of high-quality data on the effects of climate change, in response to increasing demand from academia and the public and private sectors;	
	Facilitate access to public data;	
	Foster dissemination of information and knowledge relating to impacts of climate change on the various sectors;	
	Foster integration among institutions, public players, productive sectors and society in general;	
	Stimulate national production of knowledge;	
	Expand the capacity to respond to impacts of climate change.	

Objective 2. Coordination and cooperation among public agencies and society

Goal 2.1	Initiatives	Responsible
Draw up and deploy a capacity-building strategy for adaptation for various target publics.	Conduct awareness-building and public mobilization activities;	MMA
	Conduct a capacity-building programme for professionals and active leaders in strategic areas and among more vulnerable groups;	
	Promote the production and dissemination of knowledge on adaptation by strengthening institutions and research groups that work in this field and encourage creation of new research groups;	
	Technical support for states, municipalities and the Federal District;	
	Foster integrated actions among institutions and/or federal bodies.	
	Target public: Public-sector professionals operating at the federal, state and municipal levels, vulnerable communities, education and research professionals and students, communications/media professionals, social-sector leaders and professionals, private-sector entrepreneurs and professionals, the general public.	
Indicator/Monitoring:	Number of training courses provided, number of people trained.	
Impact:	Development of capacities for adaptation, increased mobilization and awareness on the theme;	
	Greater support to effective implementation of public policies for adaptation.	
Goal 2.2	Initiatives	Responsible
Development and deployment of the NAP monitoring and evaluation (M&E) system.	M&E system for adaptation integrated into the monitoring system of the national policy for climate change;	MMA
	Includes goals, activities and indicators foreseen in the NAP and in sectoral strategies;	
	May include the actions for adaptation of federal, state and municipal bodies and of civil society.	
Indicator/Monitoring:	Progress in development and implementation of the system (%).	
Impact:	Updated information on progress and performance of the NAP and its sectoral strategies;	
	Provide transparency for deployment of adaptation policies and enable sharing of information among government bodies and society in general;	
	Inputs for drafting of international reports to be submitted by Brazil to the UNFCCC.	

Objective 2. Coordination and cooperation among public agencies and society

Goal 2.3	Initiatives	Responsible
Publish a study with systematized information on funding and economic incentives for adaptation.	Develop and deliver information on funds and economic incentives for adaptation;	MMA
	Promote debate on climate risk among agencies responsible for regulation of the financial system.	
Indicator/Monitoring:	Progress in development of the study.	
Impact:	Distribution of funding available for adaptation and on-going projects;	
	Systematise resources/incentives available for adaptation and provide functional knowledge and information on access to target publics;	
	Disseminate current knowledge and information on funding for adaptation to climate change in Brazil;	
	Foster demand related to adaptation;	
	Increase Brazil's capacity to tap funding and improve allocation of resources targeted at adaptation.	
Goal 2.4	Initiatives	Responsible
Drafting of a strategy to promote formulation by federal bodies of public policies for adaptation.	Form an inter-federative working group;	MMA
	Support formulation of an adaptation strategy, with inputs of knowledge, methodologies and training;	
	Prepare the strategy.	
Indicator/Monitoring:	Document prepared;	
	Number of federal bodies engaged;	
Impact:	Increased mobilization and awareness of the theme among federal bodies;	
	Increased capacity of municipalities and states to face up to negative aspects of climate change;	
	Incorporation of climate risk assessment into federal, state and municipal policies.	

Objective 3. Identify and propose measures to promote adaptation to and reduction of climate risk	Sectoral and Thematic Strategy: Agriculture*		
	Goal 3.1	Initiatives	Responsible
	Develop and deploy an Agricultural Risk and Vulnerability Monitoring and Simulation System.	Organize information collected from climate and agricultural observation systems;	EMBRAPA
		Enhance methods for modelling and estimation of climate risk;	
		Enhance the monitoring of impact on major production systems;	
		Develop the Agricultural Risk and Vulnerability Monitoring and Simulation System, utilizing and optimizing legacy systems;	
		Regional Vulnerability Analysis (development of indices, medium and long-term vulnerability indicators), climate-risk maps (local, regional and national), classification of the regions of Brazil in terms of climate risk for the main agricultural activities; propose a vulnerability scale; identify priority areas;	
		Identification of adaptation measures for efficient water use, phytosanitary management, integrated with development of methods and crops, with a view to increasing agricultural resilience in priority areas.	
	Indicator/ Monitoring:	Number and frequency of analyses undertaken;	
		Number of parameters evaluated;	
Agricultural Risk and Vulnerability Monitoring and Simulation System deployed;			
Number of systems and models made available;			
Percentage of the territory classified by a vulnerability and climate-risk scale.			
Impact:	Ensure appropriate and effective investment of resources for adaptation of agriculture to climate change;		
	Collaborate with national food and nutritional security authorities in facing up to increased frequency of extreme events, improving readiness, adaptive capacity and resilience of farm sector;		
	Assist with the planning of exports.		

* The Centre for Climate Intelligence for Agriculture comprises two components: the Agricultural Risk and Vulnerability Monitoring and Simulation System, and its integration with the Monitoring and Early Warning Networks of the National Plan for Reduction of Risks and Disasters (CEMADEN/MCTI; CENAD/MI).

Sectoral and Thematic Strategy: Agriculture		
Goal 3.2	Initiatives	Responsible
Establish a Centre for Climatic Intelligence for Agriculture, for application of climate risk analysis in Brazilian Agricultural Policy.	Establish an inter-institutional working group involving the key players (INMET, EMBRAPA, MAPA, MCTI, MDA, MI, MMA, IPEA, IBGE, INPE, and ANA);	MAPA
	Integration of the Agricultural Risk and Vulnerability Monitoring and Simulation System with national monitoring and early-warning networks (CEMADEN and CENAD);	
	Draft a work plan: analyse current and potential scope for generation of information by existing monitoring networks; define technical requirements for the development of platforms and systems to guarantee compatibility with existing platforms; assess current demand for information; define methodologies, design flows and processes, etc;	
	Develop support systems for the inputting of secondary data;	
	Set up a system for spatial and integrated analysis of social, economic, environmental and institutional vulnerabilities;	
	Set up a system for prioritizing vulnerable regions and land-use planning;	
	Create the Climate Intelligence Centre for Agriculture – Communications and Early-Warning Network;	
	Develop Contingency Plans and provide support for Brazilian Agricultural Policy.	
Indicator/ Monitoring:	Versions of the Agricultural Risk and Vulnerability Monitoring and Simulation System harmonised with other early-warning and monitoring networks;	
	Climate Intelligence Centre for Agriculture - Communication and Early-Warning Network consolidated;	
	Number of systems and models made available;	
	Percentage of the territory classified by the vulnerability and climate-risk scale.	
Impact:	Application of climate-risk assessment in planning of actions of Brazilian Agricultural Policy;	
	Establishment of a secure business environment for decision-making of farmers, government and investors;	
	Improve predictability of agricultural insurance planning;	
	Ensure appropriate and effective investment of resources for adaptation of agriculture to climate change;	
	Collaborate with national food and nutritional security authorities to face up to increased frequency of extreme events, and improve readiness, adaptation capacity and resilience of the farm sector;	
	Assist in the planning of exports and agricultural commodity negotiations with futures markets;	
	Support for agricultural zoning policies.	

Objective 3. Identify and propose measures to promote adaptation to and reduction of climate risk

Sectoral and Thematic Strategy: Biodiversity and Ecosystems		
Goal 3.3	Initiatives	Responsible
Preparation of Ecosystem-based Adaptation strategy measures in areas at risk of extreme events and other climate change impacts.	Establish a working group;	MMA
	Identify potential areas for implementation of Ecosystem-based Adaptation (EbA) measures;	
	Prepare a strategy in conjunction with governmental bodies, private sector and civil society.	
Indicator/Monitoring:	Percentage of the strategy drawn up;	
	Criteria for implementation of EbA measures in high-risk areas defined.	
Impact:	Strengthen current government policies for recovery and conservation of ecosystems and native vegetation;	
	Support for reduction of disaster risk;	
	Support for reduction of vulnerability to climate change of the general population;	
	Foster identification, promotion and conservation of ecosystem services;	
	Foster increased resilience to climate change of cities and metropolitan regions, especially to impacts of flooding and landslides.	
Goal 3.4	Initiatives	Responsible
Modelling of the impact of climate change on biodiversity for use in public policies for conservation, recovery and sustainable use of biodiversity.	Identify the impact of climate change on biodiversity;	MMA
	Promote incorporation of climate risk into current policies for conservation, restoration and sustainable use of biodiversity.	
Indicator/Monitoring:	Number of scenarios and maps available in an appropriate format as inputs for public policies on biodiversity;	
	Number of public policies for biodiversity management that incorporate climate modelling;	
	Number of staff of governmental and non-governmental agencies trained.	
Impact:	Foster incorporation of information on climate change into the policies of sectors involved;	
	Integrate information on climate change into the process of drafting actions for biodiversity management, thereby enhancing the effectiveness of such instruments;	
	Increase Brazil's capacity to face up to the negative aspects of climate change, and particularly impacts that affect biodiversity and provision of ecosystem services, while fostering a climatic standpoint for such policies.	

Objective 3. Identify and propose measures to promote adaptation to and reduction of climate risk

Sectoral and Thematic Strategy: Biodiversity and Ecosystems

Goal 3.5	Initiatives	Responsible
Deployment of monitoring in 50 federal Conservation Units, for <i>in situ</i> evaluation and monitoring of the impacts of climate change on current and future biodiversity.	Develop and implement an in situ programme for monitoring biodiversity in terrestrial ecosystems in 40 Conservation Units (CUs), covering different biomes, and in 10 CUs located in coastal marine ecosystems, with emphasis on critical ecosystems such as coral reefs and mangroves.	ICMBIO
Indicator/Monitoring:	Number of Conservation Units with monitoring implemented and maintained per year.	
	Number of biodiversity diagnoses in monitored CUs;	
	Number of reports and trend analyses on relationships between biodiversity and climate, including reports on specific formations/taxons;	
	Early-warning system deployed and number of warning reports issued since its deployment;	
Impact:	Systematic gathering of information on monitoring of endangered species and biodiversity in CUs, as inputs for analysis of the relationship between climate and biodiversity;	
	Enable evaluation of the contribution of CUs to reduction of the effects of climate change;	
	Increased capacity for local response - since monitoring is carried out in a participatory manner, at a local level, involving numerous institutions, thereby enabling adoption of adaptation measures at a local level, with rapid responses;	
	Increased capacity for response on a regional and national scale – since the initiative works in articulation with several others, such as the Brazilian Forestry Service (inventory grid); the Rapeld system; RedeLep, and entails a dataflow, storage and distribution system.	

Objective 3. Identify and propose measures to promote adaptation to and reduction of climate risk

Sectoral and Thematic Strategy: Vulnerable Populations		
Goal 3.6	Initiatives	Responsible
Diagnosis of Vulnerability to Climate Change of target populations of the National Territorial and Environmental Management Policy for Indigenous Lands- (PNGATI)	Spatial analysis of climate risk of target populations of the National Territorial and Environmental Management Policy for Indigenous Lands (PNGATI);	FUNAI
	Analysis of the degree of vulnerability of each group using pre-set and agreed-upon indicators;	
	Establish a vulnerability scale for identification of priority groups.	
Indicator/Monitoring:	Progress of on-going activities.	
Impact:	Identification of priority groups for support under governmental programmes.	
Goal 3.7	Initiatives	Responsible
Diagnosis of Vulnerability to Climate Change of target populations of the National Food and Nutritional Security Plan (PLANSAN).	Spatial analysis of climate risk of target populations in Federal Government's Unified Register of Social Programmes (CadUnico), especially Traditional and Specific Population Groups (TSPGs) identified in the register;	MDS/ SESAN/ CAISAN
	Analysis of the degree of vulnerability of each group using pre-set and agreed-upon indicators;	
	Create a vulnerability scale for identification of priority groups.	
Indicator/Monitoring:	Percentage of <i>CadUnico</i> population groups classified by vulnerability indicators and the climate-risk scale.	
Impact:	Identification of priority groups for support under governmental programmes.	

Sectoral and Thematic Strategy: Vulnerable Populations		
Goal 3.8	Initiatives	Responsible
Diagnosis prepared and vulnerability to climate change reduced for vulnerable populations and beneficiaries of public policies for agro-extractivism.	Analysis of the degree of vulnerability of peoples and traditional communities residing in the 10 priority territories;	MMA
	Analysis of the degree of vulnerability, by means of establishment of a vulnerability scale for identification of priority groups;	
	Foster application of measures to foster resilience in populations classed as vulnerable.	
Indicator/Monitoring:	Progress of on-going activities;	
	Progress of actions for reducing vulnerability applied to vulnerable populations in the territories listed.	
Impact:	Identification of vulnerable populations for support under public policies for agro-extractivism.	
Sectoral and Thematic Strategy: Water Resources		
Goal 3.9	Initiatives	Responsible
Incorporate measures for adaptation to climate change into actions carried out by the National Water Agency.	Identify/propose “no regrets” adaptation measures, targeted at enhancing capacity to respond of the National Water Resources Management System and at reducing vulnerabilities of the main water-user sectors, populations and ecosystems to foreseen adverse effects.	ANA
Indicator/Monitoring:	Progress in deployment of water resources management projects and instruments.	
Impact:	Enhanced the capacity of ANA and of other component bodies of the National Water Resources Management System (SINGREH) to respond to challenges posed by climate change	

Objective 3. Identify and propose measures to promote adaptation to and reduction of climate risk

Sectoral and Thematic Strategy: Water Resources

Goal 3.10	Initiatives	Responsible
Develop integrated climatic and hydrological models and assess their impact on water resources management	Use of new modelling techniques with dynamic and statistical methods borrowed from other Global Climatic Model (GCM) families, thereby increasing the number of projections available for analysis of the impact of climate change on water resources;	ANA
	Develop studies using Economics of Climate Adaptation (ECA) methodology, based on the Piracicaba-Capivari-Jundiaí River Basin project;	
	Enlist scientific and technological inputs, by means of a specific call for proposals to be drafted jointly with CNPq, targeted at the climate-change/ water-resources interface.	
Indicator/Monitoring:	Progress in the development of projects.	
Impact:	Enhanced capacity of component bodies of SINGREH to respond to challenges posed by climate change.	

Sectoral and Thematic Strategy: Health

Goal 3.11	Initiatives	Responsible
Expand the scope of the National Drinking Water Quality Surveillance Program (VIGIAGUA) to reach 85% of Brazilian municipalities, by 2019.	Enhance the National Drinking Water Quality Surveillance Information System (SISAGUA) incorporating new features and health-risk management reports;	MS (SVS)
	Expand and establish the network of laboratories for monitoring, follow-up and dissemination of information on the quality of drinking water;	
	Record on SISAGUA information on registration, control and surveillance of drinking-water quality;	
	Draw up risk maps on the supply of drinking water, based on the information generated by SISAGUA.	
Indicator/Monitoring:	Percentage of municipalities with information on registration, control and surveillance of drinking-water quality recorded on SISAGUA.	
Impact:	Strengthened surveillance of drinking-water quality;	
	Enhanced information on water supply for human consumption;	
	Reduction of risks to human health related to drink-water supply;	
	Support for attainment of sustainable-development goals relating to access to water of quality compatible with current standards.	

Sectoral and Thematic Strategy: Health

Goal 3.12	Initiatives	Responsible
Establish a study, research, monitoring and communication network on climate and health, with a view to expanding technical-scientific knowledge and inputs for health-status analysis and for consolidated decision-making of the Unified Health System (SUS)	Integrate climatic, environmental and socioeconomic risk analysis into SUS procedures for monitoring of public-health emergencies;	MS (SVS/ FIOCRUZ)
	Establish centres for studies and research on climate and health within the SUS;	
	Establish a panel for strategic information on climate and health to support the strategic management in the SUS;	
	Establish a Centre for Integration of Health, Environment and Sustainability Technologies (CITSAS) within the National Climate and Health Observatory and the Knowledge Centre on Public Health and Disasters (CEPEDES).	
Indicator/ Monitoring:	Network established and consolidated;	
	Cooperation agreement drafted and implemented;	
	Network project drafted;	
	CITSAS project drafted;	
	Protocol for monitoring public-health emergencies integrated with analysis of climatic, environmental and socioeconomic risk drafted;	
	Panel for strategic information on climate and health established;	
	Integration Centre for Health, Environment and Sustainability Technologies established.	
Impact:	Enhanced quality of information, management capacity, and disclosure of information on climate risk to human health;	
	Stimulus for production of scientific and technical knowledge on the relationship between climate and health and climate-sensitive diseases, in support of decision-making and definition of adaptive measures, within the SUS.	

Sectoral and Thematic Strategy: Coastal Zone		
Goal 3.13	Initiatives	Responsible
Establish Reference Centres for Coastal Management and build and organise information and tools for climate-risk modelling and generation of qualified responses within the Coastal Zone	Establishment of 4 Reference Centres for Coastal Management;	MMA
	Qualification and provision of instruments and tools for modelling and a knowledge-management platform for adaptation in the Coastal Zone;	
	Capacity-building for government and non-government players on deployment of adaptation activities.	
Indicator/Monitoring:	Number of Centres installed;	
	Number of managers trained;	
	Percentage of the knowledge-management system made available to the public.	
Impact:	Reference Centres established and working on models for analysis of the impacts of climate risks, for generation of qualified responses for public-policy management, and for government, civil-society and private-sector decision-making;	
	Foster coordination and cooperation among public bodies for management of climate risk;	
	Implement monitoring and evaluation of adaptation measures, with a view to continuous improvement of climate-risk management actions;	
	Promote and disseminate knowledge and include a climatic viewpoint into the methodology of the Waterfront Project (Projeto Orla) through enhancement of Ecosystems-based Adaptation actions.	

Objective 3. Identify and propose measures to promote adaptation to and reduction of climate risk

Sectoral and Thematic Strategy: Coastal Zone

Goal 3.14	Initiatives	Responsible
Draft, deploy and earmark funding for a strategy to harmonise continental altimetry with marine bathymetry (AltBat).	Establish a work plan, with methodology, cost-assessment and pilot studies, to harmonize altimetry and bathymetry with measures and guidelines for prevention of the effects of erosion and flooding;	IBGE (CONCAR) e MMA
	Draw up a strategy, with short and medium-term actions, for deployment of a methodology and systems for harmonization of altimetry and bathymetry;	
	Preparation of standards for strategy implementation (structure for governance and budget);	
	Implementation of pilot projects in priority areas.	
Indicator/Monitoring:	Percentage of the work plan completed;	
	Percentage of the strategy presented;	
	Pilot project signed (but not executed);	
	Draft of standards presented.	
Impact:	Qualification of information for studies and projects in port, coastal, oil-producing, navigation and coastal-settlement areas;	
	Enable appraisal of insurance for works and projects in the Coastal Zone, where potential risk is assessed at R\$136 billion.	
Goal 3.15	Initiatives	Responsible
Macro-diagnosis of the Coastal Zone (Macro-ZC) reviewed, considering climate-change related vulnerabilities.	Database for review of the Macro-diagnosis of the Coastal Zone organized from the standpoint of environmental, economic, social and cultural integration;	MMA
	Term of Reference for the review of the Macro-diagnosis of the Coastal Zone drafted and validated by a group of experts (researchers and coastal managers);	
	Macro-ZC review published and distributed; and managers, researchers and civil-society trained.	
Indicator/Monitoring:	Percentage of the work plan completed;	
	Publication drafted and distributed;	
	Number of managers, researchers and civil-society staff trained.	
Impact:	Provision of inputs for Coastal Zone managers at different levels, and guidance for public and sectoral policies and for intervention actions in support of adaptation to climate change.	

4.5 General recommendations for sectoral agencies, federal bodies and society in general

The promotion of adaptation policies throughout Brazil is a complex process, entailing coordinated efforts on the part of stakeholders in various sectors, governmental bodies at the three levels, and a variety of civil-society players. The following table presents general recommendations for sectoral agencies, federal, state and municipal bodies, and society in general.

Table 2. Recommendations for sectoral agencies, federal, state and municipal bodies, and society in general

General Recommendations
Incorporate the principles and guidelines of this Plan into planning and management instruments, so as to engender greater synergies and effectiveness of adaptation initiatives, while taking into account the relevance and characteristics of each segment; Analyse the characteristics, demands and vulnerabilities of different sectors and, when appropriate, draw up management strategies targeted at reducing climate risk;
Integrate climate-risk management into planning and management instruments for drafting and review of public policies, based on technical, scientific and/or traditional knowledge that validates its relevance;
Promote systematic collection and analysis of evidence of vulnerability and of climate risk, while respecting the various institutional competencies, in a manner compatible with current monitoring and evaluation systems and with those proposed in this Plan, to ensure dissemination of information and knowledge through an online platform;
Raise awareness of all players of the importance of the theme “Adaptation to climate change”, by means of information, training, mobilization, engagement, and expansion of participatory processes within society;
Enhance interaction among public authorities, sectoral bodies of the Brazilian economy, academics, civil society and other stakeholders, as a means of fostering continuous development of national adaptation strategies for facing up to the impacts of climate change.

5 Management of the Plan

This chapter presents the proposed management structure of the NAP. It describes the institutional framework of the Plan, involving participation of civil society and of federal, state and municipal bodies; makes considerations regarding funding for its implementation; and provides guidelines for monitoring and management of knowledge on adaptation to climate change.

5.1 Institutional Framework

Drafting of the NAP is foreseen in the PNMC guidelines and therefore in consonance and in synergy with other institutional instruments established by Law 12187/09.

Coordination of the NAP is entrusted to the Technical Group for Adaptation to Climate Change. This group was established for the purpose of providing technical and policy guidance for actions within the scope of the Plan. It is also responsible for monitoring, evaluation and review functions, for detailing routines, and for setting up operational management mechanisms.

In parallel to actions of the coordination group, networking mechanisms are to be established

in the states and among civil-society organisations, as described in the following sections.

5.1.1 Federative governance

For purposes of networking among the three levels of government, a standing forum is to be established for consultation with state governments and municipal administrations. The role of this forum is to draft and propose guidelines and technical recommendations. The federative coordination unit is also responsible for harmonization of methodologies for identification of impacts, climate-risk management, vulnerability assessment, adaptation options, and provision of inputs for preparation, implementation, monitoring and review of the NAP.

5.1.2 Governance of civil-society participation

Public participation in the NAP is to be achieved by means of the Brazilian Forum on Climate Change (FBMC), through other more direct means and instruments, and as yet undefined arrangements for civil society representation.

The FBMC was instituted by Decree 3515, of 20th of June 2000, and brought into effect by Decree 6263/07, for the purpose of permanently enabling participation of civil society in government forums on themes relating to climate change.

Enhanced participation of civil society is also provided for by means of regular dialogue among Plan coordination unit and sectoral and thematic councils and forums. The purpose of dialogue with these councils and forums is to broaden public engagement on the theme and promote integration of the adaptation agenda into other sectoral agendas. Themes that may be presented at these councils and forums include: (1) development of the Plan and of its strategies; (2) goals and results achieved; (3) dissemination of reports and studies; and (4) consultations for technical guidance. Other forms of social participation or discussion with civil-society players, including calls for proposals and technical inputs on themes relating to the Plan issued through the Ministry of Environment website, may be deliberated by the Plan coordination unit.

5.2 Funding sources and economic instruments

Actions foreseen in the Plan shall be funded by the various agencies that have thematic or sectoral responsibilities

for its execution. Such funding originates from the public budget and from especially constituted funds, in line with government planning under the Multi-year Plan (PPA).

In addition to the Multi-year Plan, the National Adaptation Plan is to provide strategic guidance for application of other fiscal, budgetary and funding instruments, with a view to ensuring implementation and monitoring of initiatives that promote resilience. Foremost among these are funds relating to the National Policy for Climate Change, namely: the Amazon Fund, the Low-Carbon Agriculture Programme (Plano ABC), and the National Climate Change Fund.

Other international funding sources, such as the Green Climate Fund, the Adaptation Fund of the United Nations Framework Convention on Climate Change (UNFCCC), and other multilateral and bilateral funding sources may also be tapped for attainment of goals and guidelines of this Plan.

Funding from other Brazilian financial and fiscal incentives and, when applicable, international sources, may also be made available. Further information on such funding mechanisms can be found on the Ministry of Environment website.

5.3 Monitoring and evaluation of the Plan

The NAP is to have four-year execution cycles, each with its respective review, in accordance with legal guidelines prescribed in the National Plan on Climate Change (Decree 6263/2010). It will also have its own monitoring and evaluation system.

The review process for the following NAP cycle is to be carried out during the final year of the current cycle, in the light of its monitoring and evaluation results, with a possible extraordinary review prior to this deadline.

The objectives of the monitoring and evaluation system of this Plan are: 1) to monitor the scope of proposed goals, 2) to monitor thematic and sectoral adaptation guidelines, and any local actions that may contribute toward climate-risk management in Brazil, as is presented in Volume II; 3) to promote feedback on analyses carried out for fostering continuous improvement of the policy and of its management; and 4) to ensure ample information on adaptation actions.

The monitoring proposal will be presented during the course of the first year of implementation, detailing its content, format and frequency. It

will cover monitoring of the NAP, of its activities and processes. This system will be integrated with other information systems, as appropriate, including that of the National Policy for Climate Change.

Monitoring will also be carried out and reports prepared on progress achieved and challenges identified during assimilation of climate-risk management into the policies of state and municipal bodies and of civil society initiatives, by means of strategies as yet to be defined jointly, as appropriate, with these players.

New goals and initiatives may be proposed by the Plan coordination unit. Updated information on monitoring and management of the Plan can be viewed on the Ministry of Environment website.

Plans for attainment of the goals agreed upon, shown in Table 1, shall be drawn up by the agencies responsible during the course of the first year of the NAP and shall contain, in compliance with a proposition of the Plan coordination unit, mechanisms for monitoring and evaluation of such initiatives. It is worth noting that drafting and implementation of plans and deployment of guidelines is optional, and that the decision to prepare them is up to the agencies responsible for sectoral strategies.

5.4 Management of knowledge and information on impacts, vulnerabilities and climate risk

The technical-scientific information necessary for performance of assessments of national vulnerabilities and of climate risk is to be found within the scope of agencies, institutions and research networks pertaining to different Ministries. The following sectoral institutions were identified as official information sources: the National Institute for Space Research (INPE), the National Centre for Monitoring and Early-Warning of Natural Disasters (CEMADEN), the National Centre for Disaster and Risk Management (CENAD), the Geological Survey of Brazil (CPRM), the Ministry of Science, Technology and Innovation (MCTI), the Brazilian Research Network on Global Climate Change (Rede Clima), the Brazilian Panel on Climate Change (PBMC), the National Meteorology Institute (INMET), the National Water Agency (ANA), Brazilian Agricultural Research Corporation (EMBRAPA), the Institute for Applied Economic Research (IPEA), the Brazilian Institute of Geography and Statistics (IBGE), the Ministry of Environment (MMA), among others. The Ministry of Environment website (www.mma.gov.br) provides updated methodological guidelines, tools and information to facilitate adaptation planning.

ANA and INMET, that manage databases on water resources and weather respectively, are responsible for providing ample access to such information, through technical and monitoring reports for the government and the general public.

The Brazilian Geological Survey (CPRM), a public company linked to the Ministry of Mines and Energy, is responsible for generating and disseminating the basic geological and hydrological knowledge necessary for promoting sustainable development in Brazil.

EMBRAPA plays a vital role in the farm sector, actively contributing to the development of essential knowledge and technologies for sustainable production of food, fibres and energy. Not only does it evaluate vulnerability and specific sectoral risks, but also contributes essential knowledge on changes in land use and management of natural resources such as soil, water and biodiversity. This encompasses knowledge, conservation and use of genetic resources, an essential element for analysis and for addressing regional and local vulnerabilities. It has proven effective in promoting adaptive responses to the challenges imposed by climate change on the farm sector, and has contributed toward adaptation initiatives in other sectors. Moreover,

EMBRAPA performs an important role in fostering understanding of climate change and of its impacts on local, regional and national scales, as in the case of the project for Simulation of Future Agricultural Scenarios (SCAF) based on regionalised climate-change projections, for example. EMBRAPA also coordinates the Multi-Institutional Platform for Monitoring Reduction of Greenhouse Gas Emissions in Agriculture (ABC Platform) founded through a partnership with members of Rede Clima, which involves public research and teaching institutions in measuring, reporting and verification (MRV) activities. All of this work is being carried out in view of a growing awareness of climatic uncertainties, with the aim of producing information to provide greater certainty for decision making of farmers and public-policy managers.

INPE is responsible for generating updated climatic projections, in accordance with the IPCC's revised greenhouse-gas emission scenarios. It also develops mathematical models for production of other technical-scientific information needed for identification of impacts, vulnerabilities and potential long and short-term adaptation measures, encompassing not only the physical and biological aspects, but also

human dimensions. Moreover, through its Earth System Science Centre (CCST) INPE will also contribute toward the drafting and deployment of short and long-term adaptation policies, based on national sustainable-development scenarios, and derived from monitoring of remote-sensing networks, environmental and socio-economic data, and Earth-system modelling.

The MCTI, through its *Rede Clima* is responsible for generating information needed for the conduct of future vulnerability and adaptation analyses relating to strategic sectors susceptible to impacts associated with climate change. The MCTI and INPE are jointly responsible for management and dissemination of such information to sectoral agencies and to the general public. An important source of information on Brazil's vulnerabilities is the National Communication to the UNFCCC, containing a compilation of information on emissions inventories and a climate-change vulnerability assessment.

The role of CENAD is to consolidate information on risks in Brazil, including maps of areas susceptible to landslides and flooding, and data relating to the occurrence of natural and technological disasters and associated

damage. Management of this information enables the Centre to provide assistance to states and municipalities in preparing for disasters, with a special focus on more vulnerable communities.

The Brazilian Panel on Climate Change (PBMC) is responsible for drafting of a National Evaluation Report, which provides significant systematized scientific findings for governments and the public. The first report, published in 2013, presented an analysis of national vulnerability, and subsequent reports are due at four-year intervals.

IBGE and IPEA are important national statistical and research agencies and play a significant role in the preparation of social, economic and environmental indicators and in providing information required for integrated diagnosis and analysis of Brazil's vulnerability to climate change.

To facilitate disclosure of and free access to this data, the government is developing a System for Monitoring and Observation of the Climate Change Impacts (SISMOI), under coordination of the MCTI. This purpose of this system is to provide governmental and other stakeholders and parties affected by climate changes with essential information on the vulnerabilities of

physical, biological and socioeconomic systems to climate change.

The National Natural-Disaster Monitoring and Early-Warning System, was established by MCTI/CEMADEN to respond to the increase in occurrences of such phenomena in Brazil in recent years. Its purpose is to enhance capacity to reduce the effects of natural disasters and the number of victims and of damage, by means of providing information on imminent risk of natural disasters.

The dynamics of the System are as follows. Data relating to occurrence of natural and man-made disasters and consequent damage, provided by a variety of government agencies, is received by the system. After having been processed and assessed by specialists, this information on the risk of occurrence of disasters is referred to state and municipal-level bodies responsible for Protection and Civil Defence, so that warnings can be issued, depending upon the intensity of the event. This enables better planning of actions for recovery from disaster scenarios while, at the same time, assisting with disaster prevention activities, in the light of better knowledge of areas affected and their vulnerabilities. CENAD and CEMADEN are the bodies most engaged in this process.

There are also a number of international initiatives that contribute toward management of the climatic knowledge in Brazil. Recently Brazil, represented by INPE, joined the Earth System Grid Federation (ESGF) a worldwide data-storage and distribution network whose mission is to provide global access to climate data and information. This initiative will enable access to information on scenario simulations using the latest climatic models, satellite observations, and reanalysis of data to complement other currently available and future information distribution strategies.



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