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CLIMATE CHANGE, RISKS AND ADAPTATION STRATEGIES IN THE BRAZILIAN CONTEXT

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ABSTRACT

Environmental quality and adaptation to climate change risks is mobilizing the attention of the academic community and policy makers around the world. The use of the territory and its environmental resources at levels capable of ensuring the regeneration and resilience of populations and ecosystems, as well as the structuring of international and national environmental governance capable of equating environmental vulnerabilities under different prisms, has become a challenge to be shared by many countries. This challenge is reflected in several international legal instruments such as the United Nations Framework Convention on Climate Change. The objective of this article is to analyze how the Climate Change Conventions have been internalized in Brazil. It does this by assessing how climate change adaptation is translated into legislative documents related to the prevention of climatic risks. Based on qualitative document analysis, this study shows that Brazil has built a robust legislative framework for the management of natural resources and risk management. However, the lack of tools to evaluate its effective implementation remain a matter of considerable debate.

Key-words: climate change, environmental governance, international conventions, public policies, Brazil.

ALTERAÇÕES CLIMÁTICAS, RISCOS E ESTRATÉGIAS DE ADAPTAÇÃO NO CONTEXTO BRASILEIRO

RESUMO

A qualidade ambiental e a adaptação aos riscos das alterações climáticas tem vindo a mobilizar a atenção da comunidade académica e dos decisores um pouco por todo o mundo. O uso do território e dos seus recursos ambientais, em níveis capazes de garantir a regeneração e resiliência das populações e dos ecossistemas, bem como a estruturação de uma governança ambiental a nível internacional e nacional, capaz de equacionar as vulnerabilidades ambientais sob diversos prismas, têm vindo a configurar-se como um desafio a partilhar por vários países. A partilha deste desafio traduz-se em diversos instrumentos jurídicos internacionais como a Convenção-Quadro das Nações Unidas sobre Mudança do Clima. Este artigo tem por objetivo analisar o modo como as Convenções sobre Mudança do Clima têm vindo a ser internalizadas no Brasil e em que medida a política de adaptação às *alterações climáticas se traduz em instrumentos legislativos relacionados com a prevenção de riscos climáticos. O estudo, baseado numa análise documental qualitativa, permite evidenciar que o Brasil construiu um edifício legislativo robusto tendo em vista a gestão dos recursos naturais e a gestão dos riscos. Contudo, a ausência de ferramentas de avaliação de sua efetiva implementação, pode constituir objeto de preocupação.*

Palavras-Chave: *alterações climáticas; governança ambiental; convenções internacionais; políticas públicas; Brasil*

INTRODUCTION

The environmental issue is the object of numerous studies, evidencing a concern of the scientific community about the relation between the human being and the environment. In this context, it has been defended that this relationship fits into the sustainability paradigm and adaptation to climate change, ensuring the use of the territory and its environmental resources at levels capable of ensuring the regeneration and resilience of populations and ecosystems, as well as the structuring of environmental governance at the international and national levels, capable of addressing environmental vulnerabilities under different perspectives.

Growing concern about environmental issues has resulted in several international agreements. A survey on the website of the United Nations Environment Program identifies the existence of more than 280 multilateral agreements related to the environmental theme and is one of the most discussed topics at the international level. Among these agreements, the Conventions resulting from the United Nations Conference on Environment and Development, held in Rio de Janeiro in 1992, which assumes a particularly relevant position. This Conference was understood as a milestone in the structuring of international environmental governance and has led to a number of conventions, including the United Nations Framework Convention on Climate Change (UNFCCC).

The UNFCCC is one of the first international instruments designed to address the potential risks and impacts of climate change. The UNFCCC came into force in 1994 with a total of 196 signatory countries and established the agreement on the shared role for the combating climate change. This is a legally binding instrument, i.e. countries are committed: achieving the objectives and measures of the Convention, stabilizing concentrations of greenhouse gases, elaborating national plans for climate change adaptation, and promoting the transfer of technology. Countries also undertake the rule to meet annually in the so-called Conference of Members (COP) (UNFCCC, 2018).

In the structure of the UNFCCC, the Kyoto Protocol was signed in 1997, which set up greenhouse gas reduction targets associated with climate change, but only in 2005 it reached the minimum number of signatory countries to become representative. The Protocol was ratified by 192 countries defined environmental commitments for 37 industrialized countries considered the most responsible for air pollution in the last

150 years - which were obliged to reduce their emissions of gases by 5% (UNFCCC, 2018). However, the Protocol did not earn the adhesion of the countries considered the biggest polluters, regarding the penalties for non-compliance, thus limiting the scope of the proposed objectives.

Trying to make the Kyoto Protocol goals more flexible with the greenhouse gas reduction targets, the Copenhagen Declaration created in 2009, did not reach the necessary consensus among States, presenting a low number of memberships. In 2010, the Cancun Declaration is adopted without binding effect, detailing and expanding the objectives of the Declaration of Copenhagen. With the end of the Kyoto Protocol, the Doha Amendment is established in 2012, which proposes a second commitment period from 2013 to 2020, in which the participating countries commit themselves should reduce emissions from at least 18% compared to 1990 levels (UNFCCC, 2018). However, the start of negotiations for a new climate agreement was complex and delayed its entrance into force (UNFCCC, 2018).

In 2015, the Paris Agreement was signed as the successor of the Kyoto Protocol. This Agreement covers all UNFCCC countries and encourages voluntary action, based on the principle of transparency. Its focus is not on the punitive character, it provides the expansion of the ecological consciousness through the Nations by protecting the dignity of life worldwide. The Paris Agreement entered into force in 2016, with 169 ratifications, and its implementation date scheduled for 2020, the last year of the Doha Amendment. The Paris Agreement proposes an action plan to limit global warming to below 2°C. The participating countries agreed to report every five years on their contribution and to set more ambitious targets for mitigation and adaptation to the impacts of climate change. The goals of this agreement are also based on transparency and solidarity among countries. They have agreed to submit periodic reports on their performance in meeting the targets. In addition, they agreed to support developing countries with funding to reduce the emission of gasses, ensure the implementation of their strategic plans, and increase resilience to the impacts of climate change (UNFCCC, 2018).

Brazil played a central role for Eco-92, being one of the first to signatory countries of the United Nations Framework Convention on Climate Change. The present study focuses on the Brazilian legal framework to analyze how the objectives assumed with the signing of climate change conventions have been translated into legislative and public policy docu-

ments, becoming the main guidelines of adaptation strategies to climate change. The article is divided into three sections. After this introduction, section 1 presents a brief contextualization of the challenges of integrating new regulations related to the risks and climate change in environmental governance mechanisms for adaptation, prevention or minimization. Section 2 describes the methodology adopted to analyze a set of previously selected public policy documents. Section 3 sets out the legislative framework on climate change in Brazil, identifies the documents that establish the contours of public policy according to the methodology referred to in section 2. Then, the results are discussed in light of the theoretical context exposed in section 1. Finally, the main conclusions and recommendations are presented.

1 RISKS, CLIMATE CHANGE AND INTERNALIZATION IN ENVIRONMENTAL GOVERNANCE

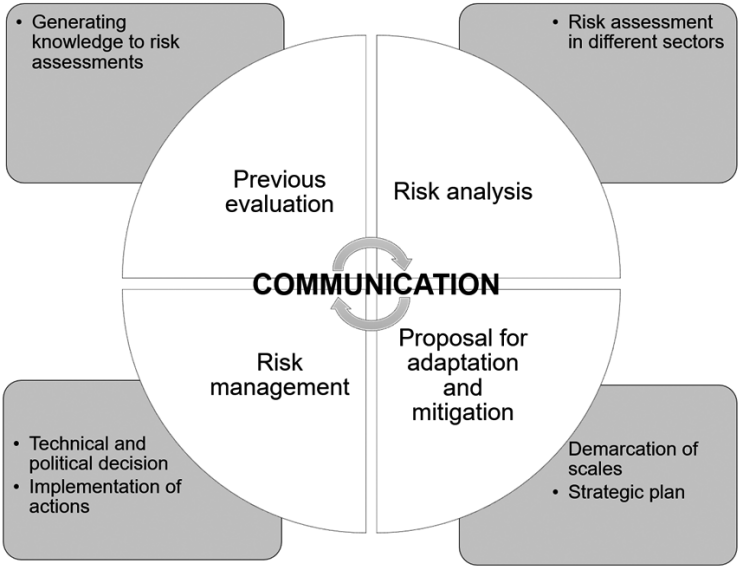
The conceptual risk model can be expressed by the probability-consequence relation (COROMINAS, et al., 2015), where one has the probability of occurrence of an event and its negative consequences. Aragão (2008) states the existence of planetary risks, since "the combined actions of scientific and technological evolution and the intensification of agricultural production, with the acceleration of consumption and the globalization of the market of goods and services, lead to massification of risks (ARAGÃO, 2008, p. 21).According to Mendes (2015), the concept of risk dates back to nineteenth-century work accidents and, from the twentieth century on, became a characteristic phenomenon of social changes that are found a new type of modernity (MENDES, 2015). Analyzing the different sociological and cultural perspectives of risk, this author evidences risk as a product of the social organization, thus underlining Aragão's argument (2008, p. 21).

The term *risk society*, much debated from Beck's theory (2011), refers to the danger associated with the decision-making process, considering that the productive process and the technological advances have an anthropic origin. Nonetheless, it considers that the distribution of risk is directly related to social inequalities, leading to unfair distribution of the consequences of harmful events. Risks are seen as a result of late modernity, where "social production of wealth is systematically accompanied by the social production of risks" (BECK, 2011, p. 23).

Within the context of climate change, risk prevention and management (AYALA-CARCEDO, 2002) highlighted the importance of land management (TAVARES, 2013), recognizing that the predatory relationship and exploitation of available natural resources has generated not only serious environmental damage but also little known or immeasurable risks (BECK, 2011), posing a threat to present and future generations (ARAGÃO, 2008).

The formulation of strategic plans for risk management depends directly on studies capable of identifying and measuring the risks, based on their different levels and factors, and proposing measures to avoid or minimize their impacts (AYALA-CARCEDO, 2002). Tavares (2013) shows the key issues of the International Risk Governance Council model (see Figure 1), which "privileges the communication and involvement of the different actors. It is a cyclical model that encompasses from knowledge acquisition processes to decision processes, based on permanent communication between citizens, technicians and decision makers" (TAVARES, 2013, p. 70).

Figure 1 - Risk management model



Source: Adapted from Tavares (2013, p. 70)[1]

The extent of the potential risks of climate change makes them a global concern. The scenarios projected by the scientific community in different countries and scales (CHOU et al., 2014; IPCC, 2014; UFSC, 2016) challenge the formulation of risk management strategies (AYALA-CARCEDO, 2002; HILL; DINSDALE, 2003; CUNHA et al., 2011; TAVARES, 2013), which refer to the different levels of governance, highlighting the importance of demarcating and articulating the scales (from supranational to local) for the effectiveness of risk management (CUNHA et al., 2011; TAVARES, 2013), allowing the definition of strategies capable of attending to the different contexts.

Reflecting the role of strategic environmental and spatial planning, Partidário (2012) stresses that these instruments are designed to overcome barriers, to define methods, techniques, and actions in the short, medium and long term. In the public context, the plans do not serve to say how the future should be, but rather to make it possible to arrive at it, based on the strategic capacity to look for the future, within a multiscale and multivalue context, reflecting the proposal of society for the future and its way of

1 Adapted by Tavares (2013) from IRGC (2005)

achieving it (PARTIDÁRIO, 2012). In this context, international treaties have particular importance and it is important to study not only the process of international relations that allow the adoption of new strategies for the management of risks from climate change but also the way in which the signatory countries develop their efforts.

International law is considered a legal system of its own (HENKIN, 1999). International treaties are amongst the different instruments used by international law (see paragraph an of article 38, of the Statute of the International Court of Justice). The treaties are the expression of the platform of the consensus reached between the countries involved, but their internalization and implementation depend on their formal confirmation by the signatory states, which is through ratification, by which the treaty becomes binding (RESEK, 2012). When they are internalized, the treaties play an important role in the management of transnational problems because they have normative power and the capacity to influence other norms and policies at the regional and national levels, especially in relation to human rights issues (MAZZUOLI and TEIXEIRA, 2013).

A large number of treaties around environmental issues does not only express an understanding of the importance of its resource management and ecological awareness but also reflects the growing recognition of nations about the implications of environmental problems in the multiple economic sectors, as well as the society in general. In addition, growing recognition of environmental rights, as one of the dimensions of human rights, is identified, strengthening and broadening the discussions on the international theme (FRÖHLICH and KIELIELING, 2013). Climate change has been identified as the environmental issue with the greatest impact on the way of life of society (IPCC, 2014), requiring a proactive attitude of the different States. The international negotiations seek, among other aspects, the formulation and adoption of treaties able to force new and articulated build political agendas in which mitigation and adaptation are adopted through cross-border, multilevel, multi-sector and multi-actor approaches (FRÖHLICH and KNIELING, 2013). Moreover, it is evident the necessary coherence between the formulation of legislative documents and the institutional means used to materialize the international treaties.

> Effective risk management is crucial to the public service; the ability to make the right decisions in relation to policies, programs, and services in an uncertain environment is fundamental. Increasingly, the public service has been forced to make difficult

> decisions about health risks, environmental risks, risks of economic well-being, technological risks and risks involved in providing services, among many others. The responsibilities and duties of the government in relation to the public good require the adoption of effective risk management practices and strategies. (HILL; DINSDALE, 2003, p. 9)

Effective risk management takes place within the governance process, which encompasses risk assessment, management, and communication, as evidenced in Figure 1. The term governance has seen used from the work developed by the World Bank, aiming to deepen the knowledge about conditions capable of guaranteeing an efficient State, encompassing the challenges and responsibilities that modern society poses on the act of governing (DINIZ, 1995 WOLKMER, and FREIBERGER, 2013). The United Nations Global Governance Commission defines governance as:

> The sum total of the various modes as individuals and institutions, public and private, manage their common business. It is a continuous process whereby conflicting or diverse interests can be accommodated, and cooperative action established. This process includes institutions and formal regimes invested with the power to enforce observance of rules, as well as informal arrangements that people and institutions have agreed to establish or perceive to be of interest to them (Commission on Global Governance, 1995, p. 53).

In governance, the State also assumes the role of strategic manager, in a process that involves articulation and cooperation between social and political actors, in the various institutional arrangements, in the planning, formulation and implementation of policies, based on the principles of accountability, institutional and management strengthening (KNIELING and LEAL FILHO, 2013). The participation of different segments of civil society (stakeholders), in turn, is a point up of good governance, especially in environmental issues, since it has the capacity to strengthen public space in the structuring of new public policies "conforming innovative practices that they break with the previous dynamics of environmental management" (WOLKMER, et. al., 2014, p.375). Environmental governance involves a set of policies, programs and international agreements to build an environmental management system that necessarily presupposes the creation of mechanisms to ensure the democratic participation of civil society (PORTO e PORTO, 2015), as well as having the ability to improve

the quality of decisions and strengthen confidence in public institutions.

According to Bursztyn and Bursztyn (2012, p. 187) it is possible to identify three generations of public policies aimed at environmental protection in different countries, including Brazil. The first is characterized by the state apparatuses to the control the use of environmental resources, through the use of specific codes. The second lasted between the 1970s to the end of the 20th century and was characterized by the social awareness about the environment and the relationship between human beings and nature. In this environmental legislation and administration was increased but without out the necessary integration into other sector policy areas. The third continues the previous one but it is also marked by the emergence of new actors in the environmental governance scenario, including both social movements and companies.

When reflecting on governance in the European context, Aragão (2008) identifies a set of principles, namely: transparency, openness, participation, accountability, effectiveness, and coherence (ARAGÃO, 2008, p. 37). This author also emphasizes that "participation must be informed, precocious, broad, plural and useful" on the basis of the principles of transparency and openness, "the recent dimension of risk governance[2]: the importance attached to citizens, *laymen* whose *profane* opinion has long been despised and only recently, with the Aarhus Convention began to gain some status." (ARAGÃO, 2008, p. 43). Furthermore, the different actors begin to assume greater interaction and action, reinforce the need to reconcile interests and construct scenarios of forces correlation with direct implications on the processes of formulation and implementation of public policies.

In reflecting specifically on climate change governance, Fröhlich and Knieling (2013) reflect that solutions in the field of climate change mitigation and adaptation are unlikely to succeed without an understanding of the structure of the problem, thus requiring collaborative stakeholder action and policymakers who shape mitigation and adaptation, avoiding the construction of models based on top-down responses (AYALA- CARCEDO, 2002).

2 Regarding the author's linguistic choice between "governança"and "governância", see his article on«A Governância na Constituição Europeia. Uma oportunidade perdida?», in: A Constituição Europeia. Estudos em homenagem ao Prof. Doutor Lucas Pires, FDUC, Coimbra, 2005

2 METHODOLOGY

This article focuses on a qualitative analysis of documents to analyze how the Conventions on Climate Change are being internalized in the Brazilian legislation. It assesses to what extent the policies adopted under the recent legislative framework adopt new instruments for risk management. The study is developed in the following stages:

(i) the first stage focuses on the contextualization of climate change in Brazil, as well as a description of key concepts such as "risks", "climate change" and "environmental governance".

(ii) the second stage focuses on the analysis of the documents that substantiate the adaptation strategy to climate change adopted in Brazil. The documents under study include the National Policy on Climate Change (PNMC), instituted by Law nº· 12.187, of December 29, 2009, the National Plan for Adaptation to Climate Change (PNA) adopted by means of Ordinance nº. 150, on May 10, 2016, formulated following the previous document and which aims to establish strategic actions, and the PNA Monitoring and Evaluation Report, prepared one year after the implementation of the PNA, from 2016 to 2017.

(iii) the third stage focuses on the analysis of the way in which the strategic measures established in the PNA under the National Policy on Climate Change give concrete expression to the Conventions on Climate Change and in particular if they are translated into the formulation of risk management instruments and identification of the country's vulnerabilities in this regard.

The analysis of the documents is based on Philips et al. (2004) research, that develops a discourse analysis model to evaluate the role of documents in the institutionalization of emerging issues. This author emphasizes that institutions are constructed through discourse and that the narratives adopted have the power to influence subsequent decision making.

It should be noted that the analysis of the documents focuses on the identification of the proposed objectives, as well as the identified risks and strategies outlined in the scope of the National Plan for Adaptation to Climate Change and the verification of the achievement of these objectives and strategies in the Monitoring Report and Evaluation of the PNA, referring to one year of implementation of the Plan. From this comparison was verified not only the actions are undertaken, but also the scope of action, actors and identified challenges.

3 CLIMATE CHANGE AND ENVIRONMENTAL RISK IN THE BRAZILIAN CONTEXT

3.1 Climate change and public policies

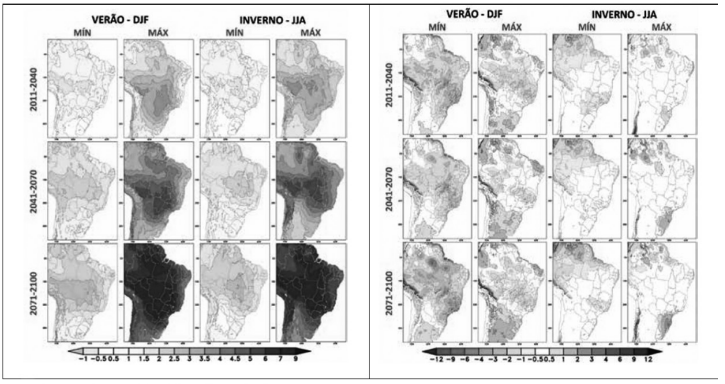
IPCC (2014) report indicates that the risks associated with climate change resulted from the interaction of climate-related hazards with the vulnerability and exposure of human and natural systems. According to recent reports in Brazil (UFSC, 2016, p. 20-22), the most recurrent disasters occurred between 2008 to 2011 were related to droughts and barrenness, followed by floods and windfalls, generating a public and private cost of approximately 15.5 billion dollars.

Considering the continental dimensions of Brazil and the existence of different biomes, the incidence of the different typologies of risks are present, such as waves of cold and heat, erosion, desertification, drought, floods, landslides, pollution of water resources, meteorological factors, climatological and hydrological, in a combination of natural and anthropic risks, including social and technological (UFSC, 2016), demanding a governance structure capable of encompassing the extensive and complex Brazilian environmental reality. By adopting sustainable development as a paradigm to be pursued by all nations, Brazil has advanced in the understanding that "governance stands as the critical tool for this paradigm to establish itself as dominant in a given social context" (MOURA and BEZERRA, 2016, p. 92).

According to the simulations of the ETA model[3] (CHOU et al., 2014), heating for the entire South American continent (left side of Figure 2) is estimated, with a higher concentration in the Midwest, extending to the North, Northeast and Southeast regions country by the end of the 21st century. These average warming highs at the end of the century can range from 2°C to 8°C in some areas. The model also predicts the reduction of rain during the summer (right side of Figure 2), concentrating the maximum levels of reduction in the Midwest and Southeast, expanding to the regions of the Amazon. On the other hand, it is projected the increase of the rains in the South region.

3 "The Eta limited area model was developed by the University of Belgrade with the Institute of Hydrometeorology of Yugoslavia and became operational at the National Centers for Environmental Prediction (NCEP) (Mesinger et al., 1988; Black, 1994). The regional model proposes to predict in more detail phenomena associated with fronts, orography, sea breeze, severe storms, etc., in short, systems organized in mesoscale. Due to the greater non-linearity of the systems in this scale the predictability is smaller and the forecasts are short-term." Available at: http://climanalise.cptec.inpe.br/~rclimanl/boletim/cliesp10a/27.html. Access 10/08/18.

Figure 2 - Regionalized projections of change in temperature (°C) and precipitation



Source: Adapted from CHOU et al., (2014)

The rising temperatures and the occurrence and intensity of rainfall, represented in climatic projections requires robust management of the risks. It also requires the identification of the environmental, cultural, and economic vulnerabilities of territories. Environmental governance at the international and national levels has become a necessary prerequisite for law on risk, as well as a fundamental human right, transboundary, trans individual and intergenerational (ARAGÃO, 2008).

Brazilian environmental policy began in 1943, with the creation of the Water Code and the Forest Code (MOURA, 2016). However, it was from the 1992 United Nations Conference on Environment and Development that the country advanced in the construction of the national environmental management system, expanding the legal framework and investing in the creation of an institutional structure with a view to implementing the created policies.

In Brazil, treaties and international conventions are ratified at different levels, depending on the subject matter and the process of incorporation into the legal system. Human rights treaties are equivalent to constitutional amendments into the legal system following the procedure set forth in article 5, § 3 of the Federal Constitution. On the contrary, treaties that do not deal with human rights enter into the legal system with the force of ordinary law (MAZZUOLI, 2016).

It is important to note that there is a divergence with human rights

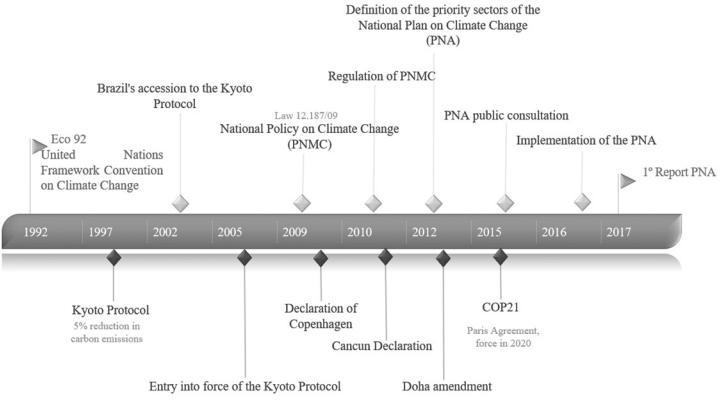
treaties so that they have not been incorporated into the legal system by the procedure set forth in article 5, § 3 of the Federal Constitution. In this case, the supreme understanding of the Federal Supreme Court has been to confer supra-legal force, that is, below the Constitution and above the common laws. In this present work, we agree with the minority understanding and immediate incorporation of the human rights treaties pursuant to Article 5, § 1 e § 2 of the Federal Constitution, in which are considered materially constitutional, after ratification. By understanding environmental law as a fundamental right, the treaties signed at the Eco-92 level are materially constitutional.

Eco-92 represented an important landmark in the creation of public environmental policies in the Brazilian context, namely, to combat desertification, reducing greenhouse gases, restoring degraded areas and preserving biomes and water resources. Regarding climate change, legislative instruments have been developed to implement the agenda established under the United Nations Framework Convention on Climate Change (UNFCCC) and other climate conventions.

The present study focuses on the National Policy on Climate Change (PNMC) published through Law nº. 12.188/2009 and the Strategic Plan resulting therefrom (instituted by Ordinance nº. 150, with the objective to "promote the reduction of national vulnerability face climate change and carry out risk management associated with this phenomenon"). The study also covers the analysis of the 1st Monitoring and Evaluation Report of the PNA, after one year of implementation of the Plan (MMA, 2017). The PNMC, regulated by Decree nº. 7390/2010, has become the main national legislative instrument to implement the United Nations Framework Convention on Climate Change (UNFCCC), established in 1992. Although Brazil has been a signatory to the UNFCCC since 1992 and the Kyoto protocol since 2002, only in 2007 was proposed a bill that would establish, in 2009, the National Policy on Climate Change. The National Plan that establishes adaptation strategies, in turn, was instituted in 2016.

The comparative analysis of the timeline associated with the National Policy on Climate Change, along the timeline associated with the United Nations Framework Convention on Climate Change, shown in Figure 3, shows the comparative process of the creation of international instruments and the internalization by legislation in the Brazilian context.

Figure 3 - Timelines associated with the main policies for adaptation to climate change in international law and in Brazilian law



The National Policy on Climate Change (PNMC) provides the concurrent responsibility of political entities and public administration bodies in the implementation of the policy, observing the principles of precaution, prevention, citizen participation, sustainable development and common responsibilities (Article 3º), establishing, among its guidelines, the commitments assumed by Brazil in the United Nations Framework Convention on Climate Change, the Kyoto Protocol and other documents on climate change of which it becomes a signatory (Article 5º).

As a voluntary national commitment, the PNMC plans to reduce its projected emissions by 2020 to between 36.1% and 38.9% (Article 12º). To implement the objectives of the PMNC, it establishes, among the policy instruments, the National Plan for Adaptation to Climate Change (PNA) (Article 6), which aims to institute measures to adapt to climate change from strategic sectors. In this sense, the PNA, established in 2016, aims to "reduce national vulnerability to climate change and manage risk associated with this phenomenon" (BRAZIL - PNA, 2016).

The adaptation strategy was based on the cyclical model (HILL and DINSDALE, 2003), which involves the identification of current and future risks based on climate projections, identifying and analyzing vulnerabilities, and then defining adaptation actions and guidelines. The PNA provides four-year implementation cycles with their respective revisions, proposing a sectorized approach, being considered 11 sectors, according to Table 1.

Table 1 - National Plan for Adaptation to Climate Change (PNA)

Sectors	Coordination	Goals
Agriculture Biodiversity and Ecosystems Cities; Natural disasters; Industry and Mining; Infrastructure; Vulnerable People and Communities; Water resources; Health; Food and nutrition security; Coastal areas	Technical Group on Adaptation to Climate Change - GTA. The group should be permanently and advisory in nature, with the objective of promoting the articulation between public and private bodies and entities to promote the implementation, monitoring, evaluation and revision of the PNA	1) To guide the expansion and dissemination of scientific, technical and traditional knowledge by supporting the production, management, and dissemination of information on climate risk, and the development of training measures for government entities and society in general; 2) To promote coordination and cooperation among public agencies for climate risk management, through participatory processes with society, aiming at the continuous improvement of actions for climate risk management; 3) Identify and propose measures to promote the adaptation and reduction of the risk associated with climate change.

Among the eleven strategic sectors adopted, the plan establishes priority areas for food and nutritional security, water resources and energy (the latter included in the infrastructure sector). According to the justifications contained in the PNA, sectorization took into account the divisions of competence within the Federal Government and the priorities and urgencies regarding vulnerabilities, defined on scenario projections, allied to the development policy adopted by the country.

The PNA was subsidized, among other studies, by the project Vulnerability to Climate Change[4], in which a software – *Climate Vulnerability System (SisVuClima)* - was developed in 2014, which calculates the human vulnerability to climate change at the municipal level. The *SisVuClima* system generates indexes and thematic maps, allowing managers to identify the degree of vulnerability to climate change by the municipality. The proj-

4 The Project Vulnerability to Climate Change is the result of a partnership between the Ministry of Environment and the Oswaldo Cruz Foundation - Fiocruz. The same is in progress, and more information can be found at: http://www.sisvuclima.com.br/

ect contemplated 6 of the 26 states, namely: Espirito Santo, Pernambuco, Paraná, Maranhão, Amazonas, and Mato Grosso do Sul, aiming to cover each region of the country. (BRASIL, 2016).

3.2 Analysis of the Policy and the National Plan for Climate Change

The analysis of the Adaptation Plan (PNA), resulting from the National Policy on Climate Change, shows that Brazil made important progress in structuring the legislative building in environmental matters, setting ambitious targets for Brazil's contribution to climate change, establishing in the PNA 24 goals and 136 guidelines, including sectoral and cross-sectoral strategies, structuring of organizations, and adopting methodological and scientific bases, for the reduction and management of the risk associated with climate change.

According to the first PNA Monitoring and Evaluation Report (MMA, 2017), 100% of the targets and 67% of the sectoral guidelines had some corresponding action implemented. Among these, 72% contribute to identifying and proposing measures to adapt and reduce climate risk, which refers to the objective nº.3 of the PNA. This Report presents the actions implemented in each strategic sector against the identified risks, accompanied by an appendix that details these actions (summarized in Table 2).

The annex to the Report (MMA, 2017) emphasizes the status of the actions, the stage in which they are found and, in some cases, brings comments in order to provide clarification on the action, considering the goals and objectives of the respective sector. The Report also emphasizes the limitations encountered in the implementation of actions, the challenges and the next steps to be taken with the view to overcoming the difficulties encountered in the first year of the PNA.

Table 2 - Risks and adaptation measures in the strategic sectors in the National Plan for Adaptation to Climate Change (PNA 2016-2017)

Sectors	Main risks	Strategies under implementation
Agriculture	Reducing water availability	• Development of Agro-meteorological Monitoring System; • Expansion of research projects • Elaboration of State Plans of Low Carbon Agriculture;
Biodiversity and Ecosystems	Extreme events linked to temperature rise and decrease of precipitation levels	• Development of studies to support the elaboration of measures of Adaptation based on Ecosystems in areas of risk.
Cities	Floods, heat waves; landslides and limitations on freshwater supply	• Investment for Urbanization of Precarious Settlements • Permanence of the Housing Program “Minha Casa, Minha Vida” • Slope Containment Works in Urban Areas • Ten urban drainage projects in municipalities.
Natural disasters	Events of sudden occurrence; events of a gradual nature (dry and floods). Rainfall (by excess or scarcity)	• Establishment of protocols of joint action with partner agencies in the monitoring and warning of natural disasters • Distance learning course (30h) developed on climate change aimed at municipal managers;
Industry and Mining	Decrease or discontinuity of productive activity	• Development of studies
Infrastructure (energy, transport, and mobility)	The occurrence of extreme events; sea level rise, interruptions or reductions in services in the mobility, transport and energy sectors.	No actions

Vulnerable Peoples and Communities	Loss of life, material loss, forced migration, loss of territory, inability to subsist and loss of traditional knowledge.	• Events (two meetings and one workshop) on climate change awareness • An Online course (30h) developed on climate change aimed at municipal managers;
Water resources	Changes in expected temperature and precipitation patterns, impacting on water availability (volumes and distribution) and the occurrence of extreme water-related events (floods and droughts)	• Considering the economic aspects, in the Piracicaba, Capivari and Jundiaí basins in the state of São Paulo, and Piranhas-Açu, which encompasses part of the states of Paraíba and Rio de Janeiro Great North • 370 desalination systems implemented in municipalities in the Northeast, aiming at water security for human supply • Implementation of the Drought Monitor of Northeast Brazil • Negotiated water allocation processes performed in 35 isolated water systems • Implementation of the "Workshop on Water Resources Regulatory Frameworks in the Semi-Arid Region" • Implementation of the National Water Quality Monitoring Program
Health	Change in behavior of diseases and injuries. Hospitalizations due to extreme events.	• Improvement of the Information System for the Surveillance of Water Quality for Human Consumption • Health Education Project of Artisanal Fishing Worker and Training of Multipliers in Participation in Health Unic System (SUS) Management

Food and nutrition security	Reduction in food production and the generation of work and income in rural areas	• Implementation of cisterns and other social technologies for access to water for human consumption • Implementation of cisterns in rural public schools • Implementation of community seed banks • Expansion from 70 thousand to 90 thousand of the number of beneficiaries of the Bolsa Verde Program • Extend the storage capacity of the National Supply Company by 700,000 tons • 13 State Plans of Food and Nutrition Security prepared.
Seaside Resort	Coastal erosion and flood; saline intrusion; acidification of natural resources and biodiversity	• Studies to elaborate the proposal of methodology to reconcile the continental altimetry with the bathymetry, besides making a survey of implementation costs in pilot areas of the Brazilian coast.

Source: Data from the Monitoring and Evaluation Report of the National Plan for Adaptation to Climate Change (MMA, 2017)

The analysis of the main risks identified in the content of the PNA in each strategic sector in light of the measures adopted for its management (Table 2), shows that most of the implemented actions are related to the three sectors established as priorities by the PNA. Among the measures implemented, there are those with a non-structural nature, linked to the expansion of studies, dissemination of information and monitoring. Considering that there was a seven-year period between the creation of the National Policy in 2009 and the implementation of the PNA, the absence

of studies in several sectors can be considered a worrying failure in this process. It is evident that the creation of measures of adaptation strategies is directly related to knowledge about risks (FRÖHLICH and KIELIELING, 2013; HILL and DINSDALE, 2003), capable of determining the degree of danger they present, from the relation probability x consequences (COROMINAS, et al., 2015; MENDES, 2015).

The Report recognizes the lack of specific knowledge about climate impacts as one of the major challenges (FRÖHLICH and KIELIELING, 2013), which is why many of them do not have planned strategic measures, but rather, studies are planned to be developed in the future to subsidize the proposition of measures. However, the Report indicates the lack of resources for research funding in various sectors.

The analysis of the main strategic actions adopted under the PNA (Table 2), allows verifying that there are several gaps and limitations in the process of identifying and implementing adaptation strategies. It should be noted the low number of measures applied at national and state level, with the concentration of some measures at the municipal level, although the size of scales is not demarcated in the PNA and there are few municipalities served, considering that the country has more than five thousand municipalities. Moreover, in the implemented strategies, there is no evidence of interdependence between the sectors, nor does it identify the adoption of coordinated policies between the federal, state and municipal spheres. The lack of demarcation of the scales in the PNA, as highlighted, is a point that deserves attention because, given the continental dimensions of Brazil, the decentralization of actions, in a planned way and to cover the specificities of each case, is a fundamental point for the effectiveness of any strategy policy at the national level.

The PNA provides that the vision that underpins it is that all sectors, within four years, have structured strategies for climate risk management, however, although there are eleven strategic sectors delimited in the plan, were elected, among them, three sectors as priorities, namely food and nutritional security, water resources and energy. This option led to a deletion of the other sectors, considering the low number of actions undertaken, most of them directed to the development of studies in the area or expansion of research in progress.

In the PNA Report, it is stated that 100% of the targets and 67% of

the sectoral guidelines had some corresponding action implemented. According to the aforementioned document, 72% contribute to the identification and proposition of measures to adapt and reduce climate risk (MMA, 2017, p. 10). Although the statistical data show an optimistic scenario, it is possible to observe that the strategic actions undertaken (Table 2) have not an effective proposition of measures for adaptation and reduction of climatic risk, but rather the identification of the needs of scientific studies in the various strategic sectors. In addition, the expression "with some action implemented" says very little or almost nothing in terms of analyzing the effectiveness of policy (PARTIDÁRIO, 2012; HILL e DINSDALE, 2003).

Although the PNA foresees public participation, it is not noticeable the involvement of non-governmental actors or the civil society in the process of implementing the Plan. Moreover, they are not included in the list of actors to be involved in the monitoring of the PNA. This suggests that the new policy does not effectively provide the opening of new spaces of dialog.

Another relevant point of the Report focuses on the objects of the actions undertaken (Table 2), not all of them are directly related to climate change and, given the way they appear (isolated, generic, sometimes at the state level, others at municipalities level), it is inferred that these actions are already undertaken in ministerial portfolios in the context of other policies already in progress, but not deriving from the PNA, a conclusion that is reinforced by comments in the PNA Report itself, including those related to strategic sector actions - 'cities', which states that "there is knowledge of actions taken, but there is still no official survey of these activities"(MMA, 2017, p. 79).

3.3 DISCUSSION OF RESULTS - CHALLENGES FOR ENVIRONMENTAL GOVERNANCE

The structuring of environmental governance at the national level, capable of managing climate risks, depends directly on the process of internalization of international conventions and on the coherence between public policies and the resulting instruments. Also, the analysis of the National Plan for Adaptation to Climate Change (PNA) identifies a series of

limitations that may be of concern.

Initially, it is considered that the construction of a strategic plan depends on previous studies. It aims to identify the risks, understand its complexity and danger, design scenarios capable of supporting the formulation of measures to reduce vulnerabilities and to perform the efficient management of risks. (AYALA-CARCEDO, 2002; TAVARES, 2013). The absence or insufficiency of studies on the impacts of climate change in several strategic sectors, as outlined in the PNA Monitoring and Evaluation Report (MMA, 2017), directly contributes to the absence of strategies in several sectors. In addition, the Report indicates the lack of resource for research funding in various sectors. Likewise, there is a conflict between the strategic dimension of the plan and its development, given its limitations, and it can be said that in some sectors there is no proper plan for adaptation, since they are still in the phase identification and analysis of risk factors, negatively impacting the effectiveness of the policy.

Another point of concern is the lack of demarcation of scales in the PNA. The distinction of scales aims to identify strategies capable of encompassing the different contexts (CUNHA et al., 2011; TAVARES, 2013), and to consider the territorial dimensions of Brazil. This distinction is crucial for risk management at the local scale (TAVARES, 2013). It enables a better risk assessment, decision making, monitoring and participation of social actors, as well as their interlinkage with the different types of risks and realities of each territorial context (UFSC, 2016), articulated with measures at the national level. The absence of this distinction of scales in the PNA also impacts on the impossibility of adopting more adequate solutions regarding the cost-benefit analysis of the measures to be adopted (TAVARES, 2013). It also prevents a wiser allocation of resources (CUNHA et al. 2011), and clear identification of the risks of distribution (BECK, 2011), and necessary priority intervention levels.

In order to ensure that the concerns and principles of climate change present in the International Conventions can be assimilated and incorporated into the different areas of public policy in each country, it is proper for the strategic planning to elect priority sectors of activity (MATUS, 1996). In this sense, the PNA is structured through the election of eleven strategic sectors, and the need for coordination among them is recognized in the Plan. However, the political sector transboundary nature of

the Plan is not identified based on the implemented measures, with the coordination of the strategic sectors, valuing the necessary interdependence of the same based on the articulation of joint actions. Moura and Bezerra (2016, p. 92) have identified this trend in Brazilian environmental policies, where there is a visible contradiction between institutional advances (legal and legal framework) and Brazilian environmental problems, on "the corporate and personalist process of defining public policies that lead to fragmentation and lack of coordination in decision-making on the execution of plans and actions to promote development", directly affecting the coherence and effectiveness of the policy.

The analysis of the process of institutionalization of the National Policy on Climate Change shows the adoption of a policy alignment discourse with the "promotion of the productive sector and with the national goals of socioeconomic development and reduction of regional inequalities". This aspect reflects a dynamic discourse underlying the governmental narrative as referred to by Phillips, et. al. (2004), but dissociated from the social, reflecting the contradictory materiality of the discourse, commonly present in Brazilian public policies, as identified by Orlandi (2010).

Another point that evidence an apparent contradiction in the PNA is the participation of different social actors. By restricting participation in the public consultation process of the Plan's text before its implementation, one of the important dimensions of governance is abandoned (ARAGÃO, 2008). It is inferred that the absence of participation can directly bias the effectiveness of the PNA, limiting the absorption of the different dimensions that is a relevant policy, (FRÖHLICH and KIELIELING, 2013) and necessary for the cyclical process (TAVARES, 2013) for monitoring and evaluation. Understanding that governance involves, "in addition to political-institutional decision-making issues, the forms of interlocution between the State and the organized groups of society regarding the process of defining, monitoring and implementing public policies" (MOURA and BEZERRA, 2016, p. 93), it is evident that governance instruments depend directly on the democratic nature of decision processes, with the involvement of new emerging actors (BURSZTYN and BURSZTYN, 2012), ensuring a better quality of decisions, confidence in public institutions and reconciling interests (KNIELING and LEAL FILHO, 2013), understanding that "science and technology are only partial realities in the context of risk decision processes" (MAZZUOLI and AYALA, 2012, p. 317).

The lack of forecasting tools for the evaluation of the Plan, identifying the criteria to be used in this process, also constitutes a limitation to the involvement and participation of the different social actors. In addition, the Report does not make clear the implementation phase of its goals, only indicating, in the item "situation", that they are in the stage "with some action started" or "no action taken" (MMA, 2017), becoming impossible to evaluate how far it reached in each sector and exposing the lack of transparency in decision making and execution of plans and actions (ORLANDI, 2010; MOURA e BEZERRA, 2016).

The analysis of the National Policy on Climate Change (PNMC) and its main instrument (National Plan for Adaptation to Climate Change - PNA) in relation to the Conventions on Climate Change, and shows the need to revise the PNA in order to reach clear objective goals (PARTIDÁRIO, 2012), the forecast of the evaluation criteria and the adoption of actions effectively directed to the threats of climate change, from the participation of the different sectors of society (ARAGÃO, 2008; TAVARES, 2013; BURSZTYN and BURSZTYN, 2012; PORTO and PORTO, 2015), combining efforts and knowledge, rescuing the objectives assumed at a global level and ensuring a climate change governance at the national level capable of guaranteeing present and future generations (ARAGÃO, 2008).

CONCLUSIONS

This article aimed to analyze on how the Conventions on Climate Change have been internalized by Brazilian legislation and incorporated into public policy and to what extent these policies on adaptation to climate change translate into risk management instruments. The international instruments represent a combination of the common interests of several countries in the pursuit of a balanced environment, assuming an agenda that aims at equating the impacts of populational growth, the advances of the productive process and the harmful potential of human activity on the environment, guaranteeing access to natural resources for present and future generations

The implementation of the Convention at the national level, Brazil has performed a robust legislative framework dedicated to environmental issues and the management of risks from climate change. However, there

is still a long way to undergo to effectively implement these policies, since they are often in touch with decisions that value the economic rather than social, environmental, and cultural aspects. The policy documents analyzed in this study reflect that strategies that are not seen in an integrated way, being assumed by different governmental sectors, with isolated and disarticulated agendas. In addition, knowledge gaps are a major challenge for the management of climate risks, since they make it impossible to propose strategic adaptation measures.

Participatory approaches are considered essential components of environmental and risk governance. They aim to develop the capacity of communities to adapt to risks. The study showed that the guiding principles internationally established, like those adopted under the Conventions, require robust efforts from national policies and related legislation to ensure that the expected aims are fully reached.

The analysis of the National Plan for Adaptation to Climate Change contributed to identify the gaps and limitations deterring the coherence and effectiveness of the National Policy on Climate Change (PNMC). Thus, we identified the absence of risk studies, the lack of prediction of the criteria for the evaluation process of the plan, the lack of coordination among the strategic sectors, the non-demarcation of scales and the limitations of the participatory process as main challenges to be overcome in the scope of the PNA, ensuring their contributions to risk management within the framework of the national environmental governance process.

In conclusion, the methodology was limited to provide an overview of the policy, considering that it is composed of other instruments that were not analyzed in this study, which is why the need for new studies is identified, encompassing the other instruments resulting from the PNMC, making it possible to provide sufficient information to better understand and evaluate the implementation of the international conventions on climate change in Brazil, and thus to propose more consistent contributions to the effectiveness of the policy.

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