

Universidade de Brasília
Instituto de Relações Internacionais
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**Measuring subnational actors' commitment
to global climate governance: inferences
from multilevel and polycentric approaches
for two cases in Brazil - the states of Mato
Grosso and Pará**

Thais Lemos Ribeiro

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Measuring subnational actors' commitment to global climate governance: inferences from multilevel and polycentric approaches for two cases in Brazil - the states of Mato Grosso and Pará

Ph.D. Dissertation submitted in partial fulfillment of the Doctor Degree of International Relations requirements on International and Comparative Politics line of research from the International Relations Institute of the University of Brasilia.

Supervisors:

Professor Dr. Cristina Yumie Aoki Inoue
Professor Dr. Carlos Marcos Batista

Examination board

Professor Dr. Cristina Yumie Aoki Inoue (supervisor)

Professor Dr. Eduardo Viola (IREL/University of Brasília and Fundação Getúlio Vargas)

Professor Dr. Pierre Mazzega (French National Centre for Scientific Research - CNRS)

Professor Dr. Sander Chan (Copernicus Institute of Sustainable Development, Universit t Utrecht)

Professor Dr. Ana Flavia Barros (surrogate member – IREL/University of Bras lia)

Abstract

This multi-method research explores climate commitment at the subnational level in Brazil. The subnational level is the immediate level after the national government. The Anthropocene, a new geological epoch, brings to perspective an endangered world, in which climate change is a main civilizational driver, federated countries have a relevant role in global climate governance as major GHG emitters, among which Brazil is considered a climate power. The research question is how subnational governments commit to global climate governance. It explores Brazilian 27 states and makes a contribution to research about the role of Global South subnational actors in global climate governance. The theoretical framework addresses multi-level and polycentric approaches for global climate governance through six dimensions to differentiate them in analytical and normative terms. Climate commitment and paradiplomacy concepts complement the theoretical framework, which is the point of departure for developing the Subnational Climate Commitment Index – a tool to measure climate commitment at the subnational level in Brazil. The index composition quantifies a policy profile, which addresses governance processes, and an emission profile, based on emissions trajectory. The results from statistical inferences and the principal component analysis indicate that governance processes at the subnational level are not necessarily translated into a decarbonization trend and point to two cases for investigation by process-tracing according to a most-similar design – Mato Grosso and Pará. The research's results are not generalizable because of the methodological choices, but they revealed a pressure on Amazonian states for action and that climate federalism – the division of authority for climate action between federated units - is a relevant element of climate commitment at the subnational level for the two cases. Future research agendas regarding Brazilian subnational units' climate commitment are the investigation of the role of transnational networks in climate commitment and a compensation mechanism among subnational governments.

Keywords: global climate governance; multi-level governance, polycentric governance; subnational climate commitment; climate federalism.

Resumo

Esta é uma pesquisa multi-métodos que explora o compromisso climático em nível subnacional no Brasil. O nível subnacional é definido como aquele imediatamente posterior ao governo nacional. O Antropoceno, uma nova época geológica, apresenta a perspectiva de um mundo ameaçado, no qual a mudança global do clima é um dos principais vetores civilizatórios, países de regime federado têm um papel na governança global do clima como grandes emissores de gases de efeito estufa, dentre os quais o Brasil é uma potência climática. A pergunta de pesquisa é como governos subnacionais se comprometem com a mudança global do clima. O estudo analisa os 27 estados brasileiros e contribui para a agenda de pesquisa sobre o papel de atores subnacionais do Sul Global na governança global do clima. O referencial teórico utiliza as abordagens multinível e policêntrica para a governança global do clima e considera seis dimensões para diferenciá-las em termos analíticos e normativos. Os conceitos de compromisso climático e paradiplomacia complementam o referencial teórico, que é o ponto de partida para o desenvolvimento do Índice Subnacional de Compromisso Climático - uma ferramenta para medir o compromisso climático em nível subnacional no Brasil. O índice é composto pela quantificação de um perfil de políticas, que analisa processos de governança, e um perfil de emissões, que apresenta a trajetória de emissões. Os resultados das inferências estatísticas e da análise de componentes principais indicam que processos de governança no nível subnacional não são necessariamente traduzidos em uma trajetória de descarbonização e apontam para dois casos para investigação por rastreamento de processos segundo um desenho de casos mais semelhantes – o Mato Grosso e o Pará. Os resultados da pesquisa não são generalizáveis por causa das escolhas metodológicas, mas revelam que existe uma pressão sobre estados amazônicos para ação e que o federalismo climático – a divisão de autoridade para ação climática entre unidades federadas – é um elemento relevante do compromisso climático para os dois casos. As futuras agendas de pesquisa sobre o compromisso climático das unidades subnacionais brasileiras são a investigação de redes transnacionais e seu papel para o compromisso climático e um mecanismo de compensação entre governos subnacionais.

Palavras-chave: governança global do clima; governança multi-nível; governança policêntrica; compromisso climático subnacional; federalismo climático.

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Acronyms and abbreviations

Abema – Associação Brasileira de Entidades Estaduais de Meio Ambiente (Brazilian Association of State Environmental Entities)

CAR – Cadastro Ambiental Rural (Environmental Rural Registry)

CBC – Centro Brasil no Clima (Brazilian Climate Center)

CBDES – Conselho Empresarial Brasileiro para o Desenvolvimento Sustentável (Brazilian Business Council for Sustainable Development)

CBMC – Conferência Brasileira de Mudança do Clima (Brazilian Conference on Climate Change)

CCT-PACT – Câmara Consultiva Temática sobre Pacto Federativo (Thematic Consultative Chamber on the Federative Pact)

CDP – Climate Disclosure Project

Conama – Conselho Nacional do Meio Ambiente (National Environmental Council)

CONAREDD+ - National Commission for the Reduction of Greenhouse Gas Emissions from Deforestation and Forest Degradation, Conservation of Forest Carbon Stocks, Sustainable Management of Forests and Increase in Forest Carbon Stocks

COP – Conference of the Parties

CPO – Causal Process Observations

FBMC – Fórum Brasileiro de Mudança do Clima (Brazilian Forum on Climate Change)

GCAP – Global Climate Action Portal

GCF-TF – Governors' Climate & Forests Task-Force

GDP – Gross Domestic Product

GIZ - Deutsche Gesellschaft für Internationale Zusammenarbeit

IBGE – Instituto Brasileiro de Geografia e Estatística (Brazilian Institute of Geography and Statistics)

ICLEI – Local Governments for Sustainability

IDESAM – Instituto de Conservação e Desenvolvimento Sustentável da Amazônia (Institute of Conservation and Sustainable Development of the Amazon)

IR – International Relations

KKV – King, Keohane and Verba

LAI – Lei de Acesso à Informação (Right to Information Law)

LPAA – Lima-Paris Action Platform

LULUCF – Land use, land use change and forests

LUCF – Land use change and forests

MCTI – Ministério da Ciência, Tecnologia e Inovação (Ministry of Science, Technology and Innovation)

MMA – Ministério do Meio Ambiente (Ministry of Environment)

MRE – Ministério das Relações Exteriores (Ministry of Foreign Affairs)

MRV - Measurement, Reporting and Verification

NAFC - Núcleo de Articulação Federativa para Clima (Federative Climate Articulation Center)

NDC – Nationally Determined Contribution

NSAs – Non-state actors

NYDF – New York Declaration on Forests

OC – Observatório do Clima (Climate Observatory)

PCA – Principal Component Analysis

PMDB – Partido do Movimento Democrático Brasileiro (Brazilian Democratic Movement Party)

PNMC – Política Nacional de Mudança do Clima (National Policy for Climate Change)

PPA – Plano Plurianual (Plurianual Plan)

PPCDAm – Plano de Ação para Prevenção e Controle do Desmatamento na Amazônia Legal (Action Plan for the Prevention and Control of Deforestation in the Legal Amazon)

PPG7 - Pilot Program for the Protection of Brazil's Tropical Forests

PPS – Partido Popular Socialista (Popular Socialist Party)

PSB – Partido Socialista Brasileiro (Brazilian Socialist Party)

PSDB – Partido da Social Democracia Brasileira (Brazilian Social Democracy Party)

PT – Partido dos Trabalhadores (Brazilian Workers' Party)

REM – REDD+ for Early Movers

SCCI – Subnational Climate Commitment Index

SCCP – State Climate Change Policies

SEEG – Sistema de Estimativa de Emissões de Gases de Efeito Estufa (System for Estimating Greenhouse Gas Emissions)

SIOF – Sistema Integrado de Planejamento e Orçamento (Integrated Planning and Budgeting System)

SIRENE – Sistema de Registro Nacional de Emissões (National Emissions Registry System)

SPIPA - Strategic Partnerships for the Implementation of the Paris Agreement

SSG – Subnational state government

TCU – Tribunal de Contas da União (Federal Court of Accounts)

TFA – Tropical Forests Alliance

TN – Transnational network

UNEP - United Nations Environmental Program

UNFCCC – United Nations Framework Convention on Climate Change

WRI – World Resource Institute

INTRODUCTION – THE GENERAL PLAN

The Summary for Policymakers (SPM) of the Working Group II (WGII) contribution to the Sixth Assessment Report (AR6) of the IPCC (2022: 7) recognizes the “interdependence of climate, ecosystems and biodiversity, and human societies” and addresses the risk of increasingly “severe, interconnected and often irreversible impacts of climate change on ecosystems, biodiversity, and human systems”. Central and South America face the risks to water and food security, health effects due to increasing pandemics and damages to life and infrastructure from floods, sea level rise, storms, erosion and landslides. Multiple risks of at least medium confidence level – loss of biodiversity, economic decline, degradation of ecosystems, urban infrastructure damage, impact on human well-being, among others - are spread worldwide (IPCC, 2022: 19).

We live in an endangered world, with environmental threats, socio-economic turbulence, the alteration of the geopolitical map (Lövbrand et al., 2020) and climate change as a main civilizational driver (Viola et al., 2013). The planetary boundaries¹ (Rockström et al., 2009) are evidence of this scenario. Two of them - climate change and biosphere integrity - are considered core planet boundaries because they are regulated by the other boundaries, operate at the level of the whole Earth System, and give other boundaries the planetary system to operate (Steffen et al., 2015b; Burke et al., 2016).

While the centrality of climate change does not ignore the other planetary boundaries’ importance, the path from dangerous to catastrophic climate change is one of the main drivers of the Anthropocene (Steffen et al., 2015b; Harrington, 2016; Bai et al., 2016; Veiga, 2019; Pereira and Viola, 2019 and 2020), with systemic impacts (Viola et al., 2013) and security concerns (Harrington, 2016: 15; Simangan, 2020: 216). Considering that even if all the measures presented at COP 21 by the INDCs are fully implemented, 55 Gtons of CO_{2e} are expected to

¹ Planetary boundaries are biophysical processes of the Earth System, with boundaries defined as “human-determined values of control set at a ‘safe’ distance from a dangerous level (for processes without known thresholds at the continental to global scales) or from its global threshold.” (Rockström et al., 2009: 3). Trespassing a boundary may trigger non-linear changes and “challenging social-ecological resilience at regional and global scales.” (5).

be emitted by 2030, a scenario that is not compatible with an increase in temperature lower than 2°C (Paragraph 17 of the Adoption of the Paris Agreement²). It also considers that the international system is under a conservative hegemony, which means that climate conservative countries are the majority powers (defined as climate powers) in the international system (Viola et al., 2013) and that the international regime under the United Nations framework and its institutions are no longer capable of coping with climate change solely.

A rank of the major greenhouse gas emitters shows that six out of ten countries are federated regimes. Together, they account for 16.65 Gton of CO_{2e} emissions, which are 52% of total GHG emissions in this ranking. Federated regimes are those in which there is autonomy and interdependence among federated units (Abrucio and Sidow, 2018). Following Selin and VanDeveer's (2012) work on multilevel governance and comparative federalism, the study of federal systems allows the analysis of differences and similarities based on similar patterns of decision-making and authority division.

This is a research about how subnational actors commit to global climate governance. There is extensive literature about city engagement and commitments, but research about the intermediate level comprised of regions, provinces, and states seems to have not reached the same development (Andonova et al., 2009: 52; Happaerts, 2012: 128; Setzer, 2015; Macedo and Jacobi, 2017: 4). In such a context, research about the subnational level can be especially relevant.

Also, since 2009, there has been a growing trend toward greater decentralization of the climate change international regime, with a shift from top-down architecture, with monocentric tendencies, towards a more bottom-up architecture with more polycentric features (Jordan et al., 2018a; Slaughter, 2016; Van Asselt and Zelli, 2018). The literature in IR about global climate governance refers to this phenomenon of decentralization through two theoretical approaches: multi-level and polycentric governance. Sometimes, they are used as synonyms, sometimes they are presented separately. I consider that there is

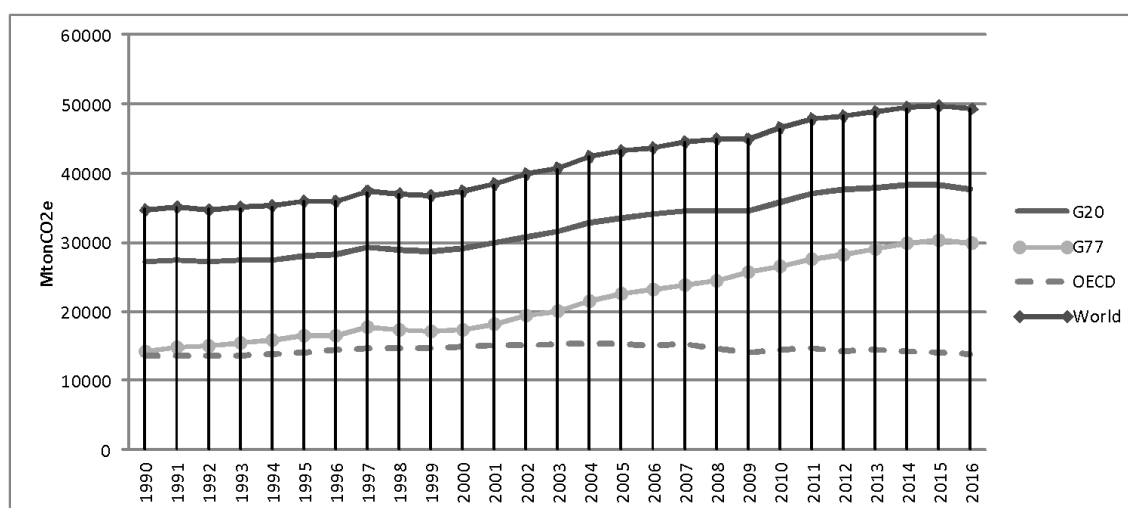
² See FCCC/CP/2015/L.9/Rev.1 Available at <https://unfccc.int/resource/docs/2015/cop21/eng/l09r01.pdf>. Access on July 4th, 2017.

a need for a clear differentiation between both approaches in order to use them as analytical lenses.

The Anthropocene is a contextual condition in this research (Earth System Governance Project, 2018). It is a new geological epoch in which humanity is the main driver of change. The definition of a geological epoch considers stratigraphic evidence - fossils, sediments, chemicals, etc. They are "reference points on stratigraphic sections of rock which define the lower boundaries of stages on the geologic time scale" (International Commission on Stratigraphy, 2021).

There is no consensus over the beginning of the Anthropocene, a debate based on global political processes. Some consider human impacts on the Neolithic (erosion and deforestation processes) and on Pleistocene/Holocene (large mammal extinction), or the 1610 Orbis dip and the Colombian exchange, which marks CO₂ stark reduction due to millions of people deaths and the emergence of a global trading network. However, the most common markers are the Industrial Revolution in the XIX century and the Great Acceleration in XX century's second half, with the nuclear bomb fallout of 1964 (Steffen et al., 2015a; Harrington, 2016; Léna and Issberner, 2017).

Graph 1 - GHG emissions including LULUCF from 1990 to 2016



Source: CAIT Climate Data Explorer. 2019. Country Greenhouse Gas Emissions. Washington, DC: World Resources Institute. Available online at: <http://cait.wri.org>. Access on August 9, 2020.

The Great Acceleration sheds light on trends in the international system that go beyond the developed-developing countries' divide on international climate regime, primarily based on the common but differentiated responsibilities. It highlights justice and equality issues beyond historical emissions trends, such as the unequal impacts of global climate change. For instance, while population growth mainly occurred in non-OECD countries, GDP growth and consumption were concentrated in OECD countries. GHG emissions have faced a shift, primarily due to China's increase since 2005 (see Graph 1). This context is one of the reasons that Viola et al. (2013) and Viola and Franchini (2018) present the necessity of a different theoretical approach to global climate governance, emphasizing international political economy aspects.

This work considers the Great Acceleration the beginning of the Anthropocene, based on Steffen et al. (2015a), because of the deeper patterns of transformations of major Earth systems' structures and functioning, and socio-economic trends of contemporary society with global scale: atmospheric composition, stratospheric ozone, water and nitrogen cycles, marine ecosystems, land systems, tropical forests and terrestrial biosphere degradation, population, economic growth, resource use, urbanization, globalization, transport, and communication. Also, because it better captures the position of Brazil in the international system as a climate power of moderate-conservative to conservative position.

The definition of the Anthropocene as a new geological epoch has impacts on International Relations (IR) as a field of study (Bai et al., 2015; Harrington, 2016; Lövbrand et al., 2020; Simangan, 2020; Pereira, 2017 and 2021). For global political processes, one implication is that institutions and policies based on Holocene patterns have not been able to cope with current biophysical changes. Therefore, there is a need for long-term and collective actions by public and private actors at local and global scales (Pereira, 2021: 4). Also, scientific knowledge has not necessarily been translated into political actions (Harrington, 2016; Franchini et al., 2017).

Rocha (2002: 27) defines a field of study by its problems, concepts, conceptual systems, and methods used to conceive and make sense of these problems. The changes in the Anthropocene questions the problems, concepts,

and conceptual systems' definition in the IR field. It also sheds light on traditional methods application, crafted considering the Holocene stability patterns, and its limitations to cope with the new dynamics (Simangan, 2020). This debate within IR was summarized by Lövbrand et al. (2020) in three perspectives: the endangered world, the entangled world, and the extractivist world.

Having this setting as a point of departure, in which climate change is a wicked problem with intersection in biophysical and socioeconomic systems, the first contribution of this research, presented in Chapter 2 is to set a sound theoretical framework for this complex context - a distinction between polycentric and multi-level approaches for global governance architecture and to link the climate commitment concept to them. These approaches are not considered synonyms because they have analytical and normative differences that have consequences for the description, explanation, and understanding of the phenomenon under study. The theoretical framework does not assume global climate governance as given and static while assessing a unilateral top-down perspective. It considers the co-constitutive nature of actors and the global climate governance system, in which actors make governance elements and, at the same time, are influenced by them.

Looking beyond the nation-state and searching for how subnational governmental actors commit to global climate governance based on the multi-level and polycentric approaches to global climate governance is a further step in the endangered world with a catastrophic perspective of the Anthropocene. It examines alternatives for global governance and political coordination at the global level, recognizing that Holocene's patterns cannot be reestablished and the necessity to develop new capacities and governance elements.

Broadly defined, multi-level governance implies Hooghe and Marks' (2003) type I of governance, which, although based on scale flexibility, operates with clearly defined levels and limited power-sharing. Polycentric governance, based on Elinor Ostrom's (2010a and 2010b) theoretical developments and Hooghe and Marks (2003) type II governance, is defined as a system with dispersed political authority among different units, overlapping jurisdiction, multiple decision-making centers, and less hierarchical relationship (Jordan et al., 2018a). To understand how different they are, in analytical and normative terms, I present a theoretical

framework based on six dimensions – governance architecture, overarching rules, authority diffusion, power dynamics, the interaction between state and non-state actors, and transaction costs.

According to Eco (1977: 2), the originality of a thesis in social sciences can be based on the “reorganization and rereading of previous studies that lead to systematization and a maturation of ideas that were dispersed in other texts.” This is exactly the aim of this research, based on the question ‘how subnational governmental actors commit to global climate governance’, and the exploration of two cases of subnational governments in Brazil – Mato Grosso and Pará. Subnational governments are defined as the first level of authority after the central government, and polycentric and multi-level theoretical approaches to global governance are used to answer the research question.

Because it is based on a federated country, the research question considers the interplay between local, national, and global levels, and the context-specific nature of autonomy, innovation, and experimentation in federated regimes countries in global climate governance. The literature review in Chapter 1 evidences a research gap about Global South subnational units. Therefore, this research makes a contribution to filling this gap by focusing firstly on how the 27 Brazilian subnational units’ climate commit to global climate governance by the Subnational Climate Commitment Index (SCCI), followed by a detailed assessment of two Brazilian subnational units – Mato Grosso and Pará. The cases investigation uses process-tracing, interviews and primary and secondary sources to understand subnational actors’ commitment to global climate governance according to the influence of international policy-making on subnational governments (a global to subnational approach) from a Global South perspective.

For Brown (2012), the International Relations discipline considers that nation-states have to deal with internal collective action, but it is considered a unitary actor because of a unified authority. The use of federalism helps to unveil internal dynamics, and the combination with the multi-level and polycentric theoretical approaches to global governance as the analytical tool allows the understanding of how governance processes’ dynamics happen between the multiple levels (Selin and Vandever, 2012) considering authority diffusion, the

relationship between national governments and other public and private actors, among other dimensions of the problem under research.

The research's second contribution is the focus on subnational governmental actors. Happaerts (2012: 128) has claimed the existence of a research gap about the efforts of subnational governments on governance for sustainable development. There is, however, the field of comparative regionalism and federalism with work on the activities of subnational governments in the international arena. Selin and Vandever (2012) present comparative federalism by the multi-level approach, combining research both at domestic and international levels, and Keating (2013) describes motives, opportunities, and strategies used by regions to get involved in the international arena. Most studies of comparative federalism and climate policy are focused on Global North subnational units. This research adds up to the works of Setzer (2013 and 2015), Macedo and Jacobi (2019), and Anderton and Setzer (2019), going beyond the State of São Paulo and assessing the 27 Brazilian subnational units and how they commit to global climate governance.

For that, I use two middle-range theories (Lake, 2013) to complement the grand theory of global governance: climate commitment (Viola and Franchini, 2018) and paradiplomacy (Setzer, 2013 and Schiavon, 2019). The theoretical framework also dialogues with the concepts of transnational networks (Andonova et al., 2009), policy diffusion (Tosun, 2018), and orchestration (Abbot, 2018; see also Gupta et al., 2015b; Bulkeley et al., 2018; Heidjen, 2018; and Mauad, 2018). Finally, it is the ground to develop a methodological contribution – the development of a climate commitment index for subnational units.

The notion of commitment implies the idea of a promise - a claim of performance. Instead, based on the notion of modified structuralism (Krasner, 1982), commitment in this research refers to engagement, specifically to a governance system. Thus, commitment is a descriptive concept for behavior. The research question aim is to understand the phenomenon of *how subnational units commit to global climate governance*, a question that has academic and policy-making implications. The answer to this research question is structured in three hypotheses:

H1: *Subnational actors' commitment is related to the global governance institutional core, represented by the UNFCCC;*

H2: *Subnational actor's commitment is complementary to national positions;*

H3: *Subnational actors commit to global climate governance through transnational actions.*

The hypothesis identified in mainstream literature is that subnational government actions are framed according to the United Nations Framework Convention on Climate Change (UNFCCC), the overarching framework for global climate governance, and to their respective central governments' positions, which are the main actors and negotiators in this governance institutional core and to whom they should play a complementary role. Therefore, the analytical causal perspective is top-down³.

Andonova et al. (2009: 57-58) consider that the political landscape of the climate regime, which was not able to establish specific obligations for key players like the USA, China, Brazil, and India, was conducive to integrating other actors, like subnational governments, to coalitions and governance practices. For Chan et al. (2016 and 2018), Hale (2016), and Bäckstrand et al. (2017), there is a trend for a bottom-up approach to establish climate national commitments, consolidated at COP-21 in Paris, with an increased role for non-state actors (private and public). There are many events cited to explain this trend, like the demise of COP 15 in Copenhagen (Hale, 2016) and how it paved the way to a more fragmented climate governance, nevertheless the evidence of non-state actors (NGOs, business, and local governments) present as 'activists, together

³ The research question could be inverted in order to understand the link between transnational climate action and global climate governance according to a bottom-up perspective (Andonova et al., 2009: 64; Chan et al., 2016: 241). The research question, then, could be: 'how global climate governance responds to subnational actors' agency', having subnational actors' agency as an assumption. However, the choice to use the climate commitment concept fits better in a top-down perspective, because the action of commitment implies the global climate governance to be committed to.

with experts and diplomats' at UN negotiations on global climate since the 1990s (Hochstetler and Keck, 2007; Bäckstrand et al., 2017: 563-564).

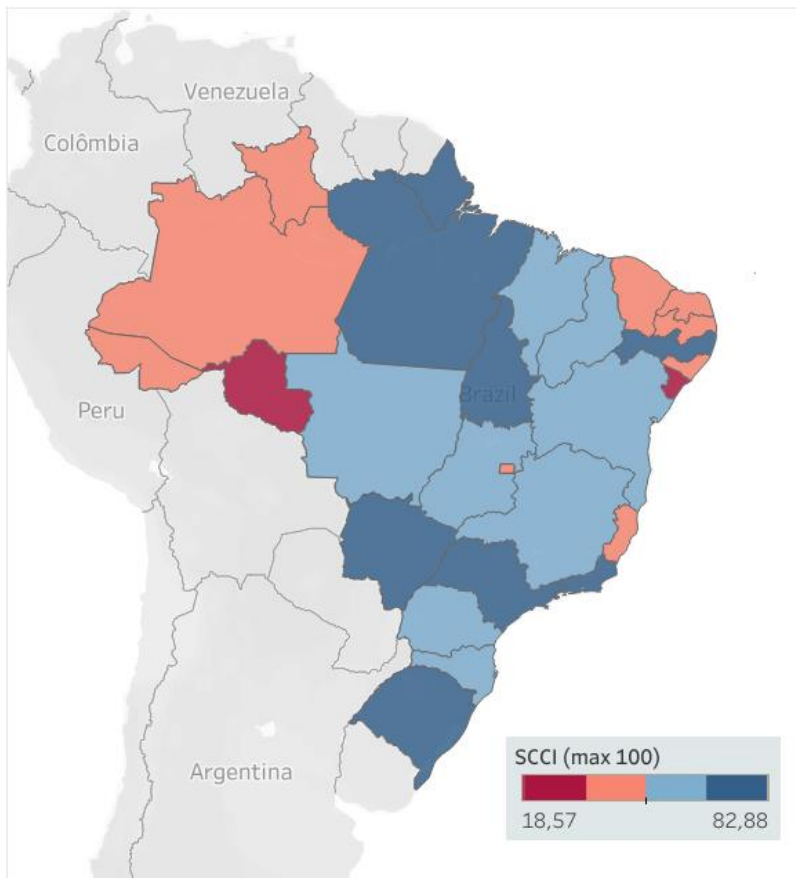
The Paris Agreement (COP 21), although recognizes and gives visibility to non-state actors' actions (Chan et al., 2016), does not present a clear framework for their role beyond being complementary to national actions either by supporting national NDCs or monitoring them, with an assumption of a non-conflictive relationship between levels. Therefore, for Chan et al. (2018: 25), there is a recognition for non-party stakeholders' efforts to achieve climate mitigation gaps and adaptation in the short term. However, it is not yet possible to know what their actual contribution is and, consequently, how much we should rely on them.

One of the challenges identified in the literature assessed is to measure the impact of subnational governmental actions on climate change mitigation and a broad decarbonization process (Chan et al., 2016; Van der Ven et al., 2017). Chan et al. (2018), for instance, make an analysis based on subnational actors' outputs and their impacts.

My contribution to overcoming this research gap (and the dissertation third contribution) is the Subnational Climate Commitment Index (SCCI), which allows the comparison of subnational actors' commitment to global climate governance based on their emission and policy profiles. Climate commitment measures the outcome of institutional effectiveness in terms of a change of behavior at the subnational level. The policy profile considers both domestic and international policies (e.g. participation in international cooperative initiatives and orchestration platforms), trying to reach beyond the governance institutional core. This index is based on Viola and Franchini's (2018) climate commitment approach, with the due adaptations to apply it to the subnational level.

The results for the SCCI between 2010 and 2018 are São Paulo with the highest score (82,88) and Rondônia with the lowest (18,57). Mato Grosso and Pará are the two subnational units with the highest GHG emissions in the country. Although they had a similar policy profile score, they had different emissions profiles, which resulted in a higher SCCI for Pará. SCCI results and supplementary readings of the data used to calculate it are available at <https://public.tableau.com/app/profile/thais.ribeiro/viz/SCCI/Histria1>.

Figure 1 – SCCI scores for 27 Brazilian subnational units



Source: Author's elaboration with Tableau Public Software.

The SCCI does not measure subnational government actions impacts. In the lack of specific guidelines and widely shared measurements to evaluate and compare the progress of subnational actors' actions, the SCCI can be a tool to understand national and cross-countries subnational governments' commitment to climate governance and different dynamics among the subnational units from the same country. However, the index's development in this research allows comparisons only between Brazilian subnational units because the results are analyzed by the principal component analysis statistical method. Nevertheless, it points to a possible avenue for further research for a broader sample of subnational units.

According to Viola, Franchini, and Ribeiro (2013) and Viola and Franchini (2018: 9) the institutional core element of global governance has been having a

diminished role in understanding global climate governance dynamics. Ribeiro and Inoue (2018) consider that institutional developments are relevant in understanding actors' behavior and agency in global governance. Climate commitment for subnational actors follows Ribeiro and Inoue's (2018) assertion, based on a modified structural position (Krasner, 1982) that places institutional elements between the political economy of climate change and subnational actors' behavior. This approach confers a more inclusive role to subnational governments' actions, which can be complementary or conflictive with the national government's position in global climate governance.

Considering that climate commitment is a complex process, however, I understand the Subnational Climate Commitment Index limitations to exploring subnational units' behavior in global climate governance. Chapter 3 presents the index's methodology - an aggregate result of a policy profile, comprised of governance processes, and an emissions profile, according to Viola and Franchini's (2018) climate commitment approach and with the due adaptations to the subnational level. A positive correlation between both profiles means that higher results at the policy profile (existing laws, plans, programs, and paradiplomacy) would have, as consequence, better results at the emissions profile. However, it is possible that the policy profile has a negative correlation with the emissions profile (favorable or unfavorable), due to other factors such as the role of local political leadership, local capacity building, association with transnational networks, or the different weights of the policy profile variables.

It is relevant to stress, nevertheless, that the correlation between the profiles could be new research on its own terms. The aggregate result of both profiles - the overall result - is the subject of this research and offers a wide picture of Brazilian subnational units' climate commitment, conducive to research based on process-tracing that helps to conceptualize and analyze climate commitment as an institutional outcome. The statistical inferences from SCCI help to identify and analyze how actors respond at this intermediary level and shed light on important variables to understand the dynamics of this governance system from global to local. This is especially relevant in federated regimes and in cases where subnational entities' behavior can differ substantially from the national state to which it is attached (Selin and Vandeever, 2012).

The states of Pará and Mato Grosso are the object of a qualitative in-depth analysis of cases based on interviews, and primary and secondary sources for each subnational unit. This is the fourth contribution of this work since this analysis allows the identification, description, and understanding of how these two Brazilian subnational governments commit to global climate governance according to a causal mechanism. Considering the three hypotheses, this causal mechanism contains three elements: institutional prescriptions, climate federalism, and transnational actions to explain climate commitment according to the global climate governance institutional core. Mato Grosso had more primary sources (e.g., forum meetings reports) than Pará, for which secondary sources were available. Because of the COVID 19 pandemic, all interviews were online, but all interviewees were very cooperative. The interviews were based on a semi-structured script, available in Appendix 4, and are not transcribed because they were conducted in Portuguese.

In summary, the research you are about to read departs from two analytical lens for global climate governance (multi-level and polycentric) to assess global climate governance architecture through a subnational perspective. The theoretical framework in Chapter 2 differentiates the two approaches according to six dimensions - governance architecture, overarching rules, authority diffusion, power dynamics, the interaction between state and non-state actors, and transaction costs. Based on analytical eclecticism, which accommodates concepts, methods, problems and arguments from different research practices (Sil and Katzenstein, 2010), this chapter finishes by bringing the concepts of climate commitment and paradiplomacy to the theoretical framework.

I contend that answering the research question of how subnational governmental units commit to global climate governance calls for multi-method research in Chapter 3. As stated by Sil and Katzenstein (2010: 415), “any attempt to investigate the interaction between general macro and micro-level processes and specific contextual factors would benefit from attention to different kinds of approaches employing different techniques of empirical analysis”.

Therefore, the methodological framework is based on Young’s (2008b and 2019) diagnostic method, statistical methods to draw descriptive inferences from Brazilian subnational governments’ climate commitment, and process-tracing. It

uses primary and secondary sources, public data, and interviews related to subnational units' commitment to climate change mitigation in Brazil, with the investigation of two the particular cases.

The statistical method is developed through the proposition of the Subnational Climate Commitment Approach (SCCI), considering why to use an index, what are the data, how they are transformed, how the index is calculated, which are its limitations and results. The data is also read through the principal component analysis in an effort to overcome some of the SCCI's limitations. Process-tracing employment follows the explaining-outcome type guidelines as presented by Beach and Pedersen (2016).

From a global to a subnational picture, this study depicts the governance system institutional core developments through a subnational lens, presents transnational networks for subnational actors' engagement by their main function, and the Brazilian national climate commitment according to Viola and Franchini (2018) timeline in to set the stage for subnational Brazilian governments climate actions. The sequence of ideas to set this stage is the introduction of the role of federated regimes in global climate governance and the specific context of Brazil in Chapter 1. Then, it presents UNFCCC historical account and the development of transnational networks in Chapter 4. This chapter's last section presents each subnational unit commitment through the SCCI.

Finally, the research looks for causal mechanisms to explain the climate commitment of Mato Grosso and Pará through process-tracing by a "most-similar" design – they are the two biggest GHG emitters among Brazilian subnational units, with a similar emission profile, mainly based on land use, land-use change, and deforestation. Therefore, the research design looks for differences in a similar context (Sartori, 1991). Process-tracing is used to explain outcomes (Beach and Pedersen, 2016) and address causal properties through a constitutive explanation (Finnemore and Sikkink, 2001). Yet, as process-tracing is case-centered, the case-specific mechanism cannot be generalized. Nevertheless, the theoretical and methodological framework here presented may be applied to other cases in order to increase the number of cases under study, and, for that, the understanding of federated regimes dynamics is relevant.

The conclusion resumes all five chapters. The spoiler is that the multi-level approach is the more adequate theoretical lens for understanding Brazilian subnational units' commitment to global climate governance. SCCI results point out that there is no positive correlation between policy and emissions profile for Brazilian subnational units, and subnational units with similar policy profile scores can have different emissions profiles. The qualitative assessment of the data and the interviews also showed a pressure on Amazonian states for action, a finding that reinforces the "deforestation buffer" described by Viola and Franchini (2018) for climate action in the country.

And finally, the analysis of Mato Grosso and Pará SCCI results may seem counterintuitive, but the causal mechanism shows that climate federalism – how authority is divided between federated units for climate action - is a relevant driver to explain the two Brazilian subnational units' climate commitment, while institutional prescriptions and transnational actions were mostly related to REDD+ projects, which was not considered by the Brazilian government, according to Hoff et al. (2015: 43) as a "leading instrument for international climate change mitigation efforts." Considering Brazilian current climate commitment, this research's findings offer a broad understanding of international institutional prescriptions from a global to subnational perspective and presents support for policy-making and climate action in Brazil to foster climate commitment at both national and subnational levels in the country.

CHAPTER 1 – RESEARCH CONTEXT

This chapter presents the broader context for this research and introduces some of its hypotheses. It is divided in two parts. The first shows how countries with federative regimes and their specific dynamics are relevant to global climate governance and the emergence of a field of research dedicated to climate federalism. The second presents Brazil, a country with a federative regime, as a moderate-conservative climate power in an international system of conservative hegemony and how the knowledge about the country is relevant for this research development.

1.1 Climate federalism - how federated regimes dynamics are relevant to global climate governance

There is a body of literature called comparative federalism⁴ that studies similarities and differences between federated systems (Selin and Vandeever, 2012; Brown, 2012). According to Brown (2012), there is growing interest in comparative federalism and global climate policy for two reasons. First, the definition of a federated regime captures the nature of the problem (a collective action problem) and state authority (not unified, as some international relations theories assume). The division of authority – expressed in climate federalism - would allow for better and more sustainable mitigation and adaptation measures because climate change is a multi-level problem.

The second reason for the growing interest in climate federalism is because six out of the ten major GHG emitter countries in 2018 were federated regimes, according to CAIT Data Explorer emission data for all GHG emissions, including land-use change and forests (LUCF) in MTCO_{2e} in 2018 (the last year available in the historical database series)⁵. The constitutional division of power in each of

⁴ For a detailed assessment of comparative federalism, see Burgess, Michael. 2006. *Comparative Federalism. Theory and Practice*. Oxon: Routledge, and Hueglin, Thomas O. and Fenna, Alan. 2015. *Comparative Federalism. A Systematic Inquiry*. New York: University of Toronto Press.

⁵ European countries are considered together as European Union, not separately. If EU 27 was excluded and European countries considered separately, Germany, a federal parliamentary republic, would be included in 9th place, with 8,776.61 MTCO_{2e}.

them varies. However, the understanding of this interplay between levels offers ground for new propositions in climate action by subnational actors.

Table 1 - Rank of ten major GHG emitters in 2016 in MTCO_{2e}, including LUCF

Country	GHG emissions in MTCO _{2e} in 2018	Government type
China	11,705.81	Communist party-led state
United States	5,794.35	Constitutional federal republic
India	3,346.63	Federal parliamentary republic
European Union (27)	3,333.16	Federation
Russia	1,992.08	Semi-presidential federation
Indonesia	1,703.86	Presidential republic
Brazil	1,420.58	Federal presidential republic
Japan	1,154.72	Parliamentary constitutional monarchy
Iran	828.34	Teochratic republic
Canada	763.44	Federal parliamentary democracy under a constitutional monarchy

Source: Author's elaboration based on CAIT Data Explorer (2019) and CIA Factbook, available at <https://www.cia.gov/library/publications/the-world-factbook/>. Access on September 27, 2020.

Adler (2008), in an analysis of California weaver's request regarding its state policy for emissions control of new motor vehicles, presents a more pessimistic scenario of subnational governmental actors' impact on climate change mitigation because of its very nature as a collective action problem. Since sub-state governments' actions do not reach the necessary level of impact, there would be increased incentives for freeriding. Therefore, climate change policies developed by sub-state governments have a problem of fit regarding the level of action, potential higher transaction costs (that could be tackled, for instance, by national standards), and the problem of leakage. The virtue of what the author calls climate federalism (a division of authority in climate change policy) is experimentation, which can inform national actions.

Multi-level and polycentric theoretical approaches for global governance address the debate about the nature of the problem and the level of action. Jänicke's (2017: 110) definition of multi-level climate governance as a system considers that, in a multi-level system, each level has a specific role. Therefore, it is not expected that subnational actions will address climate change individually in the global climate governance system: at each level, there are specific

responsibilities, challenges, and opportunities, and interactions of impulses at different levels can have a combined effect on the overall system.

Chapter 2 presents Ostrom's (2010) concept of polycentric governance and how it changes climate framing as a collective action problem based on self-organization in different scales and less hierarchical arrangements (Jordan et al., 2018a). In this matter, there is also empirical ground: Gordon (2015: 121), for instance, considers that the "country-driven" approach for climate action initiated at Copenhagen COP 15 in 2009 shifts the burden of collective action from the international to the domestic arena.

Brown (2012), Gordon (2015), Jörgensen et al. (2015), and Schiavon (2019) present different categories of subnational and central authority coordination and diffusion. Gordon (2015) presents a two-element model for the production of coordinated climate governance: adequacy over governance-defined objectives and scientific consensus, and harmony between jurisdictional engagements, based on a clear definition of authority. Schiavon (2019) focuses on paradiplomacy and defines subnational and central authority coordination according to (i) constitutional powers attributed to subnational governments to conduct international relations and (ii) subnational governments' participation in national foreign policy decision-making and implementation.

Jörgensen et al. (2015) present a relevant finding considering the multi-level perspectives to global governance: the level of subnational political and financial autonomy is not necessarily proportional to subnational governments' efforts for innovation and experimentation in climate initiatives - it is context-specific and considers different forms of coordination with central governments and other state and non-state actors. Consequently, research about major GHG emitters with federated regimes become relevant to explain climate action at the subnational level.

For Selin and VanDeever (2012), however, the combination of federalism and multi-level governance is not widespread. The studies on federalism usually focus on the subnational and national levels, without adequate regard for international governance. Although climate governance institutions in general, and international climate regime, more specifically, have consistently recognized

non-state actors' engagement, research about multi-level dynamics and actions at the subnational level uses multiple mid-level range theories and theoretical lenses. One possible explanation is the complexity of such an endeavor, considering that non-state actions are considered complementary, and each country has its legal framework for national coordination of responsibilities and policies. Therefore, understanding subnational actors' impact and experimentation is fragmented.

Nevertheless, these combined analytical approaches can help understand the global governance architecture, political dynamics, and national behaviors, including national and sub-national climate commitments. Brown (2012), Jörgensen et al. (2012), Setzer (2015), and Abrucio et al. (2018), for example, use the multi-level approach to address subnational actions of federated countries in global climate governance and sustainable development.

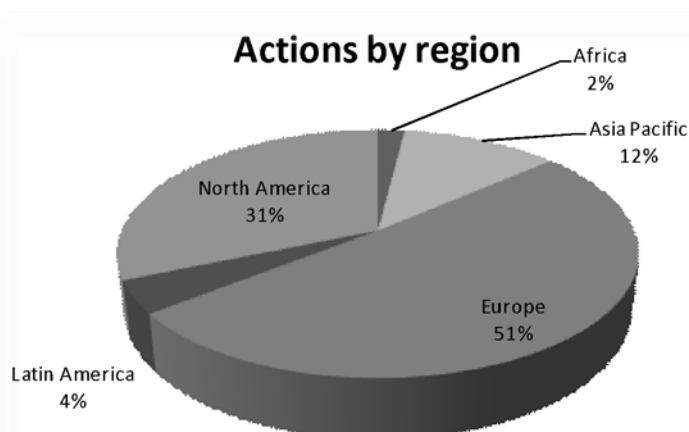
Contrary to Selin and Van Deever (2012), Happaerts (2012: 128) considers that there is a "well-developed area of study on the activities of subnational governments in the international arena" in the field of comparative regionalism and federalism. He agrees, however, that the influence of international policy-making on subnational governments (a global to subnational approach) is still underexplored. To separate a strictly bottom-up or a top-down understanding of processes, dynamics, and agency in global climate governance does not seem possible. Instead, the developments of complex thinking are applicable to foster research based on multiple causalities, fragmentation, and attention to actors and interactions.

Also, most studies of comparative federalism and climate policy are focused on Global North subnational units: Adler (2008) delivers the California case; Rabe (2011) presents a timeline for USA climate policy and contested federalism; Selin and VanDeever (2012) USA and European Union cases; Brown (2012) presents a number of the Review of Policy Research journal about how federated systems deal with collective action and multi-level governance for climate policy, which focus on the European Union, USA, Australia, and Canada; Gordon (2015) work on understanding how coordination can be achieved and sustained in federated states, based on the cases of Canada and Australia; and Jörgensen et al. (2015) editorial of the Journal of Integrative Environmental Sciences about how climate

and renewable energy policies at the subnational level presents works on India, Germany, and Belgium. Setzer (2013 and 2015) and Macedo and Jacobi (2019) present the cases of Brazilian states and municipalities, while Anderton and Setzer (2019) propose a comparison between São Paulo and California states.

Indeed, voluntarily reported data of subnational actions is mostly from countries that were part of UNFCCC Annex I and located at the Global North according to the CDP database about subnational (states and regions) actions for climate change (CDP, 2017b), which covers 2,750 actions for climate change mitigation and adaptation of 59 regions and states from 24 countries. Chan et al. (2018) found a similar concentration of climate initiatives in the Global North in an analysis of the 52 climate actions announced at the 2014 UN Climate Summit.

Graph 2 - Subnational actions distribution by region

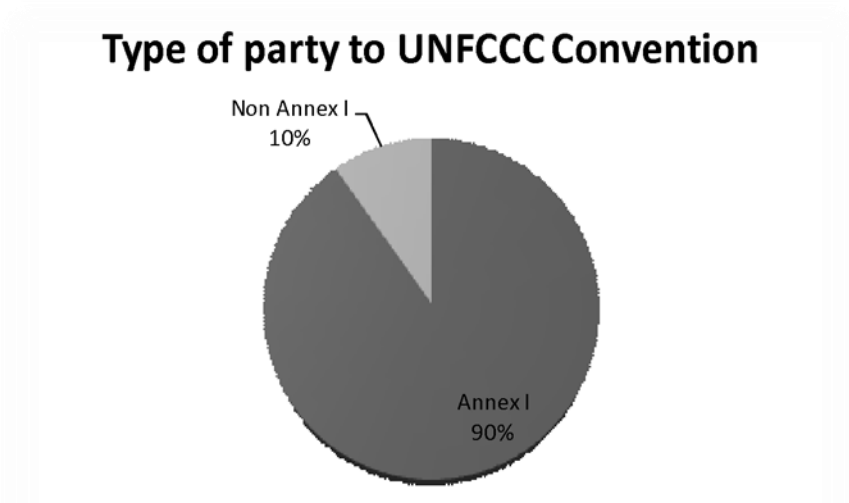


Source: CDP, 2017b.

The CDP database is one of the information sources of the Nazca Platform. Therefore, the expectation is that these characteristics are also present on the Platform, which recently became the Global Climate Action Platform. One relevant bias is the absence of China in the CDP database, whose provinces have climate actions. For example, Jänicke (2017: 113) reported in 2017 that 12 Chinese provinces had plans for a 1.3 billion tons reduction of CO₂ emissions by 2020. Zhang and Zou (2020) show an increased number – 73 provinces and municipalities with target dates for GHG emissions peaking, and 31 provinces

have published general or related plans for GHG emissions control as an answer to the 13th Five-Year Plan assignment of local emissions reduction targets. Also, there are pilots for emissions-trading systems, subsidies, and incentives for the decarbonization of energy production and transportation.

Graph 3 - Quantity of subnational actions by type of party to UNFCCC Convention



Source: CDP, 2017b and UNFCCC list of parties, available at https://unfccc.int/process/parties-non-party-stakeholders/parties-convention-and-observer-states?field_national_communications_target_id%5B514%5D=514&field_partys_partyto_target_id%5B511%5D=511. Access on December 15, 2019.

Half of the actions reported in CDP are in Europe, followed by North America, Asia Pacific, Latin America, and Africa (see Graph 2). Subnational actions are for almost their totality (90%) located in UNFCCC Annex I countries (see Graph 3). All the countries in the data set are parties to the Paris Agreement.

Regarding GHG emissions, CDP (2017a) database about 61 states and regions emissions, organized by voluntary reporting with 2016 data, indicate that the subnational units that compose the sample represent 7% of world total GHG emissions (approximately 3,751.15 MtonCO_{2e}), including land-use change and forestry (CAIT, 2017). This value is almost two times the Brazilian GHG emissions in 2018 (according to SEEG 1,939.1 MtonCO_{2e}) and should be considered relevant in searching for alternative avenues to reach climate change mitigation goals.

Therefore, this research focuses on the 27 Brazilian subnational units, and specifically on two Brazilian subnational units – Mato Grosso and Pará - to understand subnational actors' commitment to global climate governance from a global to subnational perspective. It considers the interplay between local, national, and global levels, the context-specific nature of autonomy, innovation, and experimentation in federated regimes countries in global climate governance, and the literature gap about Global South subnational units.

A country-specific study adds to comparative federalism literature as it presents a methodology applicable to other countries for comparative analysis. The following section delivers the Brazilian climate commitment and explains why the international system is of conservative hegemony to contextualize the Brazilian subnational units' profile from a global to a local perspective.

1.2 Brazil as a moderate conservative climate power in an international system of conservative hegemony

For Viola et al. (2013), from 2007 on, there is a distinctive trend in the international system, which results in a more significant demand for governance structures. A convergence between the market and the climate crisis marks this trend, with a limited response by existing institutions. The United Nations, for example, is recognized as a relevant multilateral forum but cannot present solutions to cope with the crisis and is trapped in bureaucratic inertia.

The significant characteristics of the international system are (Viola et al., 2013: 109-116): increased state strength; democracy continuing power, even though they recognize that the climate crisis has shown some dysfunctionalities of big democracies; climate change centrality as a planetary boundary in the Anthropocene; economic instability and crisis; increased demand for global governance; decreased importance of traditional developed powers – the 'old world'⁶; increased importance of emerging powers; and consumerism.

The major vectors in the post-2007 international system would be economic growth, democracy, decarbonization, global governance, globalization, natural

⁶ By 'old world,' they mean USA, European Union, and Japan (Viola et al., 2013: 117).

resources over-exploitation, population growth and consumerism, and planned obsolescence in business cycles. In this context, national states are the most significant actors (their agency to build international governance systems), and their commitment to global governance becomes relevant to redefine systemic characteristics.

Viola et al. (2013: 85-86) then use the definition of climate power as state actors that have varying degrees of agency in international governance, with impact on the international system, and not at specific domains. The agency-level derives from power resources (material and immaterial) divided into four categories: economic power, political power (which includes soft power and political regime quality), military power, and climate power (which refer to relevance and commitment). Based on the assumption that climate change is a central civilizational vector and a central issue in international politics, climate power is considered a relevant variable to analyze an actor's impact on the logic of the international system.

Viola et al.'s (2013) definition of climate power considers total national GHG emissions and its proportion in total world GHG emissions, technological and human resources towards global economy decarbonization, energy profile matrix, and costs for decarbonization. Therefore, climate commitment to international governance means the commitment to use these resources towards climate system stabilization. This concept - climate commitment - is central to this research: Chapter 2 presents it in a different perspective from Viola et al. (2013) and Viola and Franchini (2018) - as an institutional outcome measurement and the base for an index development in Chapter 4, applied to subnational governments.

Considering 34 countries, divided into superpowers, great powers, and middle powers, Viola et al. (2013) analyze different levels of climate commitment with governance structures, ranging from conservative to reformist. A conservative power does not apply its resources towards a systemic change, having a highly carbonized economy, high population growth, and consumerism. Reformist powers are engaged in post-sovereign dynamics, with increased economic productivity, decarbonization, and lower population growth.

Table 2 - Rank of ten major GHG emitters in 2016 (MtCO_{2e}, including LUCF) and classification by climate commitment

Country	GHG emissions in MTCO _{2e} in 2018	Government type	Climate commitment
China	11,705.81	Communist party-led state	Conservative
United States	5,794.35	Constitutional federal republic	Moderate conservative
India	3,346.63	Federal parliamentary republic	Conservative
European Union (27)	3,333.16	Federation	Reformist
Russia	1,992.08	Semi-presidential federation	Conservative
Indonesia	1,703.86	Presidential republic	Moderate conservative
Brazil	1,420.58	Federal presidential republic	Moderate conservative
Japan	1,154.72	Parliamentary constitutional monarchy	Moderate reformist
Iran	828.34	Teochratic republic	Conservative
Canada	763.44	Federal parliamentary democracy under a constitutional monarchy	Moderate conservative

Source: Author's elaboration based on Viola and Basso (2016), CAIT Data Explorer (2019), and CIA Factbook, available at <https://www.cia.gov/library/publications/the-world-factbook/>. Access on September 27, 2020.

According to a focus on the political economy perspective and the system's main agents, the international system is under a conservative hegemony because moderate conservative and conservative powers are predominant. They cannot provide the necessary governance mechanisms, and are unable to adequately respond to the climate change challenge (Viola et al. 2013, Viola and Basso, 2016, and Viola and Franchini, 2018: 13).

Brazil is a middle, moderate conservative power (Viola and Franchini, 2018: 11), and recent domestic developments under Bolsonaro's government steer the country towards a more conservative position. For Viola and Franchini (2018), based on a historical record of variables from 1990 to 2018, the assumption of Brazil as an environmental superpower is a myth because the country's mitigation profile is grounded on a deforestation control "buffer," which deviates the nation from pursuing a truly low carbon revolution.

However, for Ribeiro and Inoue (2019), Brazil's environmental resources are insufficient for performing leadership since the country lacks a unified strategy of action at the domestic and international levels. They present an assessment of Brazilian leadership in global environmental policy focusing on the biodiversity

issue and argue that power resources are not the only explanatory variable to power (capacity to influence rules and behaviors) at the international level.

For Ribeiro and Inoue (2019), international regimes still influence how state and non-state actors define their strategies and are a relevant locus for their exercise of power, alongside other elements in the governance architecture. In this matter, Young (2017: 38-43) underlines that domestic implementation capacity and willingness are a measure of international regime success. Applying their argument to the climate change issue, by analogy, places the international climate regime as an intermediary variable between the climate power structure (as defined by Viola, Franchini, and Ribeiro (2013) and Viola and Franchini, 2018), and political processes at international and domestic levels. Therefore, Ribeiro and Inoue's (2019) proposition dialogues with and complements the climate power approach that stresses power resources.

For this reason, I bring to fore Krasner's (1982) perspectives about the normal state of international affairs and how regimes are perceived in a causal link between basic causal variables to related behavior and outcomes. Viola et al. (2013) and Viola and Franchini (2018) are not structuralists since they do not consider international regimes as useless or misleading. Nevertheless, they put emphasis on the international political economy of climate change (the structure) and the main agents' resources and relative positions.

This work is based on a modified structural perspective, focusing on the second part of the causal chain presented by Krasner (1982: 189) on the relationship between the international regime as an intervening variable and the related outcome at the subnational level. This schematic is congruent with the global governance concept. To measure subnational units' behavior by climate commitment does not entail incommensurability with Viola et al. (2013) and Viola and Franchini's (2018) approach but offers an alternative reading with different analytical implications and limitations.

If actors' behavior and interactions define their commitment, the international system's characteristics and the national context (Brazilian climate commitment in this research) are necessary to assess subnational actors' behavior. Based on Viola and Franchini's (2018) timeline and climate power resources, this section

presents Brazilian climate commitment from 1990 to 2020, complemented by recent domestic and international developments and the analysis of Brazilian international standing and its domestic political processes. This context is necessary to understand the conditions by which Brazilian subnational units commit to the global climate governance architecture.

The timeline has four periods:

- a) 1990-2004: Brazil as a climate villain, with a rigid interpretation of the common but different responsibilities principle and paranoia and impotence to combat Amazon deforestation;
- b) 2005-2010: climate leadership, with deforestation control, domestic policy developments, and a significant change in its international standing, especially regarding forests;
- c) 2011-2016: climate negligence, with diminished state presence in the Amazon, increased deforestation and the emergence of conservative lobbies;
- d) 2017 to 2020: climate negligence with a tendency to deeper conservative dynamics in domestic policies, deforestation control, and standing at the international level.

Data from Brazilian NDC and the National Policy for Climate Change (PNMC in Portuguese), based on national communications and reports, differ from data organized by Observatório do Clima, a network of civil society organizations that produces data about GHG emissions - the System for Estimating Greenhouse Gas Emissions (SEEG in Portuguese). SEEG uses official and non-official sources of data and comprises more sectors than national communications and reports, resulting in higher absolute emissions than official records⁷. Also, it has a more regular publication than official inventories. For these reasons, SEEG data is used in this section to present GHG emissions trends in each period.

⁷ Chapter 3 explains the SEEG database in detail and presents some criticisms about national communications.

Table 3 - Comparison of GHG emissions data between SEEG and the Third National Communication to the UNFCCC from 1990 to 2010

Source (GtonCO _{2e})	1990	1995	2000	2005	2010
SEEG	1.73	2.78	2.24	3	1.98
Third National Communication to UNFCCC (in GWP-AR5)	1.41	2.65	2.07	2.84	1.36

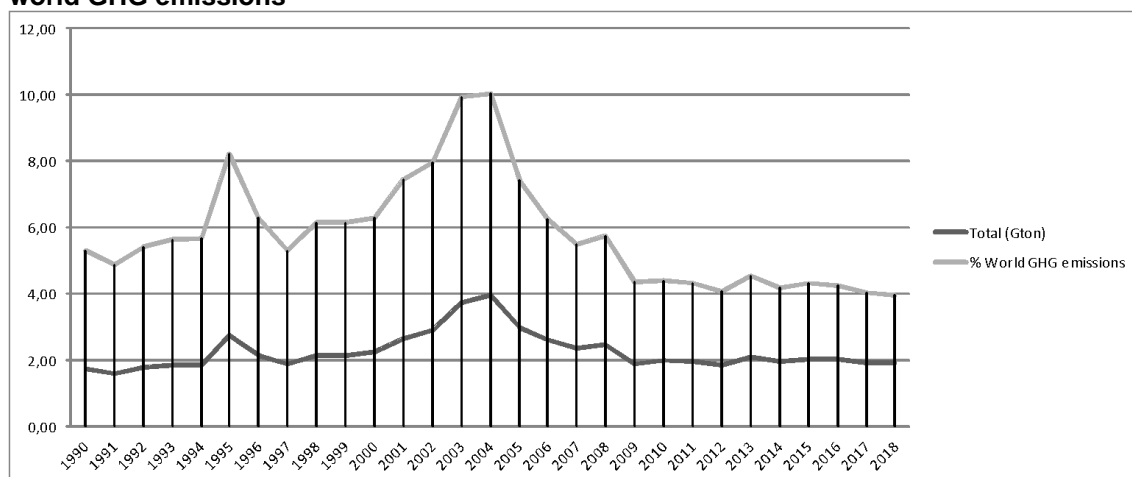
Source: BRASIL (2016) and SEEG (available at http://plataforma.seeg.eco.br/total_emission#. Access on July 26, 2020).

According to data from SEEG, the GHG emissions in 2018 were 12% higher than 1990 levels, but there were peaks of annual emissions between 1994 and 1995, and between 2003 and 2004, when the country reached 3,96 Gton CO_{2e}, after seven years of increasing emissions. From 1990 to 2018, Brazilian GHG emissions had an average of 6% in total world GHG emissions, according to data from SEEG and Climate Data Explorer from the World Resources Institute. In 2004, the country reached 10% of total world GHG emissions, the highest record in the period. From 2009 on, the country has had around 4% of world GHG emissions, with the lowest share in 2012 (Graph 4). A closer look at the Pluriannual Plan (PPA) helps understand how national government actions for climate change were designed and prioritized. A PPA begins in the second year of an elected government term and finishes in the first year of the following elected government term. The first PPA was designed in 1991, followed by eight plans (the last one is from 2020 to 2023).

Graph 4 According to Viola and Franchini (2018: 72-108), the first period is from 1990 to 2004. Brazil's rigid interpretation of the common but differentiated responsibilities principle of the UNFCCC and a position of Amazon "paranoia" and "impotence" are a mark of this period. The Amazon paranoia/impotence means that some domestic sectors, especially the military, considered the region vulnerable to foreign intervention and defined by geopolitical motivation. At the same time, there was impotence towards deforestation control, which reached the highest levels in a record (1995 and 2004), with low state capacity to monitor the region.

A closer look at the Pluriannual Plan (PPA)⁸ helps understand how national government actions for climate change were designed and prioritized. A PPA begins in the second year of an elected government term and finishes in the first year of the following elected government term. The first PPA was designed in 1991, followed by eight plans (the last one is from 2020 to 2023).

Graph 4 - Brazil total GHG emissions from 1990 to 2018 (GtonCO_{2e}) and its total share in world GHG emissions



Source: SEEG and Climate Data Explorer (CAIT).

A search for specific programs for climate change mitigation and adaptation in Brazilian Pluriannual Plans (see Appendix 2) demonstrates a meaningful increase in policy scope and budget from 2000 to 2020⁹. Actions related to forests, fire control, adaptation, and disasters were part of different programs and, although associated with climate change, are not considered in this list for simplification purposes. From 2000 to 2019, pluriannual plans had almost R\$ 4 billion planned, from which only R\$ 900 million (23%) were spent (see Graph 5).

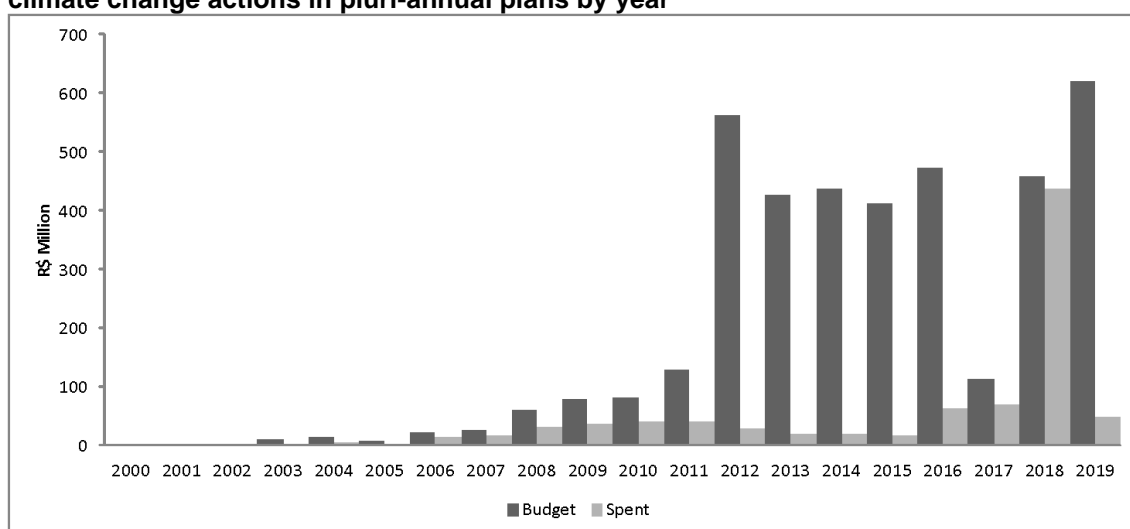
From 1990 to 2004, there was only one PPA (2000 to 2003) with a specific climate program and an estimated budget of R\$ 13 million, from which the federal government spent only 20%. The program for climate change had actions from

⁸ The Pluriannual Plan is a federal government instrument to establish priorities for governmental actions organized in programs, guidelines, medium-term objectives and goals, indicators, and budget for four years. The first year is the second year in a government term, and the last year is the first year of a newly elected government.

⁹ The budget data source is the Brazilian federal government's Integrated Planning and Budgeting System (SIOP). The difference between the planned value for each year and the value spent is due to the capacity to apply the resources and the contingency of available resources to the actual tax revenues, which is the federal government main source of revenue.

three Ministries: Science, Technology and Information; Development and Industry (the budget was destined to subventions to vehicles fueled by alcohol, but was not used); and Environment (the budget from the Ministry of Environment had an increase in 2003 and 2004). The strategy was to develop national actions – the Clean Development Mechanism operationalization, inventories, mitigation plans, and the development of studies, models, and systems - with foreign resources support.

Graph 5 - Estimated budget and values spent by the Brazilian Federal Government for climate change actions in pluri-annual plans by year



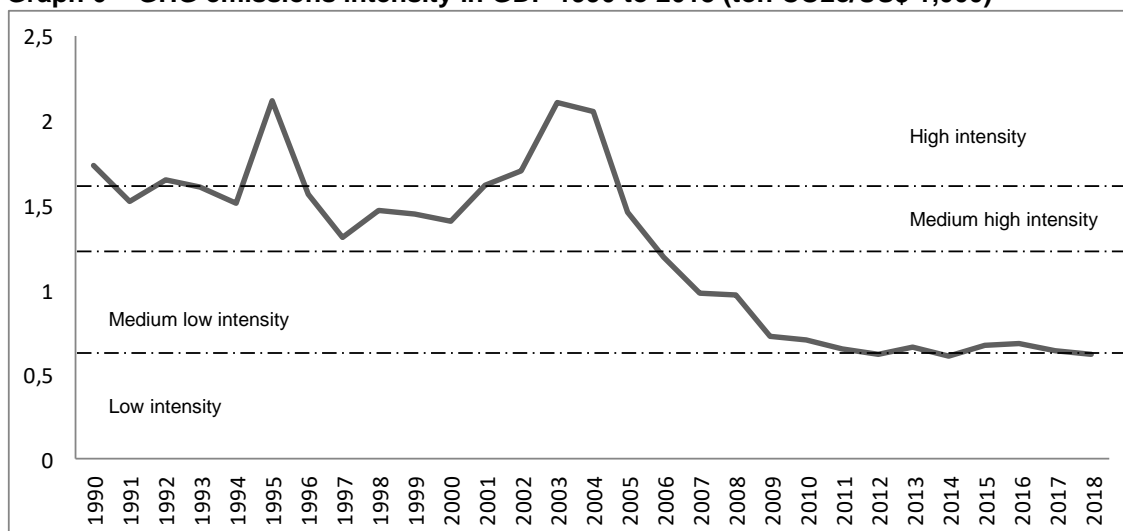
Source: Integrated Planning and Budgeting System (SIOP), available at <https://www1.siop.planejamento.gov.br/>. Access on July 26, 2020. See Annex 2 for the search queries.

Even with the Forestry Code reform in 1996, a relevant landmark in domestic policy, 1990-2004 is considered a period of policies scarcity by Viola and Franchini (2018). According to the Grantham Research Institute (see Annex 1), there were five laws related to climate change: two from the executive branch – the establishment of an interministerial commission on climate change in 1999 and the Plan to Control Illegal Deforestation and Recovery of Native Vegetation (PPCDAm) in 2003/2004; and three from the legislative branch, all related to energy use and efficiency, between 2000 and 2002 (the database does not mention the Forestry Code reform).

In her analysis of Brazilian climate institutions development, Hochstetler (2021) considers that while from 1990 to 2002 Brazilian climate institutions were

responsive to international climate negotiations, the period 2003 to 2010 is marked mainly by domestic processes that oblige compliance, including the PPCDAM, which has a multi-level and intersectoral approach (Larrea et al., 2021). The Plan, however, is not in the climate program in PPA in this period - it was present in different programs related to the participating ministries as informed by Larrea et al. (2021: 17.14) since the plan coordinates 11 federal actions, according to Esperanza et al. (2013: 36). Therefore, even if the PPCDAM is an essential instrument to climate change mitigation in the Brazilian National Policy for Climate Change, Viola and Franchini's (2018) assertion of climate policy inertia corroborates Hochstetler's (2021) argument that deforestation was considered a separate environmental issue by then.

Graph 6 – GHG emissions intensity in GDP 1990 to 2018 (ton CO₂e/US\$ 1,000)

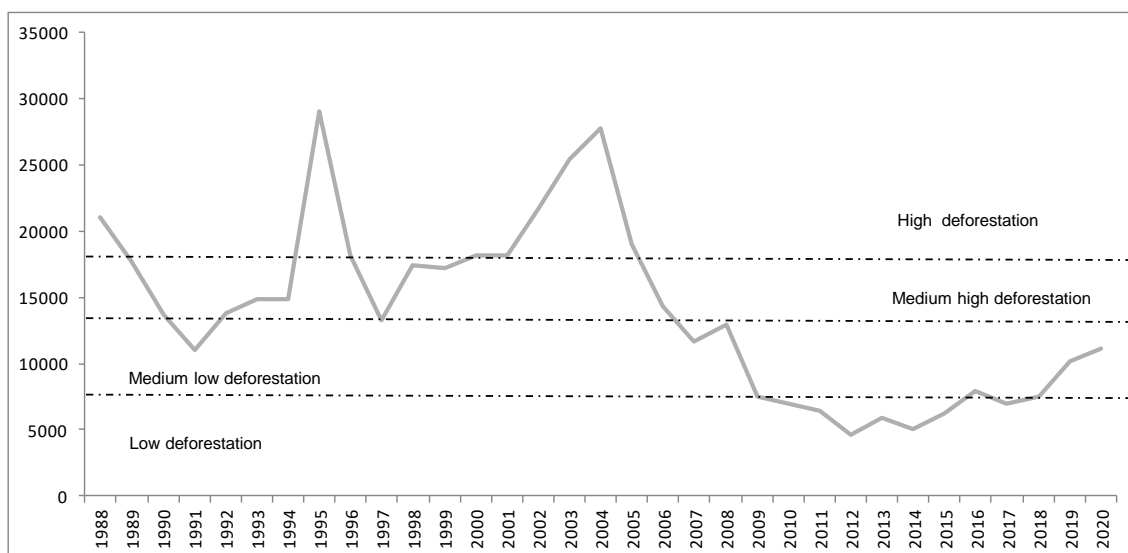


Source: Author's elaboration based on SEEG and World Bank data. The division of low, medium-low, medium-high, and high GHG emissions intensity in GDP according to the data mean and 25 and 75 percentiles from 1990 to 2018.

Compared with the 1990 to 2018 record, GHG emissions intensity in GDP had medium-high to high levels, with a 19% increase between 1990 and 2004. Deforestation was not a driver of economic growth but impacted GHG emissions intensity per GDP unity. GHG emissions at the subnational level had Mato Grosso and Pará in first and second places of higher emissions respectively (the third-place varied between Maranhão in 1990, Minas Gerais in 5 years, and Rondônia in 9 years). Both states are in the Amazon biome, and agribusiness is the most relevant economic activity.

The period from 2005 to 2010 is of higher climate commitment and a better profile: voluntary commitment, more domestic processes, and the design of a strategy to translate environmental resources into soft power, even if it was a “buffer” strategy based on deforestation control – deforestation had a decrease of 63% in the period. GHG emissions also had a significant decline (34%) from a high to a low level of emissions compared to the whole period. There was also a reduction in GHG emissions intensity in GDP (52%) and GHG per capita emissions (37%).

Graph 7 – Amazon deforestation in km²



Source: Author’s elaboration based on PRODES¹⁰. The division of low, medium-low, medium-high, and high deforestation rates according to data mean and 25 and 75 percentiles of deforestation rates in the period. Although it helps understand the trends in deforestation, this reading has to be complemented by the accumulation of deforested areas, which today is higher than 20% and can lead to the savanization of the Amazon.

There were nine national laws regarding the climate issue from 2005 to 2010: five from the legislative branch and four from the executive branch. Among them is the national plan on climate change (2008), the national policy on climate change (2009), the Amazon Fund (2008), and the Climate Fund (2008). In the agribusiness sector, the soy moratorium, declared on July 24, 2006, by industries and exporters of soy, had an impact on curbing deforestation in the Amazon

¹⁰ See <http://www.obt.inpe.br/OBT/assuntos/programas/amazonia/prodes>. Access on May 27, 2021.

biome by this kind of production. The area monitored by the moratorium includes municipalities in Mato Grosso, Pará and Rondônia states. Mato Grosso has 88% of the area destined for soy production in the Amazon, while Pará has 5.4%.¹¹ However, the Forest Code went through another reformation in 2009 with a more conservative position from the agribusiness sector and their representatives in Congress (the Agribusiness Parliamentary Front).

Brazil presented its first target to curb GHG emissions at COP 15 in 2009 and formally declared it at article 12 of Law n. 12,187/2009, which establishes the National Policy for Climate Change: reduction between 36.1% - 38.9% according to projections to 2020. Decree n. 7,390/2010 specified the methodology to calculate projected GHG emissions to 2020, which was then altered by Decree 9,758/2018. The estimation for total GHG emissions in 2020 is 3.236 Gton CO_{2e}, which means a reduction from 1,168 GtonCO_{2e} to 1,259 GtonCO_{2e} at the target year.

Viola and Franchini (2018: 115) also consider that Amazon states governors' pressure concerning deforestation was one driver of domestic policy development. Mato Grosso remained the federated unit at the subnational level with higher GHG emissions in 2005 and 2006, followed by Pará from 2007 to 2010. Both federated units remained in first or second place during the whole period. Rondônia had the third place in 2005, Minas Gerais in 2006, 2007, 2009, and 2010, and Maranhão in 2008.

Table 4 - Federated units with higher GHG emissions from 2005-2010.

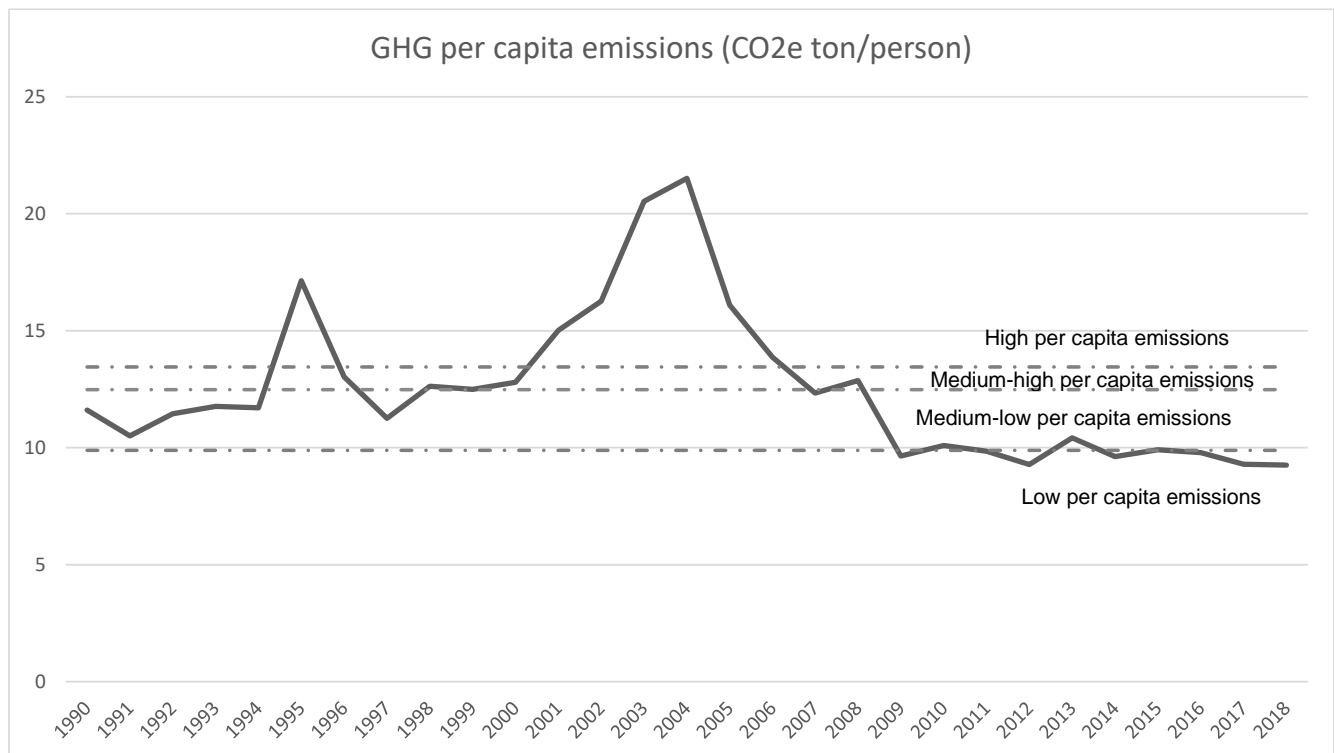
Year	Higher GHG emissions	2nd higher GHG emissions	3rd higher GHG emissions
2005	MT	PA	RO
2006	MT	PA	MG
2007	PA	MT	MG
2008	PA	MT	MA
2009	PA	MT	MG
2010	PA	MT	MG

Source: SEEG.

¹¹ See https://abiove.org.br/wp-content/uploads/2019/05/12122014-105447-19.11.2014_relatorio_da_moratoria_da_soja_-_7%C2%BA_ano.pdf. Access on May 30, 2021.

There were two PPAs in this period: 2004-2007 and 2008-2011. The former had two programs related to climate change – pollution control and scientific information, studies, and modeling for vulnerability and adaptation. The last also had two programs – knowledge and forecasting and environmental quality. There was a significant increase in the public budget for climate action compared to the previous period and higher resources application, which enforces policy development and bureaucratic structures, as Viola and Franchini (2018: 115-124) presented. The foreign policy profile is marked by changes in the international standing on forests, with support to REDD+ and a moderate interpretation of the CBDR principle.

Graph 8 – GHG emissions per capita from 1990 to 2018



Source: Author’s elaboration based on SEEG and IBGE data. The division of low, medium-low, medium-high, and high GHG emissions *per capita* according to the data mean and 25 and 75 percentiles from 1990 to 2018.

From 2011 to 2016, Brazil is considered a climate-negligent actor due to a more conservative position driven by what Viola and Franchini (2018: 167) define as a populist nationalistic economic policy. It is relevant to consider that the 2010

national elections resulted in a stronger Agribusiness Parliamentary Front, with more elected representatives and increased power. This group is an important economic pillar of the Brazilian economy and acted to weaken environmental legislation (Pereira and Viola, 2019: 11).

During this period, Amazon deforestation had a 23% increase, there was a reduced budget and retraction of federal government presence in the region. Although the 2012-2015 PPA had an increased budget, it had a low execution (only 5% of the resources), reaching a lower absolute amount than previous plans. There were still two programs, based on knowledge, technology, adaptation, and instruments for implementation (REDD and mitigation sectoral plans), with actions by the Ministry of Environment and the Ministry of Science, Technology, and Innovation.

GHG emissions increased 3.6% (representing an average of 4% world total), and 2012 was the year with the minor emissions from 1990 to 2018 - 1.85 Gt CO_{2e}. GHG emissions intensity in GDP increased 4.5%, and GHG *per capita* emissions stayed at stable low levels for the last decade. Even though all the variables remained within low to middle-low levels, the rising trends and the change of domestic political forces were signs of a turn to a more negligent climate position. There were ten new laws during the period – four from the legislative branch about forests, energy, and environmental education, and six from the executive branch, mainly related to the establishment of sector plans provided for in the National Policy for Climate Change: industry, agriculture, transport, mining, energy, and the national adaptation plan.

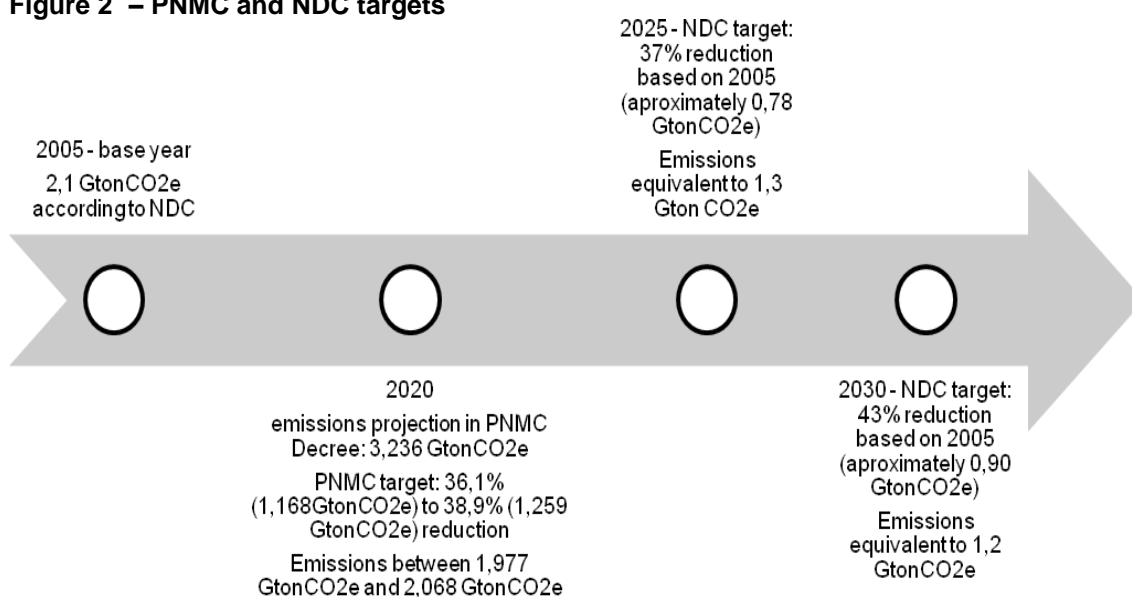
Brazilian NDC, presented in September 2015 to the UNFCCC, established absolute emissions reduction goals of 37% in 2025 and 43% in 2030, having 2005 as the base year (2,1 GtonCO_{2e} -GWP 100 AR5). This means emissions of 1,3 GtonCO_{2e} (GWP 100 AR5) in 2025 and 1,2 GtonCO_{2e} (GWP 100 AR5) in 2030, or reductions equivalent to 0,78 GtonCO_{2e} till 2025 and of 0,90 GtonCO_{2e} till 2030. The Brazilian NDC was presented one year before the publication of the Third National Communication, released in 2016 with emissions from 1990 to 2010.

As Figure 2 shows, although absolute emissions reduction is the reference for the two documents presenting Brazilian emissions reductions targets, they

have different methodologies for target calculation. To illustrate, the PNMC estimated 2020 emissions and calculated the emissions levels for that year based on pre-established percentage targets, while the NDC made estimations from a base year. Nevertheless, they present a coherent path of GHG emissions reductions.

PNMC estimations for 2020 emissions were inflated, based on the high deforestation rates from the 1990s till 2005 and GDP growth scenarios that could hardly materialize (e.g., 5% of annual GDP growth, as presented in Decree 7,390/2010 annex). SEEG data, for instance, present GHG emissions of 1.94 Gton CO_{2e} in 2018, which is almost half of the projected value for 2020, and the country has not yet committed to a profound and severe low carbon transition.

Figure 2 – PNMC and NDC targets



Source: Author's elaboration

For Viola and Franchini (2018: 122), the Brazilian government purposefully inflated estimation numbers in the National Communication to the UNFCCC and may have used the data for political ends, sometimes delaying its presentation (they describe a specific case related to the Second Communication and the release after COP 15 in 2009). The Third National Communication to the UNFCCC, presented in 2016, had already a more significant number for 2005

emissions than the amount given in the NDC the year before – 2.83 GTCO_{2e}. SEEG number is also higher - 3Gt CO_{2e} (see Table 3).

The country's foreign profile in this period was of conservative setback, with a decrease in presidential diplomacy, which did not consider climate policy as a source of soft power as in the previous period (Viola and Franchini, 2018: 152-157). For instance, although the country attended the 2014 United Nations Climate Summit, it did not sign the New York Declaration on Forest - the summit's main document.

At the subnational level, Pará had the highest GHG emissions from 2011 to 2014 and in 2016 (see data in Chapter 4). In 2015, Mato Grosso had the highest GHG emissions in 2011, 2013, 2014, and in 2016 it had the second-highest emissions. In 2012, it had the fifth highest. The third higher GHG emissions were from Minas Gerais in 2011 and 2013 to 2015, while São Paulo had the third highest in 2012 and 2016.

From 2017 on, the country continued on a path towards a more conservative position, with a steeper dive with Bolsonaro's government. GHG emissions data used in this chapter covers 1990 to 2018, while Bolsonaro's term began in 2019. However, although GHG emissions stayed in a medium-low category in 2017 and 2018, deforestation increased by 60% between 2017 and 2020, which indeed has an impact on GHG emissions (SEEG estimative based on a new methodology for 2019 GHG emissions is of 2.175 Gt CO_{2e}, which means a 12% increase). GHG emissions intensity in GDP remained in low intensity, with a decrease of 3%, and GHG per capita emissions had a rise of 0.3%, still in the low-intensity category. Pará, Mato Grosso, and São Paulo had the first, second, and third places in GHG emissions in 2017 and 2018.

In domestic policies, there were 11 new laws, mainly from the executive power: alteration, extinction, and recreation of the Brazilian Forum on Climate Change, administrative infractions and penalties, forests, targets for the transportation sector, the health sector plan, and infrastructure projects. This period's only legislative branch law is about the Renovabio – the national biofuels policy.

The 2016-2019 PPA had a smaller budget than the previous plan but a better execution – 37% of the resources. It had two programs: the first, the Climate Change Program, had actions for knowledge and technology for mitigation and adaptation, the implementation of the national policy for climate change, deforestation and forest fires monitoring, and, for the first time, an initiative for articulation between federated units to implement the national policy. The second program was about environmental policy and focused on pollution control. The Ministry of Environment and Science and Technology implemented both programs. The 2020-2023 Plurianual Plan (PPA), currently in place, presents a GHG reduction target of 30%, which is congruent with the NDC path.

Finally, Bill 3,961/2020¹² was presented by a congressman from the Brazilian Socialist Party (PSB) in July 2020 to declare the state of climate emergency and establish a target of GHG emissions neutrality till 2050, with the creation of policies for a sustainable transition. The bill includes integrating programs, plans, and policies at the subnational level (state and municipal). The Federal Executive Power has to elaborate a National Plan to Respond to Climate Emergency with 5-year targets of decarbonization until 2050. It is unclear how this plan relates to the existing laws and plans about climate change and established targets.

In December 2020, Brazil presented its NDC revision.¹³ It did not update the reduction targets, as the revision is based on the Third National Communication data: it maintained the targets of 37% reduction in 2025 and 43% in 2030, which in practice means an increase of 0.4 Gt CO_{2e} in projected emissions in 2030 (from 1,2 Gt CO_{2e} to 1,6 GT CO_{2e}). According to WRI (2017: 27), to keep GHG emissions at 1,2 Gt CO_{2e} in 2030, the new target should be a 57% reduction. The country also committed to carbon neutrality in 2060 but conditions it to a “proper functioning of the market mechanisms provided for in the Paris Agreement,” as stated on the first page of the NDC revision. The Brazilian position also required US\$ 10 billion per year to support its actions, including native vegetation

¹² See <https://www.camara.leg.br/proposicoesWeb/fichadetramitacao?idProposicao=2258739>. Access on July 4, 2021.

¹³ Available at [https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Brazil%20First/Brazil%20First%20NDC%20\(Updated%20submission\).pdf](https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Brazil%20First/Brazil%20First%20NDC%20(Updated%20submission).pdf). Access on May 31, 2021.

conservation. The executive and legislative branches' recent actions are not in harmony, and, in practice, the trend is of conservative setbacks in both powers.

1.3 Conclusion

This chapter situated the research in a broad context. Viola et al. (2013), Viola and Basso (2016), and Viola and Franchini (2018) presented that the international system is under a conservative hegemony - it does not have governance elements that adequately address climate change's catastrophic scenario and moderate conservative and conservative climate powers are predominant.

This research aims to be a further step in the endangered world/catastrophic Anthropocene contextual perspective by mainly three contributions: working the international-subnational governance processes within climate federalism, adapting Viola and Franchini's (2018) climate commitment approach to subnational governmental actors, based on the assumption that it is possible to scale the commitment to different types of actors and levels, and doing so by a Global South perspective.

Therefore, I choose a top-down global to subnational framework applied for the case of Brazilian subnational governments, with the research question of *how subnational actors commit to global climate governance*. The research design is fully aware that it is not possible to separate top-down (global to local) from bottom-up (local to global) dynamics and processes strictly, being necessary to address multiple causality mechanisms in a context-specific manner.

This endeavor's motivation is to recognize climate federalism contribution in a multi-level perspective to global climate governance, which opens room for policy diffusion, experimentation, and making up for the limitations of national-state commitments in an international system under conservative hegemony. Adding the Anthropocene contextual condition (characterized by catastrophic climate disruption) and the search for alternatives through multi-level dynamics to this theoretical approach is an invitation to consider multiple actors' agency and new institutional designs.

However, the results are context-specific, and the Brazilian case is very illustrative, considering the country's climate commitment overview and changes in the last thirty years: from being a climate villain (1990-2004), a climate leader (2005-2010) strongly committed to global governance and with a strategy, to climate negligence (2011-2016) and a steeper trend towards a conservative position since 2017.

The next chapter presents the theoretical framework for the development of climate commitment at the subnational level. The central concept used is global governance, considered in two approaches – multi-level and polycentric. Then, mid-level range theories such as the climate commitment approach, transnational networks, and paradiplomacy complement the framework.

CHAPTER 2 – THEORETICAL FRAMEWORK

The global governance theoretical development in International Relations is related to a post-Cold War world order (Barnett and Duvall, 2005:5). New research questions emerged, such as how there could be governance without government and about changes in authority inside nation-states and between supranational entities (Rosenau, 2000:13). Liberal values and the increased interstate and transnational connections (Barnett and Duvall, 2005: 5-6) offered ground for normative assumptions that global governance could offer a more inclusive and consensual way to organize international politics.

However, there is no consensual definition for global governance. The concept can be either a normative tool or an analytical instrument to understand how the world is governed, ordered, and organized, pointing towards collective objectives and a common direction (Rosenau, 2000; Inoue, 2016: 98). The concept also encourages questions about the exercise of power and authority, captures how multiple actors relate to each other, and how to make sense of global complexity (Rosenau, 2000; Stein and Turkewitsch, 2010; Inoue, 2016: 98; Aligica and Tarko, 2012; Weiss and Wilkinson, 2014; Gupta et al. 2015b; Young, 2017; Jordan et al., 2018a).

As a normative tool, it presents a judgment and is a normative precept associated with political objectives (Rosenau, 2000: 22-25; Inoue, 2016: 94), which for Barnett and Duvall (2005:5) has its roots in liberalism. Gupta et al. (2015b: 29-33) describe two examples of normative uses of governance: the good governance approach developed in the 1980s to guide development aid, and the neoliberal model, which presents decision-making and resource allocation decentralization, with a shift from state-centric models of governance to network-based approaches.

As an analytical instrument, the focus of governance is on empirical observation and different theoretical and research agendas (Inoue, 2016: 94), not only based on the multiplicity of actors (individuals, organizations, national states, among others) but also processes and practices. Thus, it includes multiple and

interlinked levels (units of analysis located at the same position on a scale, or points along a scale) of a variety of scales (spatial, temporal, quantitative, administrative, or analytical dimensions used to measure and study any phenomenon) (Gibson et al., 2000, in Gupta et al., 2015a; Gupta, 2008; Gupta et al., 2015b).

New developments in climate change governance point towards decentralization (Jordan et al., 2018a). Separate negotiation tracks under the United Nations Framework Convention on Climate Change (UNFCCC) umbrella, the Paris Agreement, and NDCs recognition of subnational and non-governmental actors' role to achieve the 2°C target support this assertion. The Conference of New England Governors, the Regional Greenhouse Gas Initiative, California Global Warming Solution Act in the USA, Eastern Canadian Premiers in Canada, The Climate Registry, a joint initiative of North American and Canadian states and provinces, Governor's Climate and Forest Task Force, Under2 Coalition, Regions 4, R20 and the *Cumbre Climatica de las Americas* are examples of regions, states, and provinces initiatives and political commitments towards climate change mitigation and adaptation.

Hence, empirical research indicates a shift to multi-leveled and bottom-up governance architecture and processes, understanding that new and more pluralistic forms of climate governance, alongside innovative institutional governance arrangements, are necessary to achieve emission reductions based on the 2°C target.

In this context, regions, provinces, states, and cities actions engaged with climate change mitigation and adaptation have been presented as alternatives to compensate for or complement insufficient regulation and action at national and international levels, as a means to contribute to national targets and compromises, and as a source of experimentation for different and alternative approaches. However, according to van Asselt and Zelli (2018: 41), "local initiatives work best when bound by a set of overarching rules that specify goals and or allow for resolution of conflicts." In this logic, the UNFCCC can be considered an overarching set of rules.

Multi-level and polycentric governance are theoretical approaches with different explanatory and normative perspectives for governance architecture, authority and power diffusion, legitimacy, policy diffusion, transactions costs, and experimentation. Sometimes, the literature presents them as synonyms (see, for example, type II governance in the work of Hooghe and Marks, 2003), but also drafts some differences for descriptive and analytical purposes (Hooghe and Marks, 2003; Ostrom, 2010a and 2010b; Piattoni, 2014; Jordan et al., 2018a and 2018b; Liefferink and Wurzel, 2018).

They also differ from the concept of regime complex, defined by Keohane and Victor (2010: 7-8) as an arrangement between fully integrated institutions through hierarchical rules and highly fragmented arrangements with no identifiable core. There are two important differences. The first resides in how the concepts portray governance architecture. Although connections between narrow regimes make regime complexes, no architecture structures them, and there is no clear hierarchy between the international regimes. The second relates to the relationship between state and non-state actors, and their interaction with governance elements. While global governance approaches recognize state and non-state actors' roles at multiple levels (Jordan et al., 2018a and 2018b), regime complexes are state-centered. Therefore, regime complexes do not fully address issues related to agency, scale, and level of analysis (Inoue, 2016: 97).

This chapter presents the research's theoretical framework. The novelty is that multi-level and polycentric governance are considered different approaches according to specific dimensions. The first section after this introduction presents the definition of global climate governance and related concepts considered for the Ph.D. dissertation theoretical framework. The following section differentiates multi-level and polycentric approaches according to six different dimensions. The last section adds the concepts of climate commitment and paradiplomacy to the main framework. Finally, it presents a brief conclusion.

2.1 Global (climate) governance

Considering the multiplicity of governance definitions, I resort firstly to Inoue's (2016: 93-100) provisory analytical framework for global climate

governance, which makes a literature review of different definitions: Rosenau's definition of governance as behaviors towards objectives, oriented activities towards goals and order systems; Oran Young's definition as social institutions to define social practices and guide interactions; Bulkeley's interpretation of driving systems which encompass non-state actors; and the proposal of the Earth System Governance Project, which includes multiple actors and levels of social organization. Andonova et al. (2009: 55), also based on literature mapping, consider that three features of global governance stand out: the public nature of its goals; it is ordered and intentional; and is authoritative (exercise authority in the pursuit of its goals).

The emergence of non-state actors is a common element of global governance concepts likewise, encompassing subnational governmental and private actors, new mechanisms for rules establishment and implementation, such as transnational regimes and public-private partnership, and new kinds of fragmentation and interconnection (Biermann, Pattberg and Zelli, 2010, in Inoue, 2016: 100). The role of non-state actors, however, also presents theoretical challenges for global governance, especially for considerations of power, authority, structure, agency, and rationalities and processes, as presented by Okereke et al. (2009: 59)

Young's (2017: 26-27) broad definition of governance as a social function to steer collective behavior towards desired outcomes is the base for this research's theoretical framework. By this definition, global governance involves the establishment and operation of social institutions, without necessarily creating organizations or another type of formal entities (Inoue, 2016: 99), and allows for governance failures, differently from Rosenau (2000: 15-16), who considers that governance does not depend necessarily on power and, in a normative stand, it is always effective.

A governance system is an ensemble of elements with governance functions, generally with institutional arrangements (among them international regimes, which are specialized to address specific issues and spatially defined areas) in its core (Young, 2017: 27), or considered as "a key constitutive element of governance" (Patterson et al., 2019:361). Institutions are defined as a "collection of rights, rules, principles, and decision-making procedures that give

rise to social practices, assign roles to the participants in these practices, and guide interactions among the participants" (Young, 2017:27). Cognitive, cultural, and technological elements also make up the system.

Young (2008a: 42) defines governance architecture as complex linkages among elements, including institutions, that make up complex governance systems. Biermann et al. (2009) and Biermann and Rakhyun (2020: 2-4), though they still relate the concept to complex institutional settings, offer a more narrow and institutionalist definition as "the overarching system of public and private institutions that are valid or active in a given issue area of world politics" (Biermann et al. 2009: 15), which comprises organizations, regimes, principles, norms, regulations, and decision-making procedures. It impacts all levels of governance and is related to a specific policy domain. Therefore, it is broader than a single institution but is narrower than the global order because of its focus on an issue area (Inoue, 2016; Biermann and Rakhyun, 2020:2)

In the same perspective, Inoue (2016: 107-108) defines institutional architecture as the organization of norms, principles, procedures, rules, and organizations and the relationship between them – networks, in polycentric form, multi-level form, complex system. They usually result from incremental and decentralized processes, with fragmentation as a permanent characteristic of governance architecture, with different degrees according to each domain. A definition of architecture based on linkages instead of institutions encompasses a complex phenomenon more broadly while facing more methodological challenges such as assessing, measuring, and representing these linkages to depict such an architecture.

I use Biermann et al.'s (2009) typology of governance fragmentation based on institutional integration, norm conflicts, and actor constellations (see Table 5) to assess this permanent fragmentation. They offer the 1985 Vienna Convention as an example of synergistic fragmentation, the 1992 UNFCCC as a cooperative fragmentation, and the regulation of access and benefit-sharing by the Convention on Biological Diversity and the TRIPS Agreement as an example of conflictive fragmentation.

Table 5 - Typology of Governance Architectures Fragmentation

	Synergistic	Cooperative	Conflictive
Institutional integration	One core institution with other institutions being closely integrated	Core institutions with other institutions that are loosely integrated	Different, largely unrelated institutions
Norm conflicts	Core norms of institutions are integrated	Core norms are not conflicting	Core norms conflict
Actor constellations	All relevant actors support the same institutions	Some actors remain outside main institutions but maintain cooperation	Major actors support different institutions

Source: Biermann et al (2009: 19)

For Young (2017: 40), designing a governance system for climate change that covers all of its aspects is not politically feasible. Therefore, the global climate governance institutional core organization is "clustered regimes, non-hierarchical arrangements linked to one another in spatial or functional terms." For instance, Van Asselt and Zelli (2018) consider that the Paris Agreement has reinforced UNFCCC as the central element in climate governance but describe how other international regimes, such as economic, human rights, and transportation institutions, are related to the global climate crisis. Finally, Biermann et al. (2009) presented that multiple negotiation tracks, contact groups, and informal negotiations in the UNFCCC characterize a cooperative fragmentation for global climate governance. There are also multiple elements and processes outside the Convention - partnerships, forums, high-level ministerial dialogues, emission trading schemes, and subnational initiatives.

These "external" elements may be related to the governance core explicitly, with coordination mechanisms; connected to it by the participation of its main actors in these initiatives; or by following the problem framing, with similar objectives, targets, principles, and norms, either in a complementary or dependent way. External elements that complement and strengthen the institutional core characterize a complementary relationship. In contrast, a dependency relationship implies that external elements are dependent on the institutional core and rely on its norms and rules. They can also have a conflictive relationship with norms and rules that oppose the institutional core (Hickmann, 2017: 49-52).

As Young's definition puts institutional arrangements at the global governance center in analytical terms, national-states have a central role in global governance systems because they are either designed or mainly composed by national-states. Although the role of non-state actors and subnational governments is relevant in the case of environmental regimes, nation-states remain the main agents. In the case of climate change mitigation and adaptation, negotiations at the global level need back up from actions at multiple levels, which encompass multiple actors beyond the state (Ostrom, 2010b) and raises questions such as which is the adequate level for climate action, or how is the interplay of different levels in climate action. For example, for Steinberg and Vandaveer (2012: 44), multi-level linkages address "the impact of international institutions on domestic interests, ideas, and institutions, and how domestic political forces mediate these influences."

Moreover, even if some of the works about global governance admit that state authority has been transferred to non-state actors (Rosenau, 2000: 14), the acknowledgment that nation-states are the main actors influences considerations about governance architecture, agency, power, authority, and the system rationality. Therefore, the theoretical depiction of the architecture impacts how its operation is perceived - actors' agency and how actors' decisions and institutions are shaped (Okereke et al., 2009; Biermann and Rakhyun, 2020: 2). Also, analysts can use the change of participants' behavior as a function of how institutional arrangements have influenced problem-solving and as a measurement of institutional effectiveness outcome (Young, 2017:28).

For that reason, the assumption of global climate governance as a multi-level or polycentric phenomenon matters in analytical and normative terms. Nevertheless, this differentiation is not static: how the system operates may be more multi-level or polycentric at different points in time, with different normative implications according to the type of rules assessed. The following section differentiates both approaches according to six different dimensions.

2.2 Multi-level and polycentric governance approaches

According to Stein and Turkewitsch (2008: 7), Piattoni (2014), and Jänicke (2017), multi-level global governance (MLG) emerged as a concept in the 1990s, from studies on the organization of the European Union (*polity* – state structure), the dynamics of decision-making processes (*policies*) and political mobilization (*politics*).

The concept definition focus on structure analysis (a multi-level polity) and its characteristics:

The term multi-level governance denotes a diverse set of arrangements, a panoply of systems of coordination and negotiation, among formally independent but functionally interdependent entities that stand in complex relationships with each other and that, through coordination and negotiation, continue to redefine interrelations. (Sabel and Zeitlin, 2007, in Piattoni, 2014: 172)

Levels are defined primarily from a territorial scale (supranational, national, subnational level), with authority hierarchy, or, more generally, from jurisdictions (specific functions and constituent units interested in performing these functions). The subnational level is a relevant level of mobilization, with overlapping competencies and interaction of political actors among different levels (subnational, national, supranational), which allows for new configurations of power and competencies. Some actors, however, are involved in policymaking, while others can shape policymaking (Piattoni, 2014: 166-168).

Hooghe and Marks (2003: 233-235) propose two types of multi-level governance as alternative responses to coordination problems that arise from the reallocation and diffusion of decision-making away from the central state. Both types can coexist and complement each other, and multi-level governance allows for scale adjustment. In building this typology, the authors present a literature review on the diffusion of authority into five categories, which share the assumption that the dispersion of governance across multiple jurisdictions is more flexible than the concentration in only one jurisdiction. The categories are:

- a) European Union studies, based on territorial levels;
- b) International Relations studies, with emphasis on the reconfiguration of authority between levels and between actors;
- c) Federalism literature, which analyzes the optimal allocation of authority between multiple levels of government and how governments between different levels interact;
- d) Local government studies, which address the issue of jurisdiction and competition or coordination between jurisdictions; and
- e) Public policy analysis, which addresses the issue of creating common goods, market principles, and self-organizing networks.

Type I multi-level governance (MLG) has a system-wide and durable architecture, with each level of government as a possible unit of analysis (Abrucio and Sidow, 2018: 45). There are five general-purpose levels of jurisdiction - international, national, regional, meso, and local, and the division is well defined – but there is only one relevant jurisdiction for each territorial scale, and there is no jurisdiction overlap. The division is usually based on broad communities, either by territorial definition or participation in religious or ethnic groups. Type I MLG is related to the concept of federalism, and the jurisdictions have a lasting character (Hooghe and Marks, 2003; Abrucio and Sidow, 2018).

Type II governance is related to international relations studies, the European Union, political economy, federalism, and public choice theorists. There is no predominant type of actor, as jurisdictions are multiple, function-specialized, and may overlap, resulting in problem-driven flexible design. However, with voluntary participation, public and private actors may have collaborative or competitive behavior in flexible arrangements according to a specific problem.

Young (2008a: 43) presents a state-centric definition of multi-level governance as "linkages across levels of social organization that have significant implications for efforts to address environmental issues," with states at the national level and a web of laws, norms, and practices at the international level. Jänicke (2017: 110) reinforces the separation of jurisdictions in defining multi-

level climate governance as a system in which each level “has its own responsibilities, challenges and opportunities” and specific horizontal dynamics to peers.

Piattoni, describing the work of Chris Sckelcher (2005: 94 *in* Piattoni, 2014: 170), points out that type I MLG is the predominant mode within national polities, with the type II MLG emerging only in specific cases when type I MLG “mainstream governmental organizations are unable to respond flexibly to policy issues that intersect their jurisdiction.” Type II MLG is generally embedded in type I (Hooghe and Marks, 2013: 238), and polycentric governance would result from overlapping between MLG types I and II. However, for Stein and Turkewitsch (2008: 26-27), the MLG type II definition should not be used because it is a conceptual stretching and not as clearly detailed as type I. As a result, they recommend its redefinition as a kind of polycentric governance, with vertical and horizontal modes of governance.

Polanyi (1951) first used polycentricity as a concept. It refers to a “social system of many decision centers having limited and autonomous prerogatives and operating under an overarching set of rules” (Aligica and Tarko, 2012: 237). Polanyi used an analogy to the self-organization of scientists to address a complex problem to address the concept, which then expanded to the analysis of markets, legal studies, urban network studies, and governance studies. It was later adopted to climate change by Elinor Ostrom (Ostrom, 2010b; Aligica and Tarko, 2012; Dorsch and Flachsland, 2017: 48-49).

According to Jordan et al. (2018a: 4-9), Elinor Ostrom's proposal could unify the diversity of terms and conceptualizations for global governance and translate the transition that global climate governance was going through from a more centralized and state-centered form to a multi-actor, multi-sector, multiscalar and complementary one. Ostrom (2010b) considers that the polycentric system concept helps reduce the threat of global climate change and defines it as

Polycentric systems are characterized by multiple governing authorities at differing scales rather than a monocentric unit [...]. Each unit within a polycentric system exercises considerable independence to make norms and rules within a specific domain (such as a family,

a state or province, a region, a national government, or an international regime). Participants in a polycentric system have the advantage of using local knowledge and learning from others who are also engaged in trial-and-error learning processes. (Ostrom, 2010b: 552)

Ostrom (2010a and 2010b) shows empirical evidence based on local and medium-range common-pool resources environmental social dilemmas that challenge the presumption that a central government is a definite solution to this type of good. However, the fit¹⁴ and trust issues gain importance whenever other actors in distinct levels are considered into the framework of analysis since there are limitations to processes and mechanisms scaling up and down across levels (Young, 2017:63-64).

Jänicke (2017:118) describes a polycentric system as a "multi-impulse system, where the plurality of impulses from different points of the system and different points in time can play the same role as one strong (often contested) impulse or instrument." For Aligica and Tarko (2012:251),

Polycentricity emerges as a non-hierarchical, institutional and cultural framework that allows the coexistence of multiple centers of decision making with different objectives and values. It sets up an evolutionary competition between those different decision centers' complementary ideas and methods.

Based on Ostrom's work, Jordan et al. (2018a) have identified five propositions from the polycentric approach to global governance: (i) local action (self-organizing processes); (ii) mutual adjustment (a spontaneous collaboration between units); (iii) experimentation (learning and innovation); (iv) importance of trust (endorsed by Dorsch and Flachslund, 2017); and (v) comprehensive rules that express the objectives to be achieved. Each of these propositions has descriptive, explanatory, and prescriptive implications. Aligica and Tarko (2012:

¹⁴ Problems of fit are related to the match between institutional arrangements and the socio-ecological issues they are supposed to address (Young, 2019:6).

245) also consider normative implications based on liberty and justice from some of these propositions.

The polycentric approach is valid for the global climate change crisis because it highlights the relevance of policies at multiple levels for commons (common-pool resources) such as the atmosphere and for considering the low likelihood of a robust global agreement to mitigate global climate change. Thus, polycentric governance encourages efforts at multiple levels, with multiscale, multi-stakeholder arrangements linked through information and monitoring networks (Ostrom, 2009; Keohane and Victor, 2016). It also encourages the link between issues, considering trade, energy, safety, and health initiatives, and their effects on global climate change – links between different governance systems (Aligica and Tarko, 2012; Asselt and Zelli, 2018).

An in-depth literature review of global environmental governance has shown that research on different issues (biodiversity, oceans, climate change) commonly uses multi-level and polycentric approaches. In this study, I find that they have the potential to highlight some dimensions¹⁵ to strengthen the global governance concept analytical scope, considering levels and actors. However, they vary in their depiction of governance architecture description and how actors and levels interact (Hooghe and Marks, 2003; Gupta, 2008; Ostrom, 2010b; Piattoni, 2014; Gallemore et al., 2015; Gupta et al., 2015b; Liefferink and Wurzel, 2018; Jordan et al., 2018a; Setzer and Nachmany, 2018; Morrison et al., 2019).

Table 6 presents six dimensions for analysis for each of the two approaches to global governance. Dimensions are defined as "unstructured aspects of reality or phenomena" and can be considered the basic concept in a multiple-scale analysis (Vervoort et al., 2012). The six dimensions are:

a) Governance architecture: an overarching system of public and private institutions that are valid or active and that has an impact on which actions and strategies are available for the actors engaged (subnational, private, and civil society), and the relationship between these institutions;

¹⁵The literature review bases the choice for these six dimensions. There are other dimensions, like legitimacy, but for this study, these are the main dimensions for the analysis framework to describe interactions among levels and how subnational intermediary governmental units operate at global climate governance.

- b) Overarching rules: an accepted ensemble of formal and informal rules, which address operational matters such as dispute settlement, reduction of discord, and mutual adjustment;
- c) Authority diffusion: authority diffusion from state to non-state actors is an assumption in global governance. It can happen in different forms, and this diffusion can reframe power dynamics in the system;
- d) Power dynamics: the concept of power is relational, emerges through interactions over time, and influences governance architecture and institutional performance;
- e) Interaction of state and non-state actors: what kind of roles, type, and level of interactions are expected according to each approach;
- f) Transaction costs: costs related to engaging in a relationship and reducing uncertainty.

Table 6 - Description of multi-level and polycentric approaches on global governance

DIMENSION	MULTI-LEVEL GOVERNANCE (MLG)	POLYCENTRIC GOVERNANCE
Governance architecture	Focus on structure analysis. Levels are defined by territorial scales, with authority hierarchy. There is less probability of overlapping because lower levels are embedded in higher levels.	Multiple decision-making centers and governing authorities coexist in different scales, based on self-organization, higher probability of overlapping jurisdiction, and trust matters.
Overarching rules	Rules arise mainly from intergovernmental interactions, establish hierarchies, have higher potential for accountability and transparency.	More organic rules emerge from activities at lower levels and a higher probability of a lower common denominator.
Diffusion of authority	Authority is a characteristic of governmental actors at the national level based on their international commitments and national legislation, which is diffused to other actors at different levels mainly through delegation.	There are multiple governing authorities with multiple and diffused interactions vertically and horizontally, and among different polycentric systems, either through delegation or autonomously.
Power dynamics	State actors dominate the roles of sovereignty and government. Non-state actors are influenced and influence state actors and governance elements, but their role as governors is limited.	State actors lose leverage over government aspects of power, and non-state actors can be considered governors in some contexts. There is complex top-down and bottom-up diffusion.
State and non-state actors interaction	The state is a gatekeeper, regulator of other actors'	Self-organization and coordination, with trust and communication as

DIMENSION	MULTI-LEVEL GOVERNANCE (MLG)	POLYCENTRIC GOVERNANCE
	behaviors, and leader of interactions. Expected interactions are mainly vertical, integrated, and strong.	essential features. Expected interactions are mixed, with weak horizontal and vertical integration.
Transaction costs	Lower	Higher

Source: Author's elaboration

2.2.1 Governance architecture

A more institutional architecture is the reference for this dimension, as defined by Biermann et al. (2009), Inoue (2016: 107-108), and Biermann and Rakhyun (2020: 2-4) as the organization and relationship between norms, principles, procedures, rules, and private and public institutions in a specific policy domain.

A multi-level architecture is more rigid and possibly durable. Its levels are defined mainly by territory jurisdictions, less prone to unexpected authority overlapping. Such a nested perspective of levels is more state-centered in the International Relations discipline, with the state acting as a gatekeeper in some institutions and regarding some procedures. This perspective also presents limitations for scaling up and down of processes and solutions across levels since some mechanisms and practices at one level are not necessarily translated to others (Young, 2017:63-64).

The elements that characterize polycentricity are the diffusion of authority and decision-making centers that share the exercise of coercive capabilities, overarching rules (or encompassing system of rules), self-correction, and spontaneity. The overarching rules are an operational criterion to define which actors are insiders and outsiders of a governance system. As in type II MLG defined by Hooghe and Marks (2003), jurisdiction overlapping in polycentric governance can be territorial and non-territorial. Therefore, an actor can be an insider of a system's unit but an outsider of another unit, a position that can alter how actors exercise authority (Aligica and Tarko, 2012: 245-255). Trust-building and conflict resolution procedures are relevant features of a polycentric system because it is based on self-organization, and there is a higher probability of overlapping.

2.2.2 Overarching rules

Overarching rules are an accepted set of formal and informal rules that address operational matters such as dispute settlement, reduction of discord, and mutual adjustment in a governance system. For the system's operation, the overarching rules should match (fit) the principal biophysical and socioeconomic settings in the system they are supposed to work (Young, 2017: 29).

In multi-level governance, overarching rules usually result from intergovernmental bargains since the nation-state is the main actor in the governance system. Operational matters are defined according to the jurisdictional levels, and top-down prevail over bottom-up dynamics. While there is a higher probability for well-defined matters of accountability and transparency, there is a higher probability for the problem of fit (lower correspondence between rules and the biophysical and socioeconomic settings) for complex issues that are multiscalar and covers multiple stakeholders. There is also a higher probability for legitimacy questioning by non-state actors because of the top-down design.

Overarching rules are a condition for polycentric systems (Aligica and Tarko, 2012: 245-250) since multiple decision-making centers operate within them. Their emergence is more organic than multi-level governance because they result from the interactions at lower levels and smaller scales. Top-down and bottom-up dynamics can operate simultaneously. Consequently, polycentric systems have a higher probability of fit and legitimacy, accompanied by a bargain result of lower common denominator set of rules at higher levels in a jurisdictional scale, resulting in lower commitments due to the plurality of actors and the necessity to accommodate multiple interests.

2.2.3 Authority diffusion

Hickmann (2017: 7-8) presents global governance as an analytical tool to study authority structures beyond the nation-state. Therefore, subnational actors can be considered a source of authority in world politics. This argument echoes Rosenau (2000: 14), recognizing that part of the governing authority was transferred to subnational collectivities. In differentiating global governance from

international regimes, Stokke (1997: 28-29) also finds a trend of authority relocation in world affairs from state interaction to subnational, transnational, and supranational actors.¹⁶

Considering the authoritative dimension of global governance – the exercise of authority in pursuing goals (Andonova et al., 2009: 55) - authority diffusion is analyzed according to actors and mechanisms to steer collectivity towards desired goals. Based on Rosenau's (2000) formulation, national states remain significant actors, but other actors gain leverage within a less hierarchical setting (Hickmann, 2017:46).

Multi-level and polycentric governance recognize multiple levels and tiers of decision-making and an increased number and types of decision-makers, helping overcome a state-centered perspective by paying attention to other levels of mobilization (Stokke, 1997; Stein and Turkewitsch, 2008: 8; Piattoni, 2012: 172).

In type I MLG, authority distribution is limited, based on delegation (the embeddedness of lower level in the upper level) and with a clear division. Therefore, diffusion of authority to subnational units regarding decision-making at the international level is limited (Stein and Turkewitsch, 2008: 15; Liefferink and Wurzel, 2018). It can be based on national legislation, standards, and mechanisms, organized around central government authority and international commitments. This depiction does not mean that in multi-level governance, authority delegation happens in all cases or that all actors respect the delegation framing. In the case of subnational governmental actors, climate federalism and paradiplomacy help understand how delegation operates and how subnational actors, bounded by the upper level of authority, sometimes may escape it.

In MLG type II/polycentric governance, authority diffusion means multiple centers of authority between levels and actors (public and private) with a less strict hierarchy among them (Liefferink and Wurzel, 2018; Morrison et al., 2019), which can collaborate or compete according to each governance arrangement coalition. Authority diffusion can work through delegation, but non-state actors

¹⁶ This section describes one direction of vertical diffusion – national to subnational. However, diffusion can also happen from subnational to national units, which, in federated regimes, can be considered a source of legitimacy and make national actions in a given domain more likely to happen (Tosun, 2018: 156). How these different logics of diffusion apply to authority diffusion can be further developed.

may also act autonomously (a pioneer or a leader) in different governance arrangements, such as transnational networks (Hickmann, 2017; Liefferink and Wurzel, 2018). As a consequence, authority diffusion can overlap among different jurisdictions. Also, there can be interaction among different polycentric systems, with what Aligica and Tarko (2012: 255) call "nested structures of authority" or "connection points."

In this framework, polycentricity facilitates authority diffusion¹⁷, presenting a conducive environment for experimentation and leadership, with multiple ranges of actions, as well as a higher probability of coordination problems (Gordon, 2015: 135; Liefferink and Wurzel, 2018: 135-136). Here, the concept of global governors may be helpful, with their different forms of exercise of authority, such as agenda-setting, establishment and implementation of rules or programs, and evaluation and adjudications of policy outcomes (Hickmann, 2017: 40).

Also, it may foster a reconfiguration of how authority is recognized – not a simple shift from state actors to non-state actors and primarily based on law and force, but also based on recognition, expertise, and moral position (Andonova et al., 2009: 67). Although this shift may happen in both multi-level and polycentric approaches to global governance, I consider that polycentric governance is more open to this kind of reconfiguration because of its architecture.

In the normative use of multi-level and polycentric approaches, authority diffusion reinforces more democratic and equitable decision-making than monocentric governance (Stein and Turkewitsch, 2008 and 2010). For Morrison et al. (2019), the polycentric approach offers opportunities for representation and participation for different social actors, resulting in a more legitimate form of governance.

2.2.4 Power dynamics

Viola and Franchini (2018: 10-11) define climate power as the "capacity to alter 'societal climate outcome' at the global level," with societal climate outcome

¹⁷ In polycentric governance, diffusion mainly happens through emulation, coercion (constrained choices), learning (social knowledge), and competition (Tosun, 2018: 153-155). How authority diffusion happens with these mechanisms can be better developed.

related directly to climate mitigation. Climate power involves the volume and trajectory of GHG emissions, human and technological capital to foster a transition to a low-carbon economy, and the relationship between resources and energy profile. It is a characteristic attributed to nation-states, considered the main agents in global governance. According to their definition, subnational governments are not capable of being a climate power since their capacity to impact the global level in mitigation terms is limited. Therefore, power dynamics are related to which locus is adequate for action and how power is distributed.

In building this theoretical framework, then, the concept of structural power as the capacity to define a governance structure¹⁸ offers limited space for subnational governments, considering their material capacities in terms of military, economic, technological, and even climate resources.

On the contrary, relational power is the ground for this research framework. Inoue (2016: 102-104) presents power relations as an analytical dimension to a complementary understanding of global governance, which entails more than the definition of power as the capacity to influence the goals, process, and outcomes, but also the conditions of interactions, based on the work of Okereke et al. (2009: 64). This approach puts forward matters of equity and justice, like who are the actors, their uneven capacity and the different practices involved in power dynamics, governance emergence and design, decisions about policy choices, and how policy outcomes are assessed within those structures. Okereke et al.'s (2009) and Inoue's (2016) attention to these matters is relevant in using the diagnostic method to understand global climate governance through subnational governments' lens, as will be detailed in Chapters 3 and 4.

Power dynamics can be assessed in many ways: for Morrison et al. (2019), the top-down diffusion of power is generally analyzed in its potential negative effects, while Finnemore and Sikkink (2001:397), based on a distributional account of power, consider that power asymmetry between nation-states at the international system can be a variable through which to understand power dynamics and norm internalization at the subnational level. For Okereke et al.'s (2009: 62) account of theoretical developments for governance, non-nation-state

¹⁸ This definition is different from Barnett and Duvall's (2005) structural power, but it is closer to their definition of institutional power.

actors can influence nation-state actors, but their role as 'governors' is still restricted. In this approach, it is possible to consider the governance system prone to domination by powerful actors or the transition of issues between scales and levels where these actors have more influence (Inoue, 2016: 103; Jordan et al., 2018a: 13).

Therefore, power dynamics will differ according to multi-level and polycentric approaches since understanding the location of power helps the understanding of a socio-political and economic order (Okereke et al., 2009: 65). Based on the relational account of power, the choice of each approach will highlight different sociopolitical factors and dynamics related to power, unequal and conflicting interests, and the relative position of multiple actors in the governance architecture and to other actors through time.

Assuming that the multi-level approach entails a more robust regulatory role by nation-states, they dominate the roles of sovereignty (control over territory with the rule of law and sanctions), government (mechanisms, techniques, and procedures to implement a program), and the capacity to influence goals, process and outcome (Okereke et al., 2009: 62-63, and Inoue, 2016: 102-103). Therefore, they can delegate decisions to non-state actors in a hierarchical structure (Aligica and Tarko, 2012) or be influenced by non-state actors. However, the interaction conditions are mainly shaped and controlled by state actors.

In polycentric governance, although still controlled by nation-states, the sovereignty account of power loses leverage because of authority diffusion and decentralization. The system hosts multiple governing arrangements, encouraged by experimentation, orchestration, and diffusion, changing the conditions of interaction for non-state actors substantially. Nevertheless, power dynamics are more challenging to observe, define, measure, manage, and generalize since they are shared between multiple actors and levels. This power-sharing is not a simple transfer of power from the state to non-state actors like in a zero-sum setting, but in new and more complex dynamics (Okereke et al., 2009: 62-68, and Aligica and Tarko, 2012).

Ostrom (2010a: 13) describes some polycentric-based design principles in long sustained regimes for successful common-pool resources management.

One of them is *collective choice arrangements*, which means that "most individuals affected by a resource regime are authorized to participate in making and modifying its rules." This principle, however, is applied to low to medium-sized arrangements and does not necessarily make its way to higher levels on a jurisdictional scale, even if it gives room for experimentation in governance design and policymaking.

Accordingly, there is increased complexity in power relations between non-state and state actors based on different possible patterns of interactions, such as coercion, collaboration, convergence, and competition, through a multiplicity of channels to exert influence on goals, processes, and outcomes. The possible result is a focus on micro-relations at the local level and risk of overemphasis of subnational governmental actors' capacity to influence state actors and governance processes (capacity to scale-up, as presented by Van der Ven et al., 2016).

However, recognizing this capacity and its limitations improves the knowledge about power in polycentric systems because it puts forward different conceptualizations and typologies, dynamics, and potential outcomes that are customarily neglected (Morisson et al., 2019).

2.2.5 State and non-state actors' interaction

According to Setzer and Nachmany (2018), the state has two roles: regulating, controlling, or influencing others' behavior; and mobilizing other actors for action. All states have both roles, but in states with more robust regulation characteristics and mechanisms influenced by different political regimes (e.g., dictatorships), the interactions between national and subnational units are expected to be state-led. For states with stronger mobilization characteristics and mechanisms, diffused and multiple types of interactions can be expected.

Stein and Turkewitsh (2008: 10), describing academic criticisms of multi-level governance, phrase that "it tends to exaggerate the importance of subnational actors" and neglect the important role of central governments as gatekeepers. Therefore, states with stronger regulation characteristics or more

rigid definitions of constitutional powers are expected to act as gatekeepers, which is better understood by the multi-level governance approach.

Ostrom (2010b: 552-556) challenges the theoretical presumption that the global level is the only relevant in the scale for the provision and production of public goods. However, the operation of such a description of an effective polycentric system appears to be organized around small to medium size arrangements, where there can be trust and commitment. Nevertheless, among the terms by which Dorsch and Flachslan (2017: 50-51) characterize a polycentric approach to climate governance is the focus on the actors, ranging from local (individuals and families) to trans and international levels (minilateral clubs, states, provinces, national governments, and international regimes and institutions) and an emphasis on self-organization and coordination among them.

Based on the New Climate Institute et al.'s (2019) evidence of national and subnational units' interactions, state and non-state interactions can be analyzed by their type and by their degree:

Types of interaction:

- State-led, subnational-led and non-state-led interactions - definition by the type of actors that lead the interactions;
- Mixed interactions, in which subnational, state, and non-state lead in different periods;
- Vertically top-down integrated interactions - lower levels are embedded in higher levels;
- Horizontally integrated interactions - multi-centered and less hierarchical interactions;
- Conflictive interactions - when interactions are based on conflict or competition;

These types of interactions can be cumulative: there can be, for instance, vertically top-down state-led interactions and horizontally conflictive interactions.

Levels of interactions:

- Weak interactions - not provided for in the overarching rules, with low interplay repeating and low level of trust;
- Strong interactions - high density of interactions among different types of actors, provided for in the overarching rules and with higher levels of trust.

For instance, Gallemore et al. (2015) found out that civil society organizations in Indonesia that engaged in REDD+ policies development had weak interactions with governmental and private organizations, which led to a lack of trust and coordination, and higher transaction costs in this multi-level governance system. In the polycentric approach, the lack of trust can be an element of order breakdown.

Multi-level governance provides a better description of vertically top-down integrated interactions. Conflictive interactions, according to Piattoni (2014), and mixed interactions (vertical, horizontal, transnational), according to Stein and Turkewitsch (2008), would be better addressed by the polycentric governance approach. However, both approaches can analyze all types of interactions with different implications.

2.2.6 Transaction costs

The atmosphere is a common-pool resource - a type of good with elevated difficulty for excluding potential beneficiaries and high subtractability of use, which means that the consumption by one member does not limit the consumption by others. Therefore, global climate change mitigation is a collective action problem, with incentives for government intervention to reduce transaction costs according to traditional social theories of utility maximization (Coggan et al., 2010; Ostrom, 2010a).

In the global climate governance system, the non-existence of a central government entails action from the system's core. This core embodies both institutional environment, defined as "the legal, social and political rules that determine the context in which economic activity takes place," and institutional

arrangements, defined as "the governance structures which structure transactor interaction" (Williamson, 1990, 1998, *in* Coggan et al., 2010: 1778).

Transaction costs are "costs associated with engaging in a relationship" (Gallemore et al., 2015). The number of participants, the need for inter-jurisdictional coordination, the level of trust among the participants, uncertainty and incomplete information, interest-group capture, corruption, spillovers among jurisdictions, and power distribution are some of the elements associated with transaction costs (Young, 2000; Hooghe and Marks, 2003: 236 and 239; Coggan, 2010; Gallemore et al., 2015). For Coggan et al. (2010: 1783), transaction costs also vary across time - institutional development, implementation, and operation

Coggan et al. (2010) emphasize uncertainty as an element of transaction cost, which in the climate change crisis can be attributed to the problem definition and the relationship among the actors involved. As to the problem definition, although IPCC reports have shown higher confidence in scientific development about climate change sources and effects, there is still some uncertainty about climate change scenarios modeling, costs, and spillover effects, as we reach a dangerous to disruptive climate change.

Young (2000: 252) and Coggan (2010: 1781) also emphasize the interaction among players. The higher the number of actors involved, with different natures, the higher the transaction costs, because of the need for information collection, power distribution, a higher probability of lower trust among participants and more difficulty to reach an agreement.

With all these elements in mind, multi-level governance is expected to have lower transaction costs than polycentric governance. For example, in type I MLG, transaction costs are reduced by limiting the number of autonomous actors and autonomous jurisdictions because of a more rigid hierarchy among levels and reduced spillovers among jurisdictions. In type II, limiting the interaction among actors reduces transactions costs by constraining interactions across jurisdictions (Hooghe and Marks, 2003: 236-239), which can be a more intricate solution considering the level of interdependency among participants and hinder the operation of the system.

For instance, Gallemore et al.'s (2015) work on social network analysis of relationships among organizations engaged in REDD+ policy development in Indonesia at national and provincial levels reached the conclusion that central government-led efforts to incorporate civil society representatives in governance processes reduce transaction costs and provided "experimentalist governance."

There is a higher probability of higher transaction costs among the different elements in a polycentric system since they may be based on different rights, rules, principles, decision-making procedures, and composition. There are also potential spillovers among the different jurisdictions (Dorsch and Flachsland, 2017: 58). Nevertheless, this does not mean that the transaction costs necessarily hinder the system's operation since there can be an acceptable level of transaction costs inherent to any operation or considered adequate compared to the risk of no action.

In conclusion, the analysis of transaction costs is a matter of potential trade-offs between the costs and the benefits of a specific architecture and the problem it aims to solve, especially considering a problem such as climate change.

2.3 Analytic Eclecticism – the role of subnational governmental actors

Even though the framework developed so far accommodates non-nation-state actors, it still focuses on the global scale and nation-state actors. Therefore, other elements should be included emphasizing the subnational level dynamics to address the research question of *how subnational governmental actors commit to global climate governance*.

Analytic eclecticism is a means to perform such a task. Sil and Katzenstein's (2010: 412) definition of analytic eclecticism has three markers: i) a broadly pragmatic ethos; ii) an effort to formulate problems in a manner that seeks to trace rather than reduce complexity (widening the scope of problems); iii) the construction of causal stories focused on the complex process through which different types of mechanisms interact. They consider that analytic eclecticism is different from multicausal explanation, multi-method research, or methodological triangulation because it aims to accommodate "a wide range of problems, concepts, methods, and causal arguments" (Sil and Katzenstein, 2010: 412). As

a result, it integrates elements from diverse research practices relevant to a more complex argument to a specific research question.

Steinberg and VanDeveer (2012) offered an example of analytic eclecticism when they found overlapping interests and research agendas between comparative politics and environmental politics, what they call *comparative environmental politics*. Anyhow, one has to be aware of incommensurability – competing ontological and epistemological foundations of different research traditions (Sil and Katzenstein, 2010: 414) to engage in such a bridging effort.

For Lake (2013: 571-577), middle-range theories have offered progressive and eclectic approaches in the International Relations discipline for "their empirical power and ability to generate new propositions that are themselves empirically confirmed" (Lake, 2013: 577). They are crafted to answer specific problems and can encompass different levels of analysis (like subnational units), mixed assumptions, issue areas, units, and interests (Lake, 2013: 573).

This section, then, departs from global governance to include two middle-range developments to the theoretical framework: the definition of climate commitment as a measurement for institutional effectiveness and paradiplomacy as a concept to assess opportunities and limitations for subnational governmental actors in global climate governance. Such an effort is also necessary to develop the multi-method framework in Chapter 3.

2.3.1 Climate commitment

Viola et al. (2013: 116) consider that in an international system of conservative hegemony, international institutions cannot answer to challenges such as global climate disruption. Therefore, there is a need for other governance elements, which they address through an alternative theoretical approach for global climate governance based on the level of commitment of individual actors with the governance system.

They define climate commitment as the level of assimilation of climate change as a main civilizational driver by a society, which expresses this society's position in global climate governance (Viola et al., 2013: 28). The definition of climate commitment has two dimensions: i) the climate situation – GHG

emissions profile and trajectory, vulnerability and mitigation options; and ii) the political situation – how the society and its political leaderships assimilate climate change in both domestic and foreign policies.

They stress that institutional developments, a common approach from the IR literature in global climate governance, are not a sufficient variable to explain variation in national climate commitment since nation-states engaged in such institutions through international negotiations have different commitment levels. Also, international institutions do not respond adequately to the scientific developments about what is necessary to tackle climate change.

Viola and Franchini (2018), also based on a pessimistic perception of institutional effectiveness, developed a climate commitment approach centered on state actors' individual political and economic developments beyond the international climate regime and based on the international political economy of global warming. They recognize global governance as a broad concept encompassing multiple actors (public and private) and levels (local to global) and consider the state as a plural actor, composed of multiple social dynamics. The authors' choice to focus on nation-states results from their level of agency compared to other players.

The climate commitment approach is an analytical tool to assess different societies' perspectives of climate governance – “whether a society is contributing to aggravate or mitigate the global warming problem” (Viola and Franchini, 2018: 12). The levels of climate commitment range from the categories of conservative to reformist. The former has political forces that resist the changes necessary to mitigate climate change and operates in a business-as-usual manner. The last has a society with high awareness about climate change and responsive domestic and foreign policies towards decarbonization.

The climate commitment has two dimensions: a GHG emissions profile and a policy profile, described in

Figure 3 - The Climate Commitment Approach

GHG emissions profile

- Total GHG emissions
- Per capita GHG emissions
- GDP carbon intensity

Policy Profile

- Domestic profile: normative and bureaucratic framework (law, target, climate bureaucracy in policy-making), policy measures (national strategy or program, target), policy implementation (policies and programs consistent to mitigation targets).
- Foreign policy profile: country is a blocker or catalyzer of climate cooperation considering its position within climate change international regime, its alliances and voluntary commitments.

Source: Author's elaboration, based on Viola and Franchini (2018: 20-23).

Even though Viola and Franchini's (2018) proposition departs from criticism to an institutionalist approach, climate commitment can be considered a measurement of institutional effectiveness based on outcomes from an institutionalist perspective, defined as the effects of institutions on the behavior of actors (Young, 2008: 17-20; 2017:28). Therefore, there are two different ways to interpret the same approach according to the theoretical argument.

If climate commitment is considered an institutional outcome, and we assume that institutional developments are insufficient, a similar result would be attained. For example, while for Viola and Franchini (2018), the main agents' profile results in an international system under a conservative hegemony, there would also be a limited change in the behavior of the main actors from an institutionalist perspective.

Viola and Franchini (2018) do not abandon the institutional variable completely, as demonstrated in the policy profile of the climate commitment

approach. However, it seems that it is considerably downsized in their theoretical proposal. The international political economy of climate change is the independent variable that explains climate commitment.

Ribeiro and Inoue (2019) assessed Brazilian leadership in global environmental politics. For them, both commitment (defined by the power structure) and institutional developments (the rules for political interplay between different actors - state and non-state) are variables to be considered in understanding actors' behavior and agency in global governance. Nevertheless, they may have different weights in different periods.

In a modified structural perspective (Krasner, 1982), a possible causal schematic would have the international political economy of climate change as the independent variable, international institutions as an intervening variable, and climate commitment as the dependent variable. This schematic is not limited to institutional elements, even though they are considered relevant explanatory variables (Young, 2017).

The novelty of this causal schematic is the focus on the subnational level and its development on how the intervening variable results in the climate commitment of subnational governmental actors. Viola and Franchini's (2018) description of the international political economy of climate change is maintained. As demonstrated in Chapter 1, countries with a higher commitment in general tend to present more action at the subnational level. However, the institutional element is maintained as part of the model because of the global governance theoretical framework. Indeed, an encompassing explanation of action at the subnational level cannot solely be limited to the nation-states' commitment.

However, the analysis of climate commitment at the subnational level will differ according to each theoretical approach. For the multi-level approach, subnational climate commitment mostly complements the national position. Therefore, players at other levels have a limited level of agency compared to nation-states, in a more hierarchical relationship between them. The polycentric approach amplifies the importance of actions at multiple levels. Therefore, non-state and subnational players have higher levels of agency. The overarching rules are the same in both approaches and located at the global level.

Rules and procedures (Krasner, 1982) define the institutional core's prescriptions for subnational actors' engagement and participation as non-party stakeholders. National constitutions define authority division between national constitutional powers within a country. Understanding the interplay between institutional prescriptions and national constitutional powers helps explain how subnational state actors conduct international relations and their commitment to global climate governance in a global-to-local perspective.

Van der Ven et al. (2017) created a qualitative value assessment of subnational actions in a bottom-up perspective, based on scaling (capacity to scale up – when subnational practices can lead to changes in national or international climate policies) and entrenchment (capacity to become entrenched in social, political and economic institutions) that demonstrates subnational actions valuation beyond quantitative and outputs measures (e.g., GHG emissions)¹⁹. Both scaling and entrenchment can increase the likelihood of broad and transformative decarbonization outcomes.

Their approach is meaningful because it analyses subnational government actions beyond their impact on global GHG emissions, reductions targets and governance processes – the possibility of transforming existing institutions (Van Der Ven et al., 2017: 5). Moreover, governance processes (policy or plans implementation, participation in international networks or initiatives, etc.) can also be considered prior to impact/output in a causal sequence, as GHG emissions reductions can be an observable result of them (Van Der Ven et al., 2017: 7).

Happaerts (2012) has a work that tries to answer how subnational governments respond to global sustainable development governance. He asserts that, though subnational governments usually do not participate in international negotiations, they are responsible for implementing practical solutions on many issues, and there is increasing action from these actors at the international level, which reinforces the necessity to understand how scaling and entrenchment happen.

¹⁹ Van der Ven et al. (2017) define four types of scaling – simple scaling, self-organized scaling, cross-over scaling, and modular scaling – and four types of entrenchment – lock-in, self-reinforcing, positive feedback, and indirect entrenchment. See Van der Ven et al. (2017, p. 8-10) for more detail.

These works use different middle-range theories: Van der Ven et al. (2017) use the concept of orchestration, while Happaerts (2012) uses the policy convergence literature. For the climate commitment approach at the subnational level in Brazil, a federated regime, I chose the paradiplomacy concept because it simplifies the causal schematic based on a clear division of authority in federated regimes, which limits the range of action for subnational governmental actors.

2.3.2 Climate federalism and paradiplomacy

Dorsch and Flachslan (2017: 54) stress that subnational actors (sub-federal state actors) can have limitations in enacting a climate policy because of constitutional constraints. The concepts of climate federalism and climate paradiplomacy help understand this condition. The former is the division of authority for climate change action between the federated units (central government, states, and municipalities in the case of Brazil). The latter defines participation in national foreign policy decision-making and the division of constitutional powers to conduct international relations for subnational units on that matter. Although different concepts, they are closely related and should be reinforcing.

Climate federalism in the Brazilian Federal Constitution reflects the complexity of climate change as a "wicked problem," broader than an exclusively environmental issue. Subnational action is addressed according to each specific issue: environmental protection, transportation, sanitation, energy production and distribution, nuclear power – each issue has a different responsibility division among governmental actors in the federal government structure.

GIZ (2020), the German Corporation for International Cooperation, has a detailed work about state-level governments' supplementary competencies to act regarding forests, nature conservancy, environmental, land and natural resources protection, and pollution control in Brazil (Federal Constitution article 24). In each of these issues, there is "concurrent legislation," which means that all three levels can legislate in the matter. However, federal legislation has precedence over state legislation, which has precedence over municipal legislation. Federal responsibility, nevertheless, is restrained to general norms,

and when there is no national legislation, states should have complete legislative competence. Agrarian issues, energy, water, and transportation (terrestrial, air transportation, and navigation) are regulated exclusively by the Federal Government (Federal Constitution article 22).

For GIZ (2020: 20), local to national governments act according to cooperative environmental federalism, as established by Complementary Law n. 140/2011²⁰, which regulates the Federal Constitution article 23. Cooperative federalism, as defined by Setzer (2013: 46-47), indicates that national and subnational governments can legislate on the same issue, but act in a complementary way to solve a social problem. Law n. 140/2011 is subsequent to Law n. 12.187/2009, which establishes the National Policy for Climate Change. Nevertheless, it does not mention the National Policy, or even climate change generally, although it mentions the division of responsibility for the National Environmental Policy, environmental education, biodiversity, among other environmental issues.

Paradiplomacy, by its turn, is not restricted to a specific issue but to foreign affairs as a state policy. Schiavon (2019: 27), based on a comparative analysis, defines it according to two dimensions: the central-local coordination in foreign affairs, according to sub-state government (SSG) participation in national foreign policy decision-making and implementation, and on constitutional powers to conduct international relations for subnational units. The result is a four-kind typology, described in Table 7.

Table 7 - Types of central-local coordination in foreign affairs

		SSG participation in national foreign policy decision making and implementation	
		Exclusive	Inclusive
Constitutional powers to conduct international relations for SSG	Exclusive	Exclusive: central control of foreign policymaking and implementation, and no constitutional powers for international relations of SSGs.	Consultative: participation in foreign policymaking and implementation, with no constitutional powers for international relations of SSGs.
	Inclusive	Complementary: central control of foreign policymaking and implementation, with constitutional powers for international relations of SSGs	Inclusive: participation in foreign policymaking and implementation, with constitutional powers for international relations of SSGs.

Source: Schiavon (2019: 27). SSG: Sub-state governments.

²⁰ See http://www.planalto.gov.br/ccivil_03/leis/lcp/lcp140.htm. Access on December 10, 2020.

Brazil has a complementary type: exclusive foreign policy making and implementation, central control, and constitutional powers to sub-state governments to conduct international relations. According to the Federal Constitution, in article 21, which defines the central government competencies, the federal government is in charge of having relations with foreign States and being part of international organizations²¹.

For Schiavon (2019: 65-70), then, subnational governments in Brazil have residual power (article 25 of the Federal Constitution) since there would be no legal restriction to subnational governments' paradiplomacy if they do not interfere with federal foreign policy. For Macedo and Jacobi (2017), state governments have been engaging in environmental paradiplomacy since the 1990s without a clear regulatory framework, while the federal government has provided moderate support to sub-state players' engagement, specifically in climate paradiplomacy.

Therefore, climate federalism is not easily defined for the Brazilian case since it encompasses various issues with different divisions of authority between the federated units. Although Schiavon (2019) defines paradiplomacy as complementary – there is central control of foreign policymaking, and sub-state governments have constitutional powers to make international relations – there is no clear regulatory framework for action in Brazil.

It is possible to assert that cooperative climate federalism influences a complementary climate paradiplomacy and that climate paradiplomacy can be a means to alter climate federalism or the national standing in the international

²¹ There was a proposal to amend the Constitution (PEC 475/2005), altering article 23, which defines common competencies to the central government, states, the Federal District, and municipalities, to allow the federated units to make agreements or sign acts with foreign subnational governments. According to a report made at the Chamber of Deputies that analyzes the constitutional adequacy of the proposal, this alteration was inadequate, based on articles 18 and 30 of the Constitution, since subnational governments (states, federal district, and municipalities) have the autonomy to sign acts and agreements in their sphere of competence. There are, however, two limitations defined by the constitutional text: when there is an explicit restriction, as in articles 49 and item V of article 52, and in the case of the responsibilities explicitly attributed by the Constitution to other state entities (the Federal Government or municipalities). Subnational governments can sign international agreements related to their responsibility with different actors – individuals, non-governmental organizations, countries, provinces. See Setzer (2015: 331-332) about subnational diplomacy in Brazil and information about this amendment proposal.

arena for some of the issues related to climate change (Chapter 4 will show that this was the case in Brazil regarding forests). For the subnational climate commitment index, in Chapter 3, paradiplomacy is the concept considered for the foreign policy profile, along with transnational networks, since it captures a foreign policy dimension. In contrast, climate federalism is a context within which Chapters 4 and 5 analyze the data.

2.4 Conclusions

Analytic eclecticism has proved to be a possible tool for this research. It bridges political science, international relations, and international political economy considerations for global governance. There was no incommensurability among the theories used, but the risk of conceptual stretching was found in the literature review.

The global governance concept has analytical (descriptive and explanatory) and normative implications (Rosenau, 2000; Inoue, 2016; Jordan et al., 2018a). Young's (2017: 26-27) broad definition of governance as a social function for collective behavior towards desired outcomes and governance system as an ensemble of elements with governance functions is the base to sketch a theoretical framework of six dimensions – governance architecture, overarching rules, authority diffusion, power dynamics, state and non-state actors interactions, and transaction costs - that differentiates multi-level and polycentric governance approaches and strengthen the concept's analytical scope regarding multiple levels and actors beyond the nation-state.

Considering the assertion that governance systems are always fragmented, a synergistic fragmentation is better suited in a multi-level depiction. In contrast, the polycentric approach may be the best definition for the system operation in a conflictive fragmentation. In a cooperative fragmentation, both approaches can support the system operation with socially desired outcomes, however, with the differences outlined in the theoretical framework.

The six-dimension differentiation of the two approaches is not intended to be a rigid framework but a tool to evaluate both approaches' analytical and normative implications in an empirical assessment of subnational actors in global climate

governance. Okereke et al. (2009: 70) argue that non-nation state actors are a heterogeneous "distinctive group-type of actors." The analysis developed in the following chapters fully acknowledges this argument and circumscribes subnational governments as the intermediary level between national and city levels.

The middle-range theories of climate commitment and paradiplomacy are necessary to the theoretical framework in addressing the research question of *how subnational actors commit to global climate governance*. The former defines commitment as an outcome of institutional effectiveness, and the last presents how they can engage at the global level and the relationship with climate federalism. The last section allows the adaptation of climate commitment at the subnational level, presenting opportunities and limitations for action by such actors.

Considering the change in global climate governance architecture (Dorsch and Flachslan, 2017: 61), multi-level and polycentric approaches do not have to be antagonistic alternatives: they can be complementary and respond to developments in different periods. In this research, the hypothesis is that the multi-level approach is the primary reference, complemented by polycentric efforts because subnational governmental actors' commitment to global climate governance is mainly related to institutional elements, which in turn were designed by nation-states. Maybe, we could be facing a transition from a mostly multi-level architecture towards a polycentric one shortly.

Although focused on analytical implications, this framework's normative implications should not be neglected, as described in its relation to governance fragmentation and by some prescriptions presented by each approach throughout the six dimensions. Also, Chapter 3 presents normative considerations regarding the use of the diagnostic method by Oran Young (2008b and 2019) based on this theoretical framework. This method pervades the research development in the following chapters.

Theories are presented before methods because ontological and epistemological choices should be prior to methodological choices since they influence how methods are used (Beach and Pedersen, 2016; Campos, 2016).

The following chapter presents the research multi-method framework, based on the diagnostic method proposed by Young (2008a and 2019), intended to draw a multidimensional picture of the issue under a subnational lens and based on the assumption that institutions are one of several driving forces that influence social behavior and human-environment relations.

Next, there is a sequence of quantitative and qualitative methods to collect, analyze, and interpret data: quantitative statistical methods to draw descriptive inferences and explaining-outcome process-tracing and interviews to collect data and search for causal mechanisms. For Campos (2016), multi-methods research has the potential to a better understanding of complex phenomena and help to eliminate alternative explanations.

CHAPTER 3 – MULTI-METHOD FRAMEWORK

This chapter presents the research methodological framework. Rosenau (2000: 33-34) suggested a methodological challenge for research about global order and governance without government in his work about order and transformations in world politics. The new interactive perspective presented made it more challenging to formulate hypotheses and identify causal sequences that could systematically associate dependent and independent variables. He points, then, three possible solutions: the first is to draw limited hypothesis in the short term, with a focus on linear and non-interactive relationships; the second is to have an empirical focus on critical situations to advance in theoretical perspectives; the third is to consider the complex and interactive nature of world order, with multiple causalities, and by different methods.

The third option seems to be the one developed in the global climate governance research agenda. Consider, for instance, the impacts of the Anthropocene on the IR discipline briefly presented in the introduction (Harrington, 2016, Pereira, 2017 and 2021). Also, Young (2008a: 9), based on research about environmental institutions and addressing complex causality, questions the usefulness of causal chains as described by the mainstream literature. A possible methodological approach would be the diagnostic method, which can identify key features of governance demands on a case-by-case basis with a set of diagnostic queries (Young 2008b: 119 and 2019: 1).

The best research strategy to answer the research question of how subnational governmental actors commit to global climate governance according to multi-level and polycentric approaches is the multi-method, bringing together quantitative and qualitative methods. Both Snidal (2004) and Campos (2016) make compelling arguments about using a multi-method strategy in international relations research. For the former (Snidal, 2004: 240), formal models can present “thin predictions” regarding interpretation or understanding of a phenomenon that case studies can further explore. Tarrow (2010: 104) presents a summary of tools to bridge the divide between quantitative and qualitative methods, from which

Campos (2016: 67) makes an adaptation based on techniques and respective procedures: process-tracing; focus on tipping points; qualitative inferences combined with quantitative techniques; quantitative data as a point of departure for qualitative research; sequential studies; and triangulation. These techniques demonstrate that mixed methods can be organized sequentially or combined with expanding and improving their results (Rudestam and Newton, 2007: 51-54; Bartels, 2010: 86; Tarrow, 2010: 104).

This research uses a multi-method framework combining quantitative and qualitative methods to improve analytical rigor. Quantitative data is the starting point to qualitative analysis. It applies a formal model that establishes a big picture and inferential leverage by triangulation based on a qualitative assessment through process-tracing. Consequently, the framework allows different perspectives of the same research problem (Tarrow, 2010: 110) because it introduces a multi-dimensional picture of global climate governance, using Young's (2008b and 2019) diagnostic method and a formal model to draw descriptive and statistical inferences (King, Keohane, and Verba, 1994). Considering that a model "is never a comprehensive representation of the problem" presented (Snidal, 2004: 231), the work is complemented by process-tracing with supplementary data collected through literature review and interviews about two specific cases. Particular sections in this chapter describe each of the methods.

3.1. Diagnostic Method

Young (2008a: 9-20), describing the research development of institutions as determinants of societal outcomes, considers that institutions can "form elements of interactive causal clusters in contrast to the mainstream conception of causal chains" (Young, 2008a: 10). Causal clusters are interacting variables and interactive clusters of driving forces. Their assessment has methodological implications since it requires a higher order of sophistication in research, for it may not be possible to address each of them individually.

The diagnostic method proposed by Young (2008a, 2008b, 2017, and 2019) refers to

the development and deployment of procedures that help identify key features of needs for governance on a case-by-case basis and especially in evaluating architectural options in order to ensure a good match between a need for governance and the institutional response selected (Young 2008b, *in* Young, 2019).

It draws a multi-dimensional picture of an issue based on essential features of the identified demand for governance and the match between these features and the institutional design. Young (2008b: 119 - 140) then presents queries organized around problems, politics, players, and practices. In this context, institutions are one of the “driving forces to determine outcomes of human-environment relations,” based on complex causality (Young, 2008a: 25). In this framework, institutional effectiveness, measured by outputs, outcomes, and impacts, is usually the independent variable for outcomes of human-environment relations. Other variables can replace it with due attention to adequate conceptualization.

The first element – problems - describes the problem’s significant characteristics and implications for the regime needed to manage or solve it. For this study, framing the problem at different levels can result in different commitments, implementation, and results. As Young (2008b: 122) puts it:

“Some treat climate change, for instance, as a problem of controlling concentrations of carbon dioxide and other greenhouse gases in the Earth’s atmosphere. Others approach it as a matter of decarbonizing industrial societies. Differences of this sort can lead actors to internalize international commitments quite differently when it comes to domestic implementation.”

The second element is politics, which addresses the distribution of power or influence among stakeholders (concentration or dispersion), interests design and interaction among negotiation blocs, how problem fit is related to policy instruments and accepted discourse, and compliance and enforcement matters regarding corrupt or manipulative activities.

The third element is players, related to power dynamics and authority diffusion. The analysis considers rationality, the force of habit, and sense of legitimacy, among others, as sources of behavior. The subjects are not necessarily unitary actors since their behavior can result from internal dynamics, and they can be organized as big or small homogeneous or heterogeneous groups. At the same time, their actions inside can vary in transparency (meaning that other players may not know violations).

Finally, the fourth element – practices - is based on the assumption that they are socially constructed and subject to change over time. This element considers: if there is the freedom to change the types of constitutive agreements to address specific problems; if practices allow for minimum winning coalitions made of like-minded players that can expand over time; if there is flexibility and heterogeneity for roles and responsibilities; if it is possible to begin with an overarching framework to be detailed by amendments and protocols over time; if the regime is expected to work individually or is embedded in a broader system of institutional and organizational arrangement; and if there are practices of implementation review, reauthorization, and amendment.

For Young (2019: 6), this diagnostic process does not entail normative matters because it is an “analytic process rather than a political process,” centered on architectural choices and their results. It is limited to offer provisions since it is an approach for governance systems design. Nevertheless, the queries presented for the method and the process for institutional design (an *ex-ante* analysis) can help build an understanding of a multi-dimensional picture for an institutional element already in operation (an *ex-post* analysis). Therefore, the method can help map and elucidate evidence about decisional processes, power exercise, authority diffusion, definition and changes of practices and their outcomes, and make contra factual of a systems' redesign towards more effectiveness.

Bennet and Satterfield (2017) present a practical and adaptable framework for the design, evaluation, and analysis of environmental governance in different social and political contexts, based on the assumption that environmental governance has four objectives: to be effective, equitable,

responsive, and robust. Each objective, then, is analyzed through attributes (qualities or capacities), general characteristics or inputs (capacity), idealized outputs (functioning), and idealized outcomes (performance). Their framework employs a literature review from which the main analytical elements, objectives, and attributes of environmental governance were selected. However, Bennet and Satterfield (2017) do not present the criteria established for this literature review, and there are relevant works about environmental governance missing from the article's references.

According to recent developments of subnational governmental actors in global climate governance, this research applies the diagnostic method to present an overview and an understanding of global governance through the lenses of subnational governmental actors in Chapter 4, according to the theoretical framework and dimensions developed in Chapter 2. It is the retelling of history already well presented in academic literature but through a different perspective.

Nevertheless, the *ex-post* analysis of institutional design will often result in varied normative considerations regarding political choices, the exercise of bargaining and authority in a more desirable design according to how the problem is defined – either by the multi-level or the polycentric approach. This assumption is particularly so if we consider institutions already in place and the attribute of participation as described by Bennet and Satterfield (2017: 7), which entails "context and scale-specific spaces, processes, and structures to enable inclusion, representation, and engagement of stakeholder groups in collective decision-making processes."

3.2 Formal model: descriptive inferences and statistical methods

For King, Keohane, and Verba (KKV), the fundamental aspect of scientific research is inference: "to infer information about unobserved facts from the facts already observed, with valid procedures" (King, Keohane, and Verba, 1994: 34; Collier et al., 2010: 35). Descriptive inference is the "process of understanding an unobserved phenomenon based on a set of observations," but it does not necessarily indicate systematic relations between variables (King, Keohane, and

Verba, 1994: 55). For Collier et al. (2010), KKV's suggested standards for scientific research highlight three aspects of descriptive inference: the generalization from a sample to a universe of cases; inferences from observations to concepts; and the separation of systematic and random components of phenomena.

Systematic factors are not constants but are persistent and have consistent consequences when the factors take a particular value, which means that a causal model can explain them. The researcher needs to repeat the tests in different contexts to define patterns as systematic (they persist on different occasions) or random processes' consequences. Nonsystematic factors are transitory, their impacts cannot be predicted, and a causal model does not explain them. Systematic factors are not more significant than nonsystematic factors in research. Tarrow (2010: 105) highlights that nonsystematic factors can help uncover tipping points in historical events that can affect the relationship between the variables under study.

The best scientific way to organize facts for KKV (1994: 46-49) is as observable implications of some theory or hypothesis, and for that, they suggest taking four steps: a) choose a theory or a hypothesis to evaluate; b) select facts that are implications of a theory; c) organize facts as observable implications of the theory; and d) systematize the data. It is relevant to notice that theory is prior to data selection and assessment.

Bartels (2010) and Brady (2010) consider that KKV's (1994) template for causal inference in qualitative research has some pitfalls. The first is that causality is too closely related to the experimental method, as for Agresti and Finlay (2009: 162), for whom "social science is usually observational rather than experimental," and it can use statistical control rather than experimental control, as the case in this research.

The second is the correlation of explanation and causality because explanation can connect causes and effects. For Brady (2010: 70-76), in what seems a more positivist perspective, not all explanations involve causality, and his interpretation of KKV approximation of explanation and causality is due to

their definition of causality based on the description and comparison of a counterfactual condition with the absence of the considered cause, which leads to the definition of causality before the identification of causal mechanisms.

Gerring (2012: 740), for example, indicates that causal inferences are more objective than descriptive inferences because they are based on instrumental rationality, while descriptive inferences are subject to substantive rationality, with more explicit normative judgments in play. This supposed objective *versus* subjective comparison between causal and descriptive inferences does not consider that the choice of variables, or even the causal relation *per se*, is also a matter of ontological and epistemological decisions and subject to normative judgments.

Gerring (2012) also contends the debate of causal inferences being “more scientific” than descriptive inferences since they usually are more structured. For the author, descriptive inferences involve conceptualization, which cannot necessarily be contested on empirical grounds, and measurement, which can incur measurement error. Both are at the center of any argument based on a descriptive inference. Therefore, description is not more uncomplicated than a work of causation and should be done thoroughly, with attention to the consequences of ontological and epistemological choices.

Finally, Gerring (2012) argues that descriptive inferences should be done independently from causal inferences but cannot ignore the potential causalities in the subject under study. If considered independent from a specific causal inference, the descriptive inference can potentially be less biased, broader, and better present the researched subject. Also, while descriptive inferences are usually related to a *what* question, causal inferences result from a *why* question. A *how-to* question, such as the one in this research, can be linked to both kinds of inferences (Gerring, 2012: 723).

A question of *how subnational actors commit to global climate governance* also has leeway for the position of Finnemore and Sikkink (2001: 394). They consider that a constitutive explanation – “how things are put together and how they occur” – can have causal properties when using constructivist concepts and

methods for empirical research and analysis. The logic, however, is different from KKV: the identification/description of causal mechanisms can lead to causality definition. I agree with Brady (2010) that explanations and causality are not necessarily correlated, but also with Finnemore and Sikkink (2001) that a constitutive explanation oriented to understand how and why change happens and capture intersubjective meanings can have causal properties. For that, a description as presented by Gerring (2012) should be performed.

The next pitfall of KKV's approach is the measurement in qualitative comparisons, which is related to internal validity. For Brady (2010: 76-81), KKV did not address the issue sufficiently, and he presents the difference between measurement and quantification, considering that measurement processes are oriented by theory, based on a literature review about measurement validity in qualitative research.

Finally, Bartels (2010) also points out the lack of concrete guidance in KKV's orientation to report uncertainty in scientific inference, which can be related to specific research aspects or the results and research conclusions. The answer to uncertainty is not only a methodological one but also a matter of epistemology: a well-reported and documented research, together with a critical understanding of its theoretical and methodological choices and limits, in line with a social-practice perspective (Young, 2017) understanding of intersubjective meanings, can be a first step towards the development of uncertainty reporting.

Bearing in mind all the pitfalls presented, this work uses a formal model to draw descriptive inferences, based on statistical methods, to assess Brazilian subnational units' climate commitment, offering both a conceptualization of commitment and a proposition of measurement resumed in the Subnational Climate Commitment Index (SCCI). The model is the base for searching for an association between variables, appropriate time order, and the elimination of alternative explanations (Agresti and Finley, 2009: 302-303). The model does not use linear regression because it can be considered a deterministic analysis (Agresti and Finley, 2009: 265), as it attributes value to the dependent variable (here subnational actors' commitment) to just one independent variable (*e.g.*, institutional elements), while this research explores a causal mechanism.

Therefore, I use the principal component analysis (PCA) to interpret the data and search for interesting trends, questions, or puzzles (Braumoeller and Sartori, 2004: 129) and to assess multivariate relationships through statistical control since it transforms data to fewer dimensions, summarizes their features, and maintains trends and patterns (Lever et al., 2017). The principal component analysis examines multiple variables related to climate commitment, attributed to statistical units - the 27 subnational governments in Brazil. It also groups them by similarity, working with a more significant number of variables in more straightforward terms (Calvo et al., 1998) while revealing essential properties of these variables in the principal components (Hongyu et al., 2015) and the statistical units' relative positions.

Since PCA's main use is descriptive, the interpretation of results allows for identifying homogeneous groups of statistical units and the relationship between the selected variables (Foucart, 1997; Hongyu et al., 2015; Jolliffe and Cadima, 2016). However, the results cannot be generalized since PCA applies to a specific data set for specific statistical units. If other variables or observations are aggregated, there is a need to recalculate the model.

Using a formal model and statistical method for inferences requires a precise theory to avoid specification and inference errors. The first is related to the relationship between the statistical test and the theory – the statistical test should always be derived from a well-developed theory. The inference errors are related to the match between data and theory, measured by statistical tests. Sometimes, they are taken without due concern about the research problem design or the theory upon which they rely on (Braumoeller and Sartori, 2004). However, PCA allows exploration without reference to prior knowledge (Lever et al., 2017) and reduces the probability of incurring on specification errors.

The Subnational Climate Commitment Index is a descriptive model of subnational climate commitment. As a model, the equation of data (variables specification and choices regarding, e.g., variable weights or correction indexes) impacts the resulting analysis. It allows descriptive but not causal inferences. However, as a model, it presents a framing for subnational climate commitment,

which should be used for in-depth analysis by process-tracing to search for causal mechanisms (Brady et al., 2010).

3.2.1 Subnational Climate Commitment Index (SCCI)

An index is a tool composed of empirical data that allows the assessment of multiple dimensions of a policy issue by a single measure and comparing relative positions of different units (Surminski and Williamson, 2012; Mazzega et al., 2019). In this study, the units compared are the subnational federated units of the Brazilian federation, and the policy issue is the commitment to global climate governance.

Surminski and Williamson (2012) present many reasons to use an index: it offers a broad understanding of an issue; it is a tool for public policy and decision making; it allows comparison between units, and it raises awareness about an issue. Gerring (2012), in work about descriptive arguments, presents an index/indicator as one type of this kind of argument in a univariate fashion – a description of one dimension. Even if it can be the product of multiple measures, it helps reduce the complexity of a phenomenon under study since it allows for establishing a scale, metrics of equivalence, and comparison between observations.

Based on literature assessment and some indexes evaluation, Surminski and Williamson (2012) found that climate policy indexes have broadened their scope, from focusing on output aspects (*e.g.*, GHG emissions) to inputs emphasis, like climate policy evaluation. Also, most indexes have national states as their units and have government decision-makers as their audiences. One possible reason for that is that international policy-making about climate change is state-centered. This research's subnational climate commitment index has output and input elements focusing on subnational units – the federated units at the intermediary level. The comprised variables also apply to municipalities – the city level.

Mazzega et al. (2019) point out that the composition method of an index can be explicit while also being arbitrary, which means that components selection and weights are subjective. Surminski and Williamson (2012) present some steps on how to build an index, which helps to express these subjective choices objectively: a) select relevant information; b) transform and translate the information in a coherent and consistent form; c) explain how components and aggregation weights were selected. These steps are relevant to interpreting an index's results and making it comparable to other indexes about the same issue.

For the first step, Mazzega et al. (2019) encourage the use of high-quality data, considering the evaluation of their availability (public or private), their composition method (primary data or aggregated data), and if it is available for all the cases under study. They also consider the index audience and the purpose of the index as criteria for the data selection. For the objectives of this work, the subnational climate commitment index has two primary purposes: to offer a broad understanding of climate commitment at the subnational level and compare these subnational units' relative positions.

To follow Surminski and Williamson (2012) steps and Mazzega et al. (2019) advice, a literature review about the issue under study can point out what is the relevant information, what should be a coherent and consistent form to present it, and what should be the index components and their weights. Chapters 1 and 2 presented the literature review about the issue and the index's theoretical background. Now, I give the relevant information and the index composition.

a) SCCI Methodology

This section presents the Subnational Climate Commitment Index (SCCI) methodology. The index has two measurements, as it mirrors Viola and Franchini (2018) climate commitment approach:

- i. the emissions profile (EP), which measures each subnational unit GHG production trajectory (a measure of governance impact); and

- ii. the policy profile (PP), which presents each subnational unit's measures to address future GHG emissions production (a measure of governance processes).

The Brazilian National Policy for Climate Change does not state any obligations for subnational governments. Still, actions at the national level should consider and integrate state and municipal public and private actions (article 3 of Law n. 12,187). There is no prior assumption of a national driver that could bias the analysis. However, domestic and external drivers are assessed together, with the necessary adaptations to the subnational level.

The policy profile comprises data related to governance processes - institutional and policy building to answer climate change (Inoue, 2016: 93). The policy profile measures prevalence, not the quality of domestic and international subnational actors' actions in governance processes. The evaluation of their quality requires the definition of reporting patterns and measurement for success, with targets, monitoring, and verification of possible contributions (Chan et al., 2016: 244-246). Therefore, the index does not have a policy implementation dimension. Instead, it has domestic and foreign policy profiles, partly inspired by the reading of data presented by Romeiro and Parente (2011) of regulatory governance evolution in Brazil from the creation of subnational policies and their impact on the national policy for climate change, with the following organization:

Table 8 - SCCI policy profile dimensions and data

Profile	Dimension	Data
SUBNATIONAL POLICY PROFILE	The normative and bureaucratic framework	<ul style="list-style-type: none"> ● at least one bill, law, and or decree about climate change mitigation; ● a general or specific state bureaucracy to deal with climate change.
	Policy measures	<ul style="list-style-type: none"> ● at least one state policy about climate change; ● a GHG inventory and how updated it is; ● a GHG reduction goal/target; ● a participatory forum about climate change mitigation; ● a specific fund for climate change mitigation; ● a specific program for climate change mitigation;

Profile	Dimension	Data
PARADIPLOMACY PROFILE	Orchestration with the central institutional core of global climate governance	<ul style="list-style-type: none"> ● At least one action was reported at the NAZCA Platform / GCAP.
	Transnational networks	<ul style="list-style-type: none"> ● Subnational unit participation in at least one transnational network for climate change mitigation beyond the UNFCCC.

Source: Author's elaboration based on Viola and Franchini (2018).

Some elements used by Happaerts (2012), based on the policy convergence literature, can be considered to interpret the domestic policy profile further: if institutionalization is a consequence of the international climate regime or UNFCCC related events; if norms and principles from the international regime permeate subnational policies; the existence of policy models promotion in the country, and if they are related to UNFCCC effort or by transnational networks, an analysis that is directly related to the foreign policy profile. A qualitative approach is necessary to perform this analysis, as presented in Chapter 5 for two specific cases.

The foreign policy profile cannot be literally defined as presented by Viola and Franchini (2018) because nation-states' agency is the base for their proposal. To develop a foreign policy profile for subnational units, I use the mid-level theory of paradiplomacy²², considering that this concept development is based on the recognition of complex interdependence, governance fragmentation, and the emergence of multiple actors and levels in international relations analysis (Keating, 2013; Schiavon, 2019). Therefore, the foreign policy profile is, from now on, addressed as a paradiplomacy policy profile.

I use Setzer's (2013: 24) and Schiavon's (2019: 12) definition of paradiplomacy, or international relations of sub-state governments (a synonym for the author), as "international actions and activities (economic, political, social or cultural) conducted by non-central governments" which are necessarily transnational and occur by joining a transnational network²³. In this case,

²² I would like to thank Niels Soendergaard for this suggestion.

²³ Setzer (2013: 42-43) points out the differences between paradiplomacy and transnationalism literature. The last does not have a focus on subnational government actions beyond their participation in transnational networks. However, paradiplomacy can occur outside of

international actions and activities towards climate change mitigation conducted by subnational units placed within the institutional core of global climate governance (the Nazca Platform/GCAP) and outside it (engagement in transnational networks) are the measures for the paradiplomacy policy profile.

Based on Schiavon's (2019: 27) four types of central-local coordination in foreign affairs (see Table 7), the more inclusive central-local coordination in foreign affairs in constitutional powers and participation in decision making and implementation, the better the scores in paradiplomacy policy profile are expected to be, because sub-state governments would have more autonomy and agency. To test this hypothesis, though, the SCCI needs to be applied to countries with different constitutional powers to their subnational units. For this work, it suffices to mention that Brazil has a complementary type of central-local coordination, since sub-state governments have residual power to conduct international relations, with no legal restriction if their actions do not interfere with federal foreign policy, according to articles 21 and 25 of Brazilian Federal Constitution (Schiavon, 2019: 65-70).

A subnational unit does not have the same agency level as a national state to block climate cooperation at the global level. Nevertheless, domestic implementation is a measure of success of international regimes (Young, 2017: 38-43), and subnational engagement can be a catalyst of action, presenting voluntary commitments and acting through alliances, which can be measured through the two variables proposed for the paradiplomacy policy dimension.

The SCCI paradiplomacy policy profile measures actors' commitment to global governance by the subnational units' formal declaration of engagement with at least one initiative in the transnational realm for climate change mitigation and adaptation. There are different concepts for that: transnational networks

transnational networks, either bilaterally or multilaterally, among states, provinces, and regions, or between them and cities or nation-states. to consider all types of paradiplomacy actions for all 27 states would not be possible. The choice for a paradiplomacy that is restricted to actions related to transnational networks allows for the calculation of the SCCI for all 27 states with more confidence about the collected data. Qualitative analysis in Chapter 5 can broaden the concept's scope.

(Andonova et al., 2009), orchestration platforms (Van Der Ven et al., 2017), and international cooperative initiatives (New Climate Institute, 2019).

According to Andonova et al. (2009:56), “transnational governance occurs when networks operating in the transnational sphere authoritatively steer constituents towards public goals.” A transnational network then must steer constituents (actors with different configurations, either individuals or organizations), have a public goal, and be recognized as authoritative²⁴ by its constituents. The transnational network can influence or govern by establishing rules based on power and legitimacy.

Based on this definition, Andonova et al. (2009) present a typology of transnational networks based on actor types – public, private, and hybrid – and governance functions, or means to steer constituents – information sharing, capacity building and implementation, and rule-setting. Although all these governance functions can be found in most transnational networks simultaneously, the typology categorization considers its primary role when analyzing each empirical example.

Van Der Ven et al. (2017: 1-2) use the concept of orchestration platforms to value non-state and subnational actors’ interventions. They are based on Abbott and Snidal (2010, in Van Der Ven et al. 2017: 2) definition of “purposive efforts by international organizations (IOs) and other transnational actors to coordinate, mobilize, and value the contributions of private, hybrid, and subnational actors, in effect enlisting them as intermediaries to achieve defined regulatory goals.”. They register and aggregate actors with different configurations, try to steer actors towards overarching objectives, and have defined regulatory goals.

Andonova et al. (2009) and Van der Ven et al. (2017) definitions of transnational network and orchestration platform are very similar. However, the orchestration platform concept applies to a predominantly intergovernmental

²⁴ Authoritative means having the network authority recognized by constituents though agreeing to membership terms (e.g., formal criteria of adhesion, reporting requirements and standards, or declaration of solidarity with network goals) as described by Andonova et al. (2009: 56).

realm. The definition of orchestration is an indirect mode of governance based on inducements and incentives used to encourage national states or, in a transnational context, to bypass them through non-state commitments and actions (Abbott, 2018: 188-196).

The New Climate Institute et al. (2019: 21)²⁵ define climate international cooperative initiatives (ICIs) as “multistakeholder arrangements that aim to mitigate the GHGs that cause climate change and or help to adapt to impacts to climate change. They are joint projects in which subnational and non-state actors work together across borders, often with national governments and international organizations.”. This definition is broader than Andonova et al. (2009) and Van der Ven et al. (2017) since it also encompasses joint projects of only two actors. I use Andonova et al.’s (2009: 59-66) transnational governance concept and typology to choose which transnational networks to consider in the SCCI paradiplomacy policy profile for more precise use.

The first step was to find the transnational networks most cited in the assessed literature about subnational governments’ engagement in global climate governance (Andonova et al., 2009; Happaerts, 2012; Chan et al., 2016; Bäckstrand et al., 2017; Macedo and Jacobi, 2017; Van Der Ven et al., 2017), as presented in Table 9 in the following categories:

Actor types:

- Public transnational governance networks: established by and for public actors (government sub-units, city or local governments, legislators, judges, or units of intergovernmental organizations quasi-independent of national decisions);
- Private transnational governance networks: established by and managed exclusively by non-state private actors;

²⁵ Their report about global climate action from cities, regions, and businesses has a sample of 190 active and concluded initiatives between 2014 and 2019, launched at COPs, global summits, or what is considered relevant fora, had at least two participants, and had climate change mitigation or adaptation measures as explicit targets.

- Hybrid transnational governance networks: public and private sectors establish networks with common objectives and share authority in global governance.

Governance main function:

- Information sharing: cognitive, discursive, and knowledge generating and diffusion as a means to govern;
- Capacity building and implementation: provision of resources (finance, technology, monitoring, etc.) to enable action;
- Rule-setting: the validation of a set of norms and the establishment of rules to guide and constrain constituents.

Table 9 is based on official websites and the United Nations Environmental Program (UNEP) Climate Initiatives Platform²⁶. The following initiatives were not considered in Table 9 because they do not fulfill Andonova et al.'s (2009) definition of transnational network:

- The Global Aggregator of Climate Action, because it is a data aggregator for subnational and non-state actions²⁷ and not a subnational actor's network *per se* with steering function;
- The Initiative for Climate Action Transparency (ICAT) Non-State and Subnational Action Guide²⁸;
- The Climate Summit of the Americas, an action statement on climate change with hybrid constituents that act as members of Under 2 Coalition;
- The New York Declaration on Forests of 2014;

²⁶ See <http://climateinitiativesplatform.org/index.php/Welcome>. Access on October 31st, 2020.

²⁷ See <https://static1.squarespace.com/static/552be32ce4b0b269a4e2ef58/t/558d8fa1e4b0cba66cbefa29/1435341166099/Introducing+GAFCA.pdf>. Access on October 31st, 2020.

²⁸ See <https://climateactiontransparency.org/icat-toolbox/non-state-subnational-action/>. Access on October 31st, 2020.

- The Galvanizing the Groundswell of Climate Actions,²⁹ a dialogue series with no authoritative function.

Table 9 - Transnational networks of subnational governments

Transnational network	Year of foundation	Actor's type	Governance Function
Local Governments for Sustainability – ICLEI ³⁰	1990, and altered in 2003	Public	Capacity building and implementation
Carbon Disclosure Project ³¹	2000	Hybrid	Information sharing
Network of Regional Governments for Sustainable Development - NRG4SD ³²	2002 (World Sustainability Summit at Johannesburg)	Public	Capacity building and implementation
Governors' Climate and Forest Taskforce (GCF-TF) ³³	2008	Public	Capacity building and implementation
R20 for Climate Action ³⁴	2011	Hybrid	Capacity building and implementation
Compact of States and Regions ³⁵	2014	Hybrid	Information sharing, aggregated NRG4SD, The Climate Group States and Regions Alliance, CDP, and R20.
NAZCA Platform (GCAP) ³⁶	2014	Hybrid	Information sharing
UNDER 2 Coalition (integrated by former The Climate Group States and Regions Alliance) ³⁷	2005/2015	Public	Information sharing

²⁹ See <http://www.climategroundswell.org/>. Access on October 31st, 2020.

³⁰ See <http://old.iclei.org/index.php?id=8> and <https://iclei.org/en/Home.html>. Access on October 25th, 2020. Although most members are municipalities and cities, there are provinces, states, and regions. Also, ICLEI has worked with federated units in Brazil on the climate agenda.

³¹ See <https://www.cdp.net/pt/info/about-us/what-we-do>. Access on October 31st, 2020.

³² See <https://sustainabledevelopment.un.org/partnership/?p=1585>. Access on October 25th, 2020.

³³ See <https://www.gcftf.org/>. Access on October 31st, 2020.

³⁴ See <https://regions20.org/>. Access on October 31st, 2020.

³⁵ See <https://unfccc.int/news/compact-of-states-and-regions-subnational-initiatives-driving-climate-ambition#:~:text=The%20Compact%20of%20States%20and%20Regions%20is%20an%20initiative%20designed,set%20goals%20and%20measure%20progress>. Access on October 25th, 2020.

³⁶ See <https://climateaction.unfccc.int/>. Access on October 31st, 2020.

³⁷ See <https://www.theclimategroup.org/project/under2-coalition> and <https://www.under2coalition.org/>. Access on October 25th, 2020. The Climate Group States and Regions Alliance, founded in 2005, merged with the Under 2 Coalition. It is not listed in Table 2 separately because it was not possible to find information on its composition and primary function.

Transnational network	Year of foundation	Actor's type	Governance Function
Carbonn Center ³⁸	2019	Public	Information sharing
REGIONS 4 (former NRG4SD) ³⁹	2019	Public	Capacity building and implementation

Source: Author's elaboration based on Andonova et al. (2009), Happaerts (2012), Chan et al. (2016), Bäckstrand et al. (2017), Macedo and Jacobi (2017), Van der Ven et al. (2017), Kuyper et al. (2018), New Climate Institute et al. (2019), and interviews.

The Initiative for Climate Action Transparency (ICAT) Non-State and Subnational Action Guide is a project due in 2023 to support transparency and capacity-building under the Paris Agreement through the availability of data and knowledge to share experiences and assess actions impact. Participating countries are from Africa, Asia, the Pacific, Latin America, and the Caribbean. In Brazil, ICAT has worked with the Brazilian Forum on Climate Change (FBMC), the Centro Clima/COPPE of the Federal University of Rio de Janeiro, the Centro Brasil no Clima, and UNEP DTU Partnership with a focus on the establishment of a MRV framework to track the country's NDC⁴⁰.

Posts and news related to each summit are the primary information source about the *Cumbre Climática de las Américas* (Climate Summit of the Americas)⁴¹. The first edition was in 2015 in Ontario, Canada, the second in 2016 in Jalisco, Mexico, and the third edition in 2019 in Santa Fé, Argentina. Since 2015, The Compact of States and Regions, The Climate Group, and the UNDER 2 Coalition have supported the summit realization and its final statements⁴². The Santa Fé Declaration, from the third edition, is very clear in its statement that signatories will work as members of the Under 2 Coalition.

³⁸ See <https://carbonn.org/>. Access on October 31st, 2020.

³⁹ See <https://www.regions4.org/>. Access on October 25th, 2020.

⁴⁰ For more information, see <https://unepdtu.org/>. Access on June 4th, 2021.

⁴¹ See <https://www.ontario.ca/page/climate-summit-americas-retrospective>, <https://www.under2coalition.org/news/latin-american-leaders-commit-accelerate-climate-action>, <https://nariño.gov.co/inicio/index.php/sala-de-prensa/noticias/2223-iii-cumbre-climatica-de-las-americas>, <http://sdg.iisd.org/events/climate-summit-of-the-americas/>, <https://sdg.iisd.org/events/second-climate-change-summit-of-the-americas/> Access on November 8th, 2020.

⁴² See <https://news.ontario.ca/en/release/33550/landmark-climate-statement-signed-in-ontario>. Access on November 8th, 2020.

Finally, the New York Declaration on Forests was signed at the UN Climate Summit in 2014, without clearly defined targets or actions. However, it has a high mitigation ambition (Chan et al., 2016: 246) – to halt global deforestation by 2030⁴³. It is a voluntary political declaration of multiple actors – national and subnational governments, companies, financial institutions, indigenous peoples, local communities, and non-governmental organizations. It currently has 190 endorsers: 41 national governments, 21 subnational governments, 62 companies, 22 representative institutions of indigenous peoples, and at least 40 non-governmental organizations⁴⁴. In 2017, the NYDF Platform was launched to re-invigorate political endorsement, facilitate coordination and communication, share best practices, resources and lessons, and monitor results⁴⁵.

Table 10 presents the selected transnational networks that are considered in the paradiplomacy policy dimension of the policy profile according to the literature review and Brazilian subnational units information disclosed on reports and official websites (Happaerts, 2012; Setzer, 2015; Bäckstrand et al., 2017; Van Der Ven et al., 2017; Macedo and Jacobi, 2019; Abema and GIZ, 2020).

⁴³ See <https://forestdeclaration.org/about>. Access on May 31st, 2021.

⁴⁴ See <https://forestdeclaration.org/about/nydf-endorsers>. The list of non-governmental organizations does not allow the entire reading. Access on May 31st, 2021.

⁴⁵ See <https://forestdeclaration.org/about/about-platform>. Access on May 31st, 2021.

Table 10 - Transnational networks and Brazilian subnational units' membership

	REGIONS 4 (2019) – former NRG4SD (2002)	GOVERNORS' CLIMATE & FORESTS (GCF) TASK FORCE (2008)	R 20 FOR CLIMATE ACTION (2011)	UNDER2 COALITION (2015)	NAZCA PLATFORM (GCAP)
Does it mention the UNFCCC?	No. The reference was the World Summit on Sustainable Development in Johannesburg in 2002	Not directly, it mentions Reducing Emissions from Deforestation and forest Degradation (REDD+) in its design.	No.	Yes – cites the Paris Agreement. The Climate Group States & Regions Alliance, formed in 2005, was the coalition forerunner. Under2 was founded in 2015.	Yes.
Website link	https://www.regions4.org/members/	https://www.gcftf.org/about	https://regions20.org/members-and-partners/national-and-subnational-authorities/#1472031315115-8e2888f8-7a95	https://www.under2coalition.org/members	https://climateaction.unfccc.int/
Brazilian Subnational units' membership	São Paulo	Acre Amapá Amazonas Maranhão Mato Grosso Pará Rondônia Roraima Tocantins	Acre Mato Grosso São Paulo Rio de Janeiro Pará	Acre Amazonas Amapá Mato Grosso Pernambuco Rondônia São Paulo Tocantins	Acre Amapá Amazonas Ceará Goiás Mato Grosso Minas Gerais Paraná Pernambuco Rio de Janeiro Rio Grande do Sul Rondônia Roraima Santa Catarina São Paulo Tocantins

Source: Author's elaboration.

Considering global climate change as a *wicked* problem, energy, transportation, biodiversity, finance, and many other policies, programs and actions could be related to climate change mitigation. However, to compute all such measures in one aggregative index would add complexity and request simplifications which could jeopardize the index meaning.

For that reason, this work follows Mauad's (2018) criteria to analyze Latin American cities' climate responses. Her definition of climate response is an "official act from the municipal government that mentions climate change directly as the main reason to act and can be related to mitigation and adaptation" (Mauad, 2018: 49). This research accommodates the definition to official acts from the state-level government. However, considering the Brazilian GHG emissions profile, the focus on governance processes mainly linked to climate change mitigation also considers programs directed at deforestation reduction and prevention. Finally, Chapter 5 deals with relevant information related to climate governance processes from other issue areas or adaptation measures in qualitative analysis for specific cases.

The emission profile is a sum of three variables: one absolute measure - total GHG emissions - and two intensity measures - GHG emissions (CO_{2e} ton) *per capita* and GHG emissions (CO_{2e} ton) *per* US\$ 1,000 of GDP. These three variables mirror Viola and Franchini's (2018) climate commitment approach with no necessary adaptation. However, their measurement is different from the work developed by Franchini (2016).

Subnational actors have been present at the global scale processes since the 1990s, with increasing engagement. The period of the SCCI policy profile is from 2005 to 2020, when it is possible to find at least one of the listed governance processes. This period is larger than the one most cited in the literature in Chapter 4 about subnational actions in the UNFCCC, which mentions more attention and weight since COP 15 (in 2009), with a focus on the Paris Agreement (in 2015).

Nevertheless, the emission profile analysis goes from 2010 to 2018 for two reasons: the first is a prevalence of governance processes at Brazilian subnational units from 2009/2010, presented in Chapter 4. The second is the data

availability since the three variables data sources are available for this period. The policy profile scores did not consider revoked norms, plans, or programs. Consequently, a policy sanctioned in 2007, for example, would still exist in 2018, and if the index restricted the policy profile to the 2010-2018 time frame, the score would remain the same. Therefore, the SCCI is not impacted by the different time frames for the two profiles.

Also, there can be multiple combinations between the two profiles: a better policy profile with a worse emissions profile, and a worse policy profile with a better emissions profile, since the policy profile is a measure of prevalence, not of implementation of governance processes. The expected combinations, informed by theory, would be: a good policy profile would result in a better emissions profile, and a bad policy profile would result in a worse emissions profile. Then, if there was a correlation between policy and emissions profiles, the emissions profile could be read as the implementation, and the model would have to be drafted differently. Finally, because of data limitation and the uncertainty regarding how the two profiles are related, the principal component analysis is a sound statistical method for theory testing and development since it explores how these variables behave.

b) Data sources

All data sources and methodologies are public and available to all units under study. The emissions profile has four data sources, described by each variable:

Population: the Brazilian Institute of Geography and Statistics (IBGE) makes the Brazilian population census every ten years. The last census available is from 2010, and the following census schedule was August to October 2020. However, due to the COVID-19 pandemic and budgetary cuts, it was delayed to 2022.

Based on population censuses, household sampling surveys, and administrative birth and death records, IBGE makes population projections for the

years between the censuses intervals that go through periodic revisions. For this work, I chose the predictions used by the Federal Court of Accounts (TCU), with data from 2001 to 2019, because it has the most updated calculations.⁴⁶

Gross Domestic Product in US\$: to calculate GDP in USA dollars, I used data from the World Bank database⁴⁷ for the Brazilian national GDP and the IBGE report for regional GDP⁴⁸, both sources in purchasing power parity conversion factor and on current values. IBGE report on subnational units GDP has data from 2010 to 2018. Subnational units GDP in US\$ were calculated based on their percentage in total national GDP for each year.

GHG emissions: the coalition of non-governmental organizations Climate Observatory (Observatório do Clima - OC) has a System for Estimating Greenhouse Gas Emissions⁴⁹ (SEEG in Portuguese), with national and subnational data from 1970 to 2018 in total emissions and emissions by sector. However, land-use change sector data is dated from 1990 to 2018, since before 1988, Brazil did not officially monitor Amazonia's deforestation.⁵⁰

SEEG is a secondary dataset with data from official and non-official sources – national inventories, government reports, institutes, research centers, industry, and other non-governmental organizations – covering agriculture, livestock, energy, industrial processes and product use, land-use change, waste, removals from land-use change, international marine and aviation bunker

⁴⁶See <https://www.ibge.gov.br/estatisticas/sociais/populacao/9109-projecao-da-populacao.html?=&t=o-que-e>. Access on June 12th, 2020. There are several tables and methodological working papers on the website. The difference between these tables and the TCU table was informed by IBGE on a quest using the Brazilian Right to Information Law (12.527/2011) on May 4th, 2020, under the number 03006006063202060.

⁴⁷ See <https://data.worldbank.org/indicator/NY.GDP.MKTP.CD>. Access on June 12th, 2020.

⁴⁸ See Sistema de Contas Regionais - PIB by purchase power parity. Available at <https://www.ibge.gov.br/estatisticas/economicas/contas-nacionais/9054-contas-regionais-do-brasil.html?=&t=resultados>. Access on May 17th, 2020.

⁴⁹ See http://plataforma.seeg.eco.br/total_emission#. Access on June 12th, 2020. A new methodology revised the database in 2021, and there can be some differences in data by year. The analytical report presents the new methodology and its impact. See https://seeg-br.s3.amazonaws.com/Documentos%20Analiticos/SEEG_8/SEEG8_DOC_ANALITICO SINTE SE_1990-2019.pdf. Access on March 8th, 2021.

⁵⁰ This information was obtained by e-mail with the Communication Coordinator of Observatório do Clima on October 16th, 2019. Access for all data from SEEG for subnational units was on February 17th, 2020.

emissions, and not inventoried GHG emissions and removal sources (Azevedo et al., 2018: 2).

Brazil has three national GHG inventories: the first was released in 2005 and covered the period 1990 to 1994; the second was released in 2010 and covered the period 1990 to 2005; the third was released in 2016 and covered the period 1990 to 2010. The National Emissions Registry System (SIRENE) now organizes all the data.⁵¹ It is a system developed by the Ministry of Science, Technology, and Innovation, which also has data organized by federated states emissions for agriculture and livestock, and land use, land-use change, and forest.

The country also has four Annual Greenhouse Gas Emissions Estimates⁵², documents developed to allow the follow up of the voluntary national commitment to climate change mitigation as stated by Law n. 12.187/2009 – the Brazilian National Climate Policy. The Ministry of Science, Technology, and Innovation developed the reports. The first report was published in 2013, the second in 2014, the third in 2016, and the fourth in 2018.

For Viola and Franchini (2018: 41), the Brazilian government has used the GHG inventories for political purposes, delaying their publication to avoid pressure at international fora. As a consequence, the national inventories time gaps and the lack of regularity in GHG emissions estimates reports publication can “miss capturing and understanding GHG emissions trends” and jeopardize the development of effective policies and the accomplishment of national and international pledges (Azevedo et al., 2018: 2 and 5).

For Azevedo et al. (2018), the SEEG system, which has year estimations for national and subnational emissions from 1970 to 2018, is one of the most comprehensive datasets considering the number of records, time, geographic coverage, and transparency. SEEG, for instance, has estimated GHG emissions

⁵¹ See <https://sirene.mctic.gov.br/portal/opencms/index.html>. Access on July 15th, 2020.

⁵² See http://www.mctic.gov.br/mctic/opencms/ciencia/SEPED/clima/Comunicacao_Nacional/Estimativas_Anuais.html?searchRef=gases%20do%20feito%20estufa&tipoBusca=expressaoExata. The link to the fourth report was not working correctly. Access on July 15th, 2020.

not yet inventoried for soil carbon stock variation in agricultural areas, which are relevant for the Brazilian NDC implementation and are not reported in the national inventories. For that reason, this research uses SEEG data for national and subnational gross GHG emissions, which sometimes differ from official estimates, inventories and reports, as presented in Chapter 1 for Brazilian GHG emissions.

Information about emissions-generating activities and the availability of activity data and emissions factors for specific subnational units are the base for allocating GHG emissions at the subnational level (Azevedo et al., 2018: 4). For the energy sector, it was possible to allocate 91.7% of emissions in 2015, based on official data of the “most important emission drivers detailed by federative units” (Azevedo et al., 2018: 21). Waste and land-use change and forest sectors had 99.9% of emissions allocated, and agriculture had 100% (Azevedo et al., 2018: 37).

The industrial processes and product use sector had the lowest subnational GHG emissions allocation – 77.8%. Steel production had 96% of GHG emissions allocation at the five federative units (Minas Gerais, Rio de Janeiro, São Paulo, Espírito Santo, and Rio Grande do Sul). However, it was impossible to allocate 4% of emissions, as they were emissions of dolomite and limestone, and there was no data available for subnational consumption of these carbonates. Most emissions were related to ferroalloy and other non-ferrous metal production, glass production, soda ash consumption, calcium carbide production, halocarbons production and consumption, and some other chemical products production, like methanol, ethylene, dichloride ethylene and vinyl chloride, ethylene oxide, carbon black, phosphoric acid, ABS resins, among others (Azevedo et al., 2018: 23-29). Consequently, there is a difference of about 4% between the sum of the 27 subnational units and the total national GHG emissions from 2010 to 2018.

Table 11 summarizes the emissions profile variables:

Table 11 – Emissions profile data sources

Variable	Data source
Population	IBGE estimation for Federal Court of Accounts (TCU) with data from 2001 to 2019.
GDP	World Bank database for Brazilian national GDP and IBGE report on regional GDP, both in purchase power parity conversion from 2010 to 2018.
GHG emissions	System for Estimating Greenhouse Gas Emissions, by Observatório do Clima from 1990 to 2018.

Source: Author's elaboration

The policy profile estimation has five primary sources:

- i. The Public Policies on Climate Change Observatory⁵³, sponsored by Climate Forum - Enterprise Action about Climate Change;
- ii. Educaclima Portal from the Ministry of Environment⁵⁴, which has the purpose of education and public awareness about climate change;
- iii. An environmental legislation survey made by the Permanent Joint Committee on Climate Change of the National Congress (CMCC, 2013);
- iv. A presentation by Climate and Society Institute (Instituto Clima e Sociedade in Portuguese) about subnational states legislative actions for climate change in a public hearing on October 17th, 2019, sponsored by the Environment and Sustainable Development Commission of Brazilian Legislative Chamber⁵⁵;

⁵³ Available at <http://forumempresarialpeloclima.org.br/observatorio-de-politicas-publicas-de-mudancas-climaticas/>. Access on May 26th, 2020.

⁵⁴ Available at <http://educaclima.mma.gov.br/o-que-e/>. Access on May 26th, 2020.

⁵⁵ See <https://www2.camara.leg.br/atividade-legislativa/comissoes/comissoes-permanentes/cmads/audiencias-publicas/audiencia-publica-2019/17-10-2019-discutir-com-os-coordenadores-das-frentes-parlamentares-dos-estados-as-demandas-que-promovam-verdadeiramente-o-cumprimento-das-leis>. Access on August 2nd, 2020.

v. Abema and GIZ (2020) report about the state's best practices for climate commitments, according to a survey with 23 Brazilian subnational units and the Federal District, and 69 reported experiences.

Data about GHG emissions inventories were also drawn from the work of Conceição (2017) that, although focused on inventories of municipalities, has data about the year of publication of states' inventories as well. All data sources are public and available to all subnational units.

Although policy profile variables are estimated by their prevalence, not their quality or degree of implementation, the policy profile considers the base year of each inventory and not the first year of publication. This choice is because the base year can measure how updated or outdated measures at the federated unit are and, therefore, reflect on their climate commitment.

The first two sources were significantly outdated: the legislation survey is from 2013 and the Observatory was last updated in 2015, The Educaclima Portal had information till 2018 for federated subnational units and the presentation by Climate and Society Institute comprises a search from 2015 to 2019 and focused on legislative action. Abema and GIZ's (2020) report has the most updated information.

The effort to update the policy profile included literature review, access to public subnational units' websites, and e-mail requests for information. When all these actions were not enough, formal requests for information used the Brazilian Right to Information Law (12.527/2011⁵⁶), as summarized by Table 12:

Table 12 - Requests for information using Brazilian Right to Information Law (12.527/2011)

Subnational Unit	Request number
Alagoas	860/2020
Bahia	2084688
Rio de Janeiro	10871

⁵⁶ The Brazilian Right to Information Law grants the right to request information from all executive branch entities (e.g., Ministries, state and municipal governments, secretaries, public companies, etc.). The answer is obligatory, and the applicant has the right to appeal if the answer is not satisfactory or does not fulfill all the conditions stated by the Law. For more information, see <https://www.gov.br/acessoainformacao/pt-br/>. Access on February 23rd, 2021.

Subnational Unit	Request number
Rio Grande do Norte	21052020212829531
Roraima	55/2020
Sergipe	05993/20-3

Source: Author's elaboration.

The federated units of Bahia and Rio Grande do Norte did not adequately answer the demands for information. In the case of Bahia, the answer to the formal request indicated that the information would be published at the state's institute for the environment and water resources (called Inema) website, which was previously and after searched for, and the information was not available. In the case of Rio Grande do Norte, the answer was the indication to make phone contact with the state agricultural research company (Empresa de Pesquisa Agropecuária do Rio Grande do Norte – EPARN). Therefore, I decided not to appeal in any cases because the lack of information indicates how governance processes occur at these subnational units.

c) Information transformation and translation

The second step described by Surminski and Williamson (2012) to build an index is to transform and translate the information in a coherent form, which entails measurement. This section presents the data for each of the profiles separately.

Policy profile (PP)

The policy profile equation (PP) is the sum of all the variables according to Table 13 scores. The results can range from 0, which means that the subnational unit does not have any of the items considered in governance processes, to 10.5, indicating the prevalence of all the items. The highest result in the profile equation means that the subnational unit is theoretically more

politically committed to addressing GHG emissions and has a path towards decarbonization.

Table 13 – Policy profile variables

Variable	Value
Bill	0.25
Decree	0.75
Law	1
Climate Change State Policy	1
GHG emissions inventory	Until 2010 = 0.5 2011 - 2015 = 0.75 After 2016 = 1
GHG reduction target	1
Participatory Forum	1
A specific or designated fund	1
Plans or Programs	1
State bureaucracy	Specific area = 1 General area = 0.5
The state unit has presented at least one action at Nazca Platform	0.75
The state unit is part of at least one of the listed transnational networks	0.75
TOTAL	10,5

Source: Author's elaboration.

In general, governance process prevalence scores 1 point. A bill and a decree score 0.25 and 0.75 because bills are at a proposal level. A decree is an executive act, which an executive action from a newly elected government can easily change, compared to legislative action. Paradiplomacy variables have a 0.75 score because they are voluntary commitments with no predicted sanctions for lack of action. Data from the Nazca Platform (Global Climate Action Platform – GCAP) considers only individual action since collective efforts can involve participation at transnational networks, which are considered separately.

For state bureaucracy evaluation, the definition of a specific area means at least one sublevel in the public bureaucracy (department, coordination, assistant secretary) with a direct mention of the climate change issue. A general state bureaucracy means that the issue is among the state bureaucracy competencies, but it was not possible to identify such a sublevel.

Emissions Profile (EP)

Table 14 summarizes all Emissions Profile variables and their respective units:

Table 14 – Emissions profile variables

Variable	Unit
GHG emissions	Mton CO _{2e}
Population	People
GDP	US \$ billion
GHG emissions <i>per</i> GDP unit	ton CO _{2e} per US\$ 1,000
GHG emissions <i>per capita</i>	ton CO _{2e} per person

Source: Author's elaboration.

GHG total emissions, GHG emissions *per capita*, and GHG emissions *per* US\$ 1,000 were plotted in a dispersion diagram to analyze the possibility of double-counting values between total GHG emissions and the intensity measures. If there were a positive linear correlation, in a positive diagonal line, the variables would have a positive correlation (as the higher the GHG emissions, the higher GHG emissions *per capita*), and there would be double counting. If the points have a dispersion similar to a cloud, there is no positive linear correlation, meaning there is no double counting.

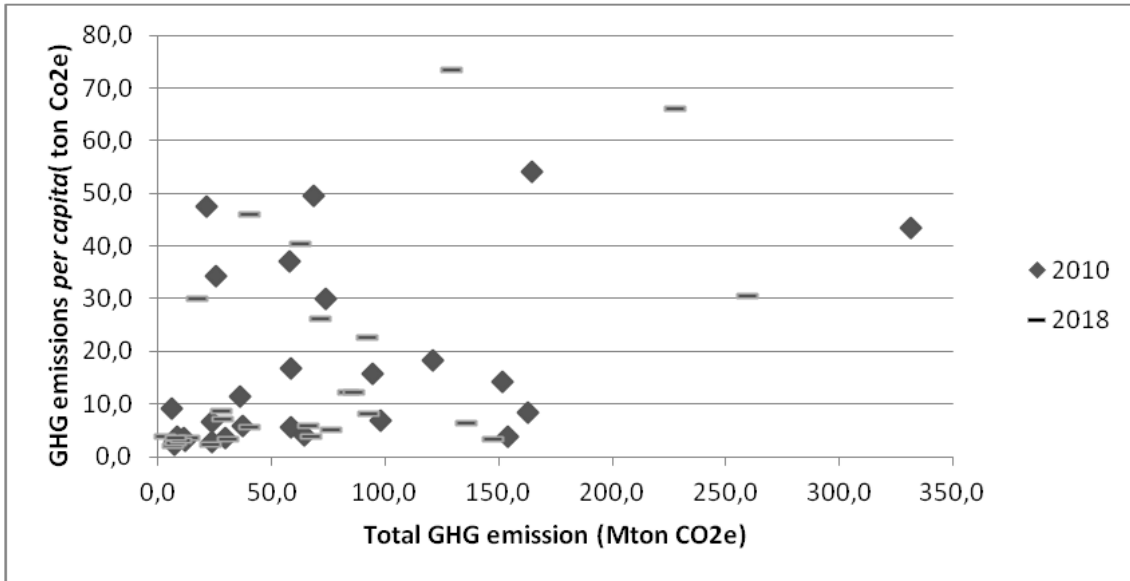
According to Graph 9 and Graph 10, there is no positive linear correlation between total GHG emissions and the two intensity measures. Each point in these figures is a subnational unit in a given year (2010 and 2018). Considering the behavior of these points, the model can add all variables to the emissions profile equation without double counting⁵⁷.

Graph 11 shows a positive correlation between GHG per capita emissions and GHG emissions intensity in GDP. This finding does not have a relevant

⁵⁷ I would like to thank Prof. Pierre Mazzega for this remark.

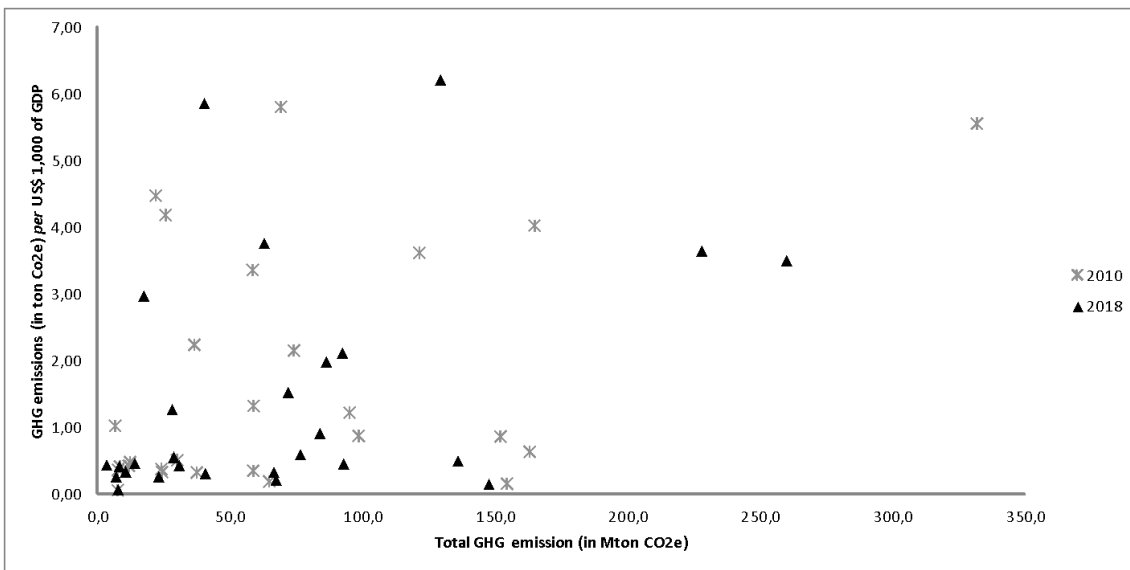
impact in the descriptive inferences for this research because the principal component analysis assesses each of these variables individually and no regression is applied to assess the relationship between the emissions profile variables.

Graph 9 – Dispersion diagram of total GHG emissions (in Mton) and GHG emissions (ton) per capita from 2010 and 2018



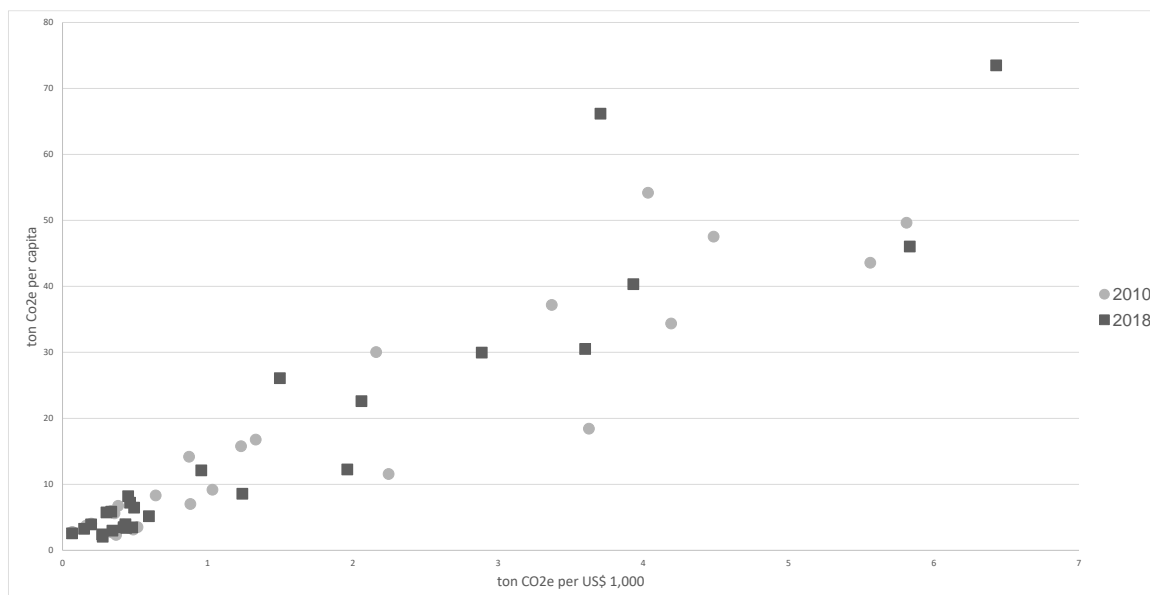
Source: Author’s elaboration based on IBGE (2020) and SEEG data.

Graph 10 - Dispersion diagram of total GHG emissions (in Mton) and GHG emissions (ton CO_{2e}) per US \$ 1,000 of GDP for 2010 and 2018



Source: Author's elaboration based on SEEG data and World Bank (2020).

Graph 11 – Dispersion diagram of GHG per capita emissions (in ton CO2e per person) and GHG emissions (ton CO2e) per US\$1,000 of GDP for 2010 and 2018



Source: Author's elaboration based on SEEG, IBGE and World Bank (2020).

The emissions profile equation (EP) considers average growth rates from 2010 to 2018 according to the equation:

Equation 1 - Emissions Profile (EP)

$$\frac{[ig (GHG \text{ emissions}) + ig (GHG \text{ emissions per capita}) + il (GHG \text{ emissions per US\$ 1,000 of GDP])}{3}$$

3

In which:

ig (GHG emissions) = geometric average growth rate of GHG emissions from 2010 to 2018;

ig (GHG emissions per capita) = geometric average growth rate of GHG emissions per capita from 2010 to 2018;

il (GHG emissions per US\$ 1,000 of GDP) = linear average growth rate of GHG emissions per US\$ 1,000 from 2010 to 2018.

This equation means that all three measures have the same weight in the emission profile and that the higher the results, the more carbon-intensive the subnational unit profile is.

GHG emissions and GHG emissions per capita are estimated by a geometric average growth rate, calculated with the equation

Equation 2 - Geometric average growth rate

$$ig = \left(\frac{An}{Ao} \right)^{\frac{1}{n}} - 1$$

In which:

ig = average geometric growth rate

An = the last record in the specific time series

Ao = the first record in the specific time series

n = the number of periods in the specific time series

GHG emissions per US\$ 1,000 of GDP is estimated by a linear average growth rate, with the equation

Equation 3 - Linear average growth rate

$$il = \frac{An - Ao}{Ao}$$

In which:

il = average linear growth rate

An = the last record in the specific time series

Ao = the first record in the particular time series

GHG emissions and *per capita* average rates are calculated with the geometric average because of their cumulative behavior: the previous year's result directly affects the following year. This choice is evident for population estimation. The exponential pattern of climate change (Viola and Franchini, 2018: 3) and scientific evidence about self-reinforcing feedback loops that can result in temperature rises and increased GHG concentration in the atmosphere explain the geometric pattern for GHG emissions (Pereira and Viola, 2020: 6). A linear estimation could downsize the impact that is addressed to climate change as a civilizational driver.

Considering GDP growth behavior, a cumulative pattern, expressed in a geometric growth, is an extraordinary event. Therefore, linear growth is the reference for estimating GHG intensity in GDP.⁵⁸ The linear average growth for GDP in US\$ and R\$ are very different due to exchange rates variation from 2010 to 2018. To provide more consistent behavior, all values in GDP are in US\$. This currency conversion, however, has impacts on the analysis of GHG intensity in GDP because of the Brazilian currency devaluation in the period under investigation and, as a consequence, a possible underestimation of the GHG intensity per unit of GDP.

Instead of absolute values, the choice for average growth rates in the emissions profile presents a final unit measured in percentage. This result has to be analyzed comparatively, giving a relative position of units among the population under study. Hence, it is essential to notice that a result of 0.5, for instance, does not mean that a specific federate unit has a profile of 50% more carbon-intensive than others. It simply means that 0.5 is the sum of the average growth of the three variables of the emission profile, which has to be analyzed among the other units to establish a comparison rule.

Nevertheless, this choice of measurement can mask the relative position of subnational units in national and international contexts. In the case of Brazil, subnational units' disparities and their different impacts on the Brazilian total GHG

⁵⁸ I want to thank Professor Carlos Marcos Batista for this remark.

emissions, population, and GDP is of concern. Therefore, the EP could use a correction index, measured according to each subnational unit percentage in total national values for each emission profile variable. This correction emphasizes subnational units with bigger relative weights in the national context.

This choice biases the subnational emission profile for making it directly related to the national profile. It also jeopardizes the comparison between the federated units of different countries. Even if national context interferes with subnational action (economic context, state politics, and government according to Keating, 2013), this index purpose is not to evaluate such interference but to present the subnational climate commitment of individual subnational units in a global governance perspective. Therefore, I do not apply a correction index in the emission profile calculation. Finally, the principal component analysis includes the relative weight in the last year available in the time series (2018) in order to present a more accurate reading of subnational units' position and clustering⁵⁹.

Subnational Climate Commitment Index (SCCI)

Considering that emissions profile variables and policy profile variables have different units and are in different orders, there is a need for all values adjustment to a standard interval in a 0 to 100 scale through the equation

Equation 4 - Adjustment from 0 to 100

$$\left[\frac{Ai - Amin}{h} \right] \times 100$$

Where:

⁵⁹ I made a test applying the correction index. The result is that there is a redistribution of federated units among the smallest values (meaning the most negligible carbon-intensive emissions profiles) and minor changes among the ten federated units with the highest results (more carbon-intensive emission profiles). The three highest scores remained the same.

A_i : is the specific subnational unit value;

A_{min} : is the smallest number in the particular population;

h : is the range between the biggest and the smallest values in the population.

This adjustment is necessary to facilitate the index reading, compare the results of Emissions Profiles and Policy Profiles, and allow for their sum in the SCCI. However, this adjustment creates a relative position for each of the results: the 100 score is the highest in that particular population. Suppose one wants to compare the results of this population with a subnational unit of a different country. In that case, it is necessary to adjust the values for the new population, which now has the additional units.

The Emissions profile (EP) and the policy profile (PP) have different order measures, with opposite evaluation scales. To add them up, it is necessary to invert the EP evaluation scale, making the most intensive subnational unit have the smallest score and the less intensive subnational unit the highest. For that, the model uses the following equation for the EP:

Equation 5 - Emission Profile with evaluation scale inversion (EPesi)

$$EP_{esi} = \left[- \left(\frac{A_i - A_{max}}{h} \right) \right] \times 100 \quad \text{or simply} \quad EP_{esi} = 100 - EP$$

in which:

EP_{esi} : Emissions profile with evaluation scale inversion;

A_i : the value of a specific subnational unit;

A_{max} : the highest number in the population;

h : is the range between the biggest and the smallest values in the population.

EP: Emissions profile value with adjustment.

The SCCI final equation is:

Equation 6 - SCCI final equation

$$SCCI = \frac{[EP_{esi} + PP]}{2}$$

Where:

SCCI is the climate subnational commitment index for a given subnational unit;

EP_{esi} is the emission profile with evaluation scale inversion;

PP is the policy profile.

Both profiles range from 0 to 100 after the adjustment, and the final result is divided by two to make the SCCI range from 0 to 100. This equation means that EP and PP have the same weight in subnational climate commitment and that the subnational unit with the better commitment approach will score 100.

The 100 score does not necessarily mean that the subnational unit has an absolute high climate commitment but a relatively better climate commitment than the other Brazilian subnational units. Considering that Brazil is a moderate-conservative country (Viola and Franchini, 2018), going towards a more conservative profile (Ribeiro and Inoue, 2019), a complementary qualitative assessment better describes each subnational unit climate commitment as conservative or reformist, according to Viola et al.'s (2013) and Viola and Franchini's (2018) conceptualization.

Beyond the ranking that results from the SCCI, applying the principal component analysis with the SCCI variables presents how they are related. It also informs how subnational governmental units are clustered, identifying homogeneous groups, and makes the normalization of variables. Based on the SCCI limits given so far and for the exploratory purposes of this research, I present two other variables to apply to the PCA for subnational climate commitment and some necessary adaptations:

a) Large differences in scales interfere in the plotting of vectors. Therefore, the policy profile is measured in PCA as a percentage of the total possible score (each subnational unit result was divided by 10.5), being equivalent to the emissions profile scale. This adjustment for PCA does not impact the relative position of each subnational unit in the policy profile;

b) The deforestation rate of Amazonia and Cerrado biomes between 2010 and 2018 is added to the PCA, considering that deforestation has a strong influence on the Brazilian national emissions profile, and these two biomes were responsible for 96% of all deforestation areas in the country in 2019 (Mapbiomas, 2020);

c) The emissions profile variables are considered independently, assuming they are not duplicated. This choice allows the assessment of their specific loading values and vectors;

d) Each subnational unit's total GHG emissions in 2018, measured as a percentage of national emissions because of scale adjustment, is included to assess their relative position.

The inclusion of the two variables – deforestation and GHG emissions in 2018 – offers a better picture of subnational governments' relative positions. Since the emissions profile measures a behavior between 2010 and 2018 in percentage points (growth or degrowth) for each variable, total emissions in 2018 will help position each subnational unit's absolute position. This relative weight in 2018 impacts the evaluation differently from the SCCI equation because of the PCA methodology.

3.3 Process-Tracing with literature review and interviews

King, Keohane, and Verba (1994: 226) and Bennet (2010: 208) present process-tracing as a method to perceive more observable implications of a theory, search for alternative explanatory hypotheses, and to support descriptive generalizations. Tarrow (2010) describes it as a means to bridge the divide between qualitative and quantitative research methods and can be used both for within-cases analysis and the comparison of cases. In the former, Beach and Pedersen (2013: 2) present process-tracing methods as “tools to study causal mechanisms in a single-case research design.” For Underdal (2008: 75), “intensive process-tracing will often discover factors and causal pathways overlooked in more formal or extensive modes of inquiry.”.

Beach and Pedersen (2016) consider that, although literature commonly presents process-tracing as a single research method, there are three types of process-tracing with ontological, epistemological, and methodological differences: theory testing and theory building, which are theory-centered, based on neo positivist and critical realist positions, and focused on finding systematic factors; and explaining outcome process-tracing, which is case-centric, hosts both dualistic and monistic ontologies, and disposes of theory as an analytical tool to explain a case-specific outcome (Beach and Pedersen, 2016: 11-13).

Differently from KKV, whose logical priority is the definition of causality (Brady, 2010: 72), based on the construction and comparison of counterfactuals, Beach (2016: 15) defines process-tracing as a shift of attention from causes and outcomes to causal processes that links them, describing what happened, but not necessarily why it happened (see also Oliveira and Andrade, 2020).

While for Collier (2011), process-tracing is a tool for causal inference, King, Keohane, and Verba (1994: 228) consider that it probably does not result in strong causal inferences. Still, it can provide descriptive generalizations about the frequency of potential causal mechanisms. As perceived by this brief literature review, causation claims strongly describe process-tracing. Beach (2016: 17-20) presents causal mechanisms as systems, which would capture what is inside

causal arrows and make causal logic between causes and outcomes explicit. Therefore, the research should be able to check if processes and mechanisms foreseen by a specific theory happened as expected, tracing observable manifestations, not counterfactuals.

Beach and Pedersen (2016: 9-22) present the three process-tracing methods according to their characteristics:

Table 15 - Process-tracing methods

Method/Characteristics	Theory testing	Theory building	Explaining outcome
Ontological foundation	Neopositivism and critical realism		Dualist and monist ontologies
Ambition of study	Theory-centric Deduction (theory before facts)	Theory-centric Induction (facts before theory)	Case-centric
What is being traced?	Theorized causal mechanism presence in a case	The systematic mechanism in a population of cases	The case-specific mechanism for a single case
Necessity claim	NO – necessary cross-case analysis	YES	NO
Sufficiency claim	NO	NO	YES for a particular outcome, with systematic and nonsystematic parts

Source: Author's elaboration, based on Beach and Pedersen (2016: 9-22)

In process-tracing, background knowledge, careful hypothesis formulation, and a broad body of evidence are essential elements (Bennet, 2010: 219; Collier, 2011: 825) for applying tests to alternative hypotheses and treating evidence. Bennet (2010) and Collier (2011: 825), based on Van Evera (1997, in Bennet, 2010: 210-212), present a typology for hypothesis testing according to the necessity and sufficiency criteria. The necessity criteria mean that if there is A, not necessarily there is B, but if there is B, there must be A. The sufficiency criteria mean that in a causal hypothesis that A causes B if there is A, there is B, but B is not always produced by A (Beach and Pedersen, 2013: 81-82; Oliveira and Andrade, 2020).

Table 16 - Process Tracing Four Tests for Causation

		Sufficient to establish causation	
		NO	YES
Necessary to establish causation	NO	Straw in the wind Passing the test affirms the relevance of the hypothesis but does not confirm it. Failing suggests that the hypothesis may not be relevant but does not eliminate it.	Smoking Gun Passing the test confirms the hypothesis. Failing does not eliminate it.
	YES	Hoop Passing the test affirms the relevance of the hypothesis but does not confirm it. Failing eliminates it.	Doubly Decisive Passing confirms hypotheses and eliminates others. Failing eliminates it.

Source: Bennet, 2010: 210

These tests indicate the existence of evidence, which increases the confidence in the hypothesis, and if the hypothesis formulation is unique – there are no alternative hypotheses that apply (Beach and Pedersen, 2013: 100-107). The tests are applied to hypotheses, not to causal mechanisms, and using process-tracing, then, does not obligate the use of these tests. Beach and Pedersen (2013) also consider that in explaining-outcome process-tracing, there are multiple overlapping mechanisms and nonsystematic mechanisms, making it more difficult to test them, and, therefore, the sufficiency of an explanation cannot be generalized.

The "straw in the wind" test means that evidence is insufficient or necessary, but it can support the hypothesis if cumulative. The "hoop" test indicates that the found evidence is certain, but it is not the only evidence. The "smoking gun" evidence affirms a hypothesis but is not sufficient to confirm it (Oliveira and Andrade, 2020). Cases that pass the doubly decisive test are considered rarer in social sciences because it proves that pieces of evidence are singular and certain, but the combination of the hoop and smoking gun tests can accomplish the same analytical goal of the doubly decisive test (Bennet, 2010: 211; Collier, 2011: 827).

To apply this method, Collier (2011: 828) suggests that the researcher begins with a good narrative and a timeline with the sequence of events to explore causal ideas and their respective evidence before identifying which of the tests are appropriate to evaluate the evidence. The prominent critics over this method are the possibility of infinite regression and the “degrees of freedom” of a small number of cases of qualitative research with a large number of variables, which in statistical studies results in indeterminacy (Bennet, 2010: 209).

I apply process-tracing in this research closer to Finnemore and Sikkink (2001) and Beach’s (2016) formulations of process-tracing according to the explaining outcome type. Beach and Pedersen (2013: 52-53) present strategies to explaining-outcome process-tracing: eclectic theorization, with the combination of existing mechanisms, new theories development, and the incorporation of nonsystematic parts.

Chapter 5 application of explaining-outcome process tracing presents the causal mechanism, follows the quantitative data organized in the SCCI in Chapter 4, and uses bibliographical and documental research described along with the dissertation, with data gathered through interviews. Unlike the SCCI, which allows for cross-case inferences and to look for regularity, process-tracing searches for the presence or absence of causal mechanisms in specific cases, and evidence may not be comparable across cases (Beach and Pedersen, 2013: 69-74).

Recognizing the disparities between the two methods is relevant to assess incommensurability and make an adequate framework for their sequential use. In fact, Beach and Pedersen (2013) do not recommend explaining-outcome process tracing in mixed-method designs, especially with statistical methods due to different ontological assumptions. While explaining-outcome process tracing has a deterministic ontology with a mechanistic understanding of causality, large – n statistical methods have a probabilistic ontology with causality as a regular association.

However, the statistical methods in this research do not rely on regression analysis or causality. The index proposition assigns a theory-informed value to the climate commitment concept, and the principal component analysis

addresses the variables and statistical units' behavior for a specific set of variables and a specific sample of subnational governments. Therefore, the results cannot be generalized to a population and the search for causality lies in the process-tracing employment.

Interviews can also be part of multi-method research as the primary source of data or as one of multiple means to gather data, construct more general theories, or test theories' accuracy (Mosley, 2013). For Martin (2013: 118), using interview data and other data types can increase data reliability and validity. However, in all circumstances, Mosley (2013) identifies four challenges in interview making: issues related to ethics and informed consent, sampling, validity, and reliability.

For Lynch (2013), interviews can be applied in preliminary research (before data collection) to generate and test alternative hypotheses and refine concepts and measures. In the main study, they help test the central descriptive and causal hypothesis. In multi-method research, they allow to access experiences and motivations and to make triangulation with other methods, which permits both to enhance the internal and external validity of data, in a positivist perspective, and to perceive the social construction of knowledge in a specific object under study, in an interpretivist perspective.

The interviews use is according to Lynch's (2013) definition for multi-method research both in positivist and interpretivist perspectives. They can inform if the SCCI has used correct measurements, if the index is a tool that could be used for policy prescription, and to make triangulation of evidence. Finally, they help generate causal process observations (CPOs). Chapter 5 further describes the rigorous subjectivity and consultative approach implications of the interviews.

3.4 Conclusion

The mixed methodological framework proposed to this research comprises three methods: the diagnostic method, descriptive inferences based on exploratory statistics, and process-tracing, with interviews as a data source.

Quantitative work, summarized in the Subnational Climate Commitment Index and the principal component analysis, is the ground for descriptive inferences.

This index is not based on linear or multiple regressions because the former would not entail the object under study complexities. Instead, with the due adaptations of the Subnational Climate Commitment Index, the principal component analysis is an effort to offer a deeper understanding of the association between variables and the clustering of statistical observations.

The logic under the sequential use of these methods should provide a sound contextual understanding with the diagnostic method, followed by descriptive inferences based on quantitative data. Chapter 4 applies the diagnostic method to look at global climate governance through subnational governments' perspectives, the SCCI results, and the principal component analysis for the 27 Brazilian states.

Beach (2016) and Finnemore and Sikkink (2001) positions inform the process-tracing application by the explaining-outcome type in a multi-method sequence to search for a constitutive explanation and the identification of causal mechanisms, which can lead to causality definition, and the understanding of causal mechanisms that precedes the definition of causality. As defined by Young (2008: 9-11), I consider causal mechanisms as interacting variables that form composite drivers in a mechanistic understanding. Consequently, the research tries to capture what is inside causal arrows and make the causal logic explicit.

Chapter 5 takes this next step, It provides an in-depth analysis of two states – Pará and Mato Grosso - to enhance data's internal and external validity through triangulation, data generation through interviews, and search and analysis of processes and causal mechanism with process-tracing.

CHAPTER 4 – THE SUBNATIONAL LEVEL

This chapter presents the subnational level in three perspectives: the first is subnational units' engagement at the UNFCCC according to chapter's 2 theoretical framework. The second is the characterization of subnational government's transnational networks. Thirdly, the focus is shifted to Brazilian subnational actors, presented through the concepts of climate federalism and paradiplomacy. Following this description, the fourth section presents the result of the Subnational Climate Commitment Index applied to the 27 Brazilian subnational actors. Next, a conclusion summons up all Brazilian subnational actors' behavior in global climate governance.

4.1 Subnational actors at the UNFCCC

Most of the literature about non-state actors and subnational governments at the international climate regime focus on COP 15 in Copenhagen, COP 20 in Peru, and COP 21 in Paris, even if they have participated since the 1990s in deliberative and participatory mechanisms at the UNFCCC and climate governance in general (Gupta, 2010; Bäckstrand et al., 2017: 564; Kuiper et al., 2018; Macedo and Jacobi 2019). The UNFCCC text does not explicitly reference them or observer organizations. However, they were gradually recognized as constituencies (local governments and authorities, indigenous peoples' organizations, and research, trade, independent, women and gender, and youth NGOs), granted provisional status (farmers), or accredited as observers (environmental NGOs, researchers, business, among others) since the first COP in 1995 (Kuyper et al., 2018: 351).

Throughout UNFCCC history, there were moments of international negotiations setback between national governments, when alternative or complementary arrangements were created (Rabe, 2011; Bäckstrand et al., 2017: 563-564). The Bali Action Plan in 2007, with a second negotiating track which followed USA refusal to ratify the Kyoto Protocol, and the inauguration of what Kuyper et al. (2018: 346-351) call a hybrid multilateralism after COP 15, institutionalized in the Paris Agreement in COP 21, are two examples.

Subnational governments' transnational networks date since the 1990s - ICLEI appears in the literature as one of the first. However, from 2002 onwards, there was greater interest in the potential of policies at the subnational level and the acknowledgment that policy implementation has undergone decentralization. Among the examples to support this assertion are US and Australian municipalities and Canadian provinces that were more active than their national governments and the cases of France, Italy, the Netherlands, and China as an example of federalism and decentralization.

Gupta (2010) describes the history of the international climate change policy from the 1990s to 2008. In her conclusion, this 20-year-old process of engagement of subnational governments, including cities, would remain, and in COP 14 (2008), Catalonia presented an amendment that included the term 'subnational governments' for the first time in the negotiating text with the support of NRG4SD⁶⁰. Interestingly, the NRG4SD first conference of regional governments happened in the Basque Country, which has identity claims. The Basque Country is very active in this realm, heading regional chairs and hosting events. At COP 11, in 2005, NRG4SD partnered with the Climate Group by signing the Declaration of the Federated States and Regional Governments on Climate Change at UNFCCC COP 11, which was a request made by subnational governments for recognition.

COP 15, in Copenhagen in 2009, is considered one of the landmarks for subnational actors' engagement due to the failure of intergovernmental negotiations (Gordon, 2015). For Bäckstrand et al. (2017: 563-565), three characteristics of the post COP 15 governance are an explosion of non-state and sub-state actions, an increasing involvement of non-state and sub-state actors at the UNFCCC system, and an increasing interplay between the UNFCCC system and non-state climate actions, linking multilateralism to transnational actions.

In 2010, COP 16 Decision 1/CP.16.par.7. reads⁶¹:

Recognizes the need to engage a broad range of stakeholders at the global, regional, national, and local levels, be they government, including subnational and

⁶⁰ See <https://www.regions4.org/about-us/regions4/>. Access on October 25th, 2020.

⁶¹ See <https://unfccc.int/resource/docs/2010/cop16/eng/07a01.pdf>. Access on June 4th, 2021.

local government, private business or civil society, including youth and persons with disability, and that gender equality and the effective participation of women and indigenous peoples are important for effective action on all aspects of climate change.

Table 17 presents other landmarks and COP Decisions that ensued and corroborated Bäckstrand et al.'s (2017) characterization of the post COP 15 governance:

Table 17 – Non-state actors landmarks in UNFCCC framework by year

Year	Landmark / COP Decision
2011	<ul style="list-style-type: none"> • UN Secretary-General – Momentum For Change Campaign, which mobilized and highlighted multiple climate actions. • UNFCCC Ad Hoc Working Group on the Durban Platform for Enhanced Action (ADP), a locus for state and non-state stakeholders to share policies, practices, and technologies.
2013	<ul style="list-style-type: none"> • UNFCCC COP 19 – Decision 1/CP.19 par. 5b⁶² about the sharing among Parties of experiences and best practices of cities and subnational authorities
2014	<ul style="list-style-type: none"> • COP 20 Lima – High-Level Meeting on Climate Action to highlight transnational climate action; • Lima-Paris Action Agenda (LPAA); • NAZCA Platform; • Global Climate Action Summit in San Francisco and New York Climate Week showcased climate action from multiple stakeholders.⁶³
2015	<ul style="list-style-type: none"> • UNFCCC COP 21 – Decision 1/CP.21⁶⁴ preamble par. 15, par 73 d&g, 106, 109, 116, 117, 118, 119, 120 d., 121b., 133-136.
2016	<ul style="list-style-type: none"> • UNFCCC Global Climate Action Agenda road map links actions to national action plans/transparency • Marrakesh Platform for Global Action Agenda⁶⁵, which aims to convene stakeholders by sectors and encourage actions and higher commitment
2018	<ul style="list-style-type: none"> • UNFCCC COP 24 Decision 2.CP/24 establishes the Local Communities and Indigenous Peoples Platform Facilitative Working Group

Source: Author's elaboration based on Chan et al. (2016), van der Ven et al. (2017), <https://unfccc.int/climate-action/introduction-climate-action/history-non-party-stakeholder-engagement> and <https://www.regions4.org/about-us/regions4/>. Access on December 13th, 2020.

⁶² Available at <https://unfccc.int/resource/docs/2013/cop19/eng/10a01.pdf>. Access on June 4th, 2021.

⁶³ See <https://unfccc.int/news/global-climate-action-summit-brings-surge-of-new-commitments-and-calls-for-increased-government> and <https://unfccc.int/news/un-climate-change-at-new-york-climate-week-24-30-september>. Access on December 13th, 2020.

⁶⁴ See the full text in <https://unfccc.int/resource/docs/2015/cop21/eng/10a01.pdf>. Access on December 13th, 2020.

⁶⁵ See <https://unfccc.int/climate-action/introduction-climate-action/history-non-party-stakeholder-engagement> and <https://unfccc.int/climate-action/marrakech-partnership-for-global-climate-action>. Access on June 4th, 2021.

In 2014, the Lima-Paris Action Agenda (LPAA) and the Nazca Platform were landmarks related to greater visibility of non-state actors, as their design steers orchestration in climate governance (Van der Ven et al., 2017: 3). In fact, Chan et al. (2018: 26) point out that "the 2014 UN Climate Summit was the first UN summit dedicated to state and non-state climate action.". Nevertheless, the efforts were directed to the institutional core of global climate governance dynamics – COP 21 in Paris the following year – to encourage more ambitious national targets and the alignment of state and non-state actors (Chan et al., 2016: 241; Chan et al., 2018: 26). In June 2021, there were 28,863 actions and 19,690 actors registered at the Nazca Platform⁶⁶, among which are 247 regions with 676 actions, with a concentration of actions from regions in Western Europe, North America, and Oceania (UNFCCC, 2021:15).

The Paris Agreement recognizes non-party stakeholders' engagement, but it does not present their role with precision. COP Decision 1/CP.21 defines them as civil society, private sector, financial institutions, cities, and other subnational authorities. The decision calls them to scale up their efforts and actions, demonstrate them through the Nazca Platform, and promote regional and international cooperation while recognizing the need to incentivize emission reduction activities (Chan et al., 2016: 242).

There is a specific section for them in COP Decision 1/CP.21, Section V⁶⁷:

V – Non-party stakeholders

133. Welcomes the efforts of all non-Party stakeholders to address and respond to climate change, including those of civil society, the private sector, financial institutions, cities, and other subnational authorities;

134. Invites the non-Party stakeholders referred to in paragraph 133 above to scale up their efforts and support actions to reduce emissions and/or to build resilience and decrease vulnerability to the adverse effects of climate change and demonstrate these efforts via the Non-State

⁶⁶ See <https://climateaction.unfccc.int/views/stakeholders.html?type=regions>, Access on September 9th, 2021. Although the research has a timeline till 2018, the Nazca Platform does not have a filter to analyze actions by year.

⁶⁷ See <https://unfccc.int/resource/docs/2015/cop21/eng/10a01.pdf>. Access on June 4th, 2021.

Actor Zone for Climate Action platform referred to in paragraph 117 above;

135. Recognizes the need to strengthen knowledge, technologies, practices, and efforts of local communities and indigenous peoples related to addressing and responding to climate change, and establishes a platform for the exchange of experiences and sharing of best practices on mitigation and adaptation in a holistic and integrated manner;

136. Also recognizes the important role of providing incentives for emission reduction activities, including tools such as domestic policies and carbon pricing;

Following COP 21 Decision 1/CP.21, the French Ambassador for climate change, Ms. Laurence Tubiana, and the Minister Delegate to the Minister of Energy, Mines, Water and Environment of Morocco, Ms. Hakima El Haite, were appointed as high-level climate champions. Their task was to engage with interested parties and non-party stakeholders of the Paris Agreement and help coordinate high-level events to foster engagement. Since then, different high-level champions have been appointed.⁶⁸

The champions published a roadmap for action, launched a consultation among parties and non-party stakeholders regarding the climate-action landscape, and presented and discussed the roadmap and the consultation results in three different meetings. They also presented a document with reflections on the way forward for climate action⁶⁹, which recommended information disclosure in the Nazca Platform according to established criteria and the annual publication of the climate action yearbook with a high-level summary of information about non-party stakeholders' actions, progress, results, and commitments.

⁶⁸ See <https://unfccc.int/climate-action/marrakech-partnership/actors/meet-the-champions>. Access on December 8th, 2021.

⁶⁹ See https://unfccc.int/files/paris_agreement/application/pdf/reflections_on_the_way_forward_final.pdf. Access on December 8th, 2021.

The document has some keywords aligned with a polycentric approach of global governance – experimentation, innovation, and self-organization, and indicates that the champions are not "gatekeepers". However, it also mentions the necessity to connect the UNFCCC and voluntary and collaborative actions, considering that non-party stakeholders' actions complement and shall not replace parties' commitments. Regions and cities measures are presented as disclosure of information, participation in coalitions for climate action, and supporting the implementation of NDCs.

The Marrakech Partnership for Global Action⁷⁰ for the period 2017-2020 is the result of this process. Although the whole context offers recognition and increased visibility for non-state actions and transnational governance, and establishes some criteria for the registration of actions at the Nazca Platform, there are no actual guidelines or conditions for registering actions nor progress follow-up through monitoring and verification (Chan et al., 2016: 243-244; Bulkeley et al., 2018: 64). The 2021 Yearbook acknowledges this assertion by stating that "Central to this process [to mobilize further and align non-Party stakeholders to maximize ambition] is the promotion of clear methodologies for non-Party stakeholders and metrics for measuring and reporting their progress towards the Paris Agreement objectives." (UNFCCC, 2021: 9).

By November 2021, data visualization changed in the Platform, which now is called Global Climate Action Portal (GCAP). Although it is still possible to find how many regions have registered their actions, to assess how many actions and their characteristics need thorough work with the dispersed data presented. Therefore, there is an impact on transparency and quality of actions' assessment, their alignment, and contribution to the UNFCCC, differently from the mechanisms designed for stakeholders⁷¹.

⁷⁰ See

https://unfccc.int/files/paris_agreement/application/pdf/marrakech_partnership_for_global_climate_action.pdf. Access on December 8th, 2021.

⁷¹ It is not currently possible to download data from the GCAP website or get the dataset through direct contact due to the Platform agreements with data providers. This information was obtained through an e-mail to NAZCA@unfccc.int on December 21st, 2021. Chan et al. (2018: 33) have already stressed the need for more data transparency for climate actions, especially the Nazca Platform, to assess their implementation and contribution over time.

Even if COP 16 Decision 1/CP.16.par.7 recognized the need for a broad range of stakeholders' engagement at multiple levels, Paragraph 134 of COP 21 Decision 1/CP.21 and the Marrakech Partnership for Global Climate Action show a clear indication of what are the expectations for subnational actions within the UNFCCC: to be scaled up and support actions to reduce emissions. This understanding means the locus for action is not the subnational but the national level. Subnational actors' formal access to negotiations and information remains through their national states or the UNFCCC Secretariat, despite the high-level champions report, and their position is of support for nationally determined contributions, in a complementary manner (Chan et al., 2016; Bäckstrand et al., 2017: 571-572).

The rules for subnational actors' engagement in global climate governance derive from intergovernmental interactions, with scales defined territorially and less prone to overlapping. Authority is centered at nation-states, although subnational governments are recognized as non-party stakeholders. Even if there are some criteria for reporting actions at the CGAP, there are no methodologies for follow-up actions and measuring results similar to nation-states NDCs.

Also, Dorsch and Flachsland (2017: 57) consider that monitoring is a weak practice for developing trust among the actors involved while sanctioning or institutionalized conflict resolution mechanisms (a characteristic of polycentric governance) are considered potentially beneficial. However, these are not well established in global climate governance architecture from a subnational perspective. Therefore, the UNFCCC and the governance processes through a subnational lens indicate that global climate governance has a predominantly multi-level architecture according to the six dimensions framework that differentiates multi-level and polycentric governance approaches (Table 6).

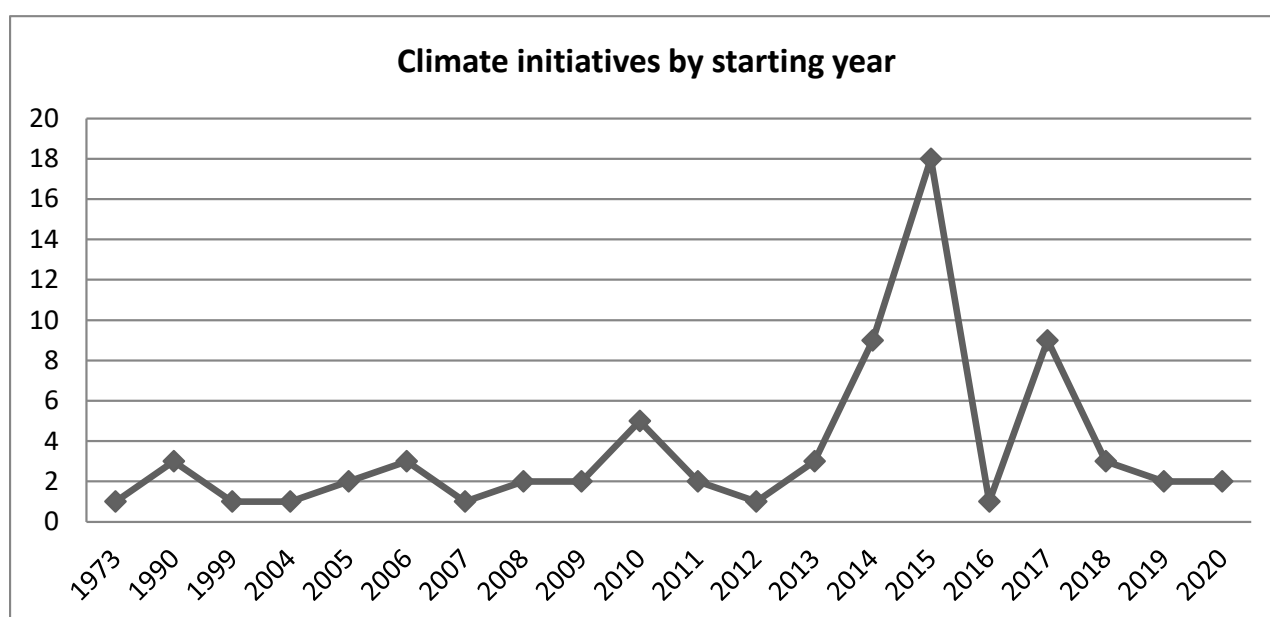
COP 21 Decision 1/CP.21 asks non-state actors to promote regional and international cooperation, and GCAP indicates 426 cooperative actions of subnational governments as of September 2021. Although reported in the Platform, these actions include participation in networks that do not necessarily cite the UNFCCC in their missions and can have independent dynamics. The following section looks at the transnational networks presented in Chapter 3

(Table 10) by actor's type and governance function, focusing on Brazilian subnational actors.

4.2 Transnational networks

Data about subnational governments' transnational networks is dispersed and lacks reporting patterns and congruence among different locus of information, which use different concepts - international cooperation initiatives, transnational networks, and orchestration platforms. The Climate Initiatives Platform⁷², for instance, hosted by the United Nations Environmental Program (UNEP), has 71 initiatives of cities and regions, among which 40 are listed as Nazca initiatives and 63 as still existing. Among the total, 80% are initiatives that started from 2009 on, and 2015 alone was the starting year of 25% of them.

Graph 12 – Climate Initiatives of cities and regions by starting year



Source: Author's elaboration based on data from the Climate Initiatives Platform. Access on November 28th, 2021.

For that reason, it was necessary to resort to one concept and choose a collection of transnational networks of subnational actors to make a more thorough assessment. Among the ten transnational networks presented in Table

⁷² See <https://climateinitiativesplatform.org/index.php/Welcome>. Access on December 6th, 2021.

9, six are public networks, mainly with capacity building and implementation function (four networks). Four are hybrid, with three of them with information sharing as the primary function. There was no transnational network with a rule-setting function, a finding which reinforces the argument of a predominantly multi-level architecture focused on authority diffusion, power dynamics, and the interactions between national and subnational governments.

For Jänicke (2017:112), there is a strong knowledge-base influence at the global level, which has defined problems and broadly agreed-upon general objectives, provides core beliefs, legitimacy, and relevant information for actors at the lower levels of the system. This assertion fits well in the case of the Global Climate Action Platform (GCAP), which incorporated and centralized data of other networks, such as the Compact of States and Regions, the CDP⁷³, and the Carbonn Center (Chan et al., 2016: 244).

ICLEI reports some of its actions to CDP, which, in its turn, partners with Under2 Coalition, the GCAP, and the Compact of States and Regions. NRG4SD and R20 also signed the Compact of States and Regions. Therefore, the GCF-TF is the only network that does not directly relate to any other and is not listed in the GCAP among the 21 regions initiatives⁷⁴.

Under 2 Coalition Memorandum of Understanding⁷⁵ is aligned with the UNFCCC 2°C target and is the only among the initiatives mapped that mentions the UNFCCC explicitly. This coalition had The Climate Group States & Regions Alliance, formed in 2005, as its forerunner. This alliance was organized after the signing of the Montreal Declaration of Federated States and Regions at the first Climate Leaders Summit, organized by the Climate Group⁷⁶.

Brazilian, North-American, and Indonesian governors created the Governors' Climate and Forest Taskforce (GCF-TF). The task force's objectives are cooperation in tropical forests protection and recovery, reducing GHG

⁷³ See <https://www.cdp.net/en/campaigns/nazca>. Access on December 6th, 2021.

⁷⁴ See <https://climateaction.unfccc.int/Initiatives>. Access on December 6th, 2021. Some of the initiatives listed do not fit the transnational network concept used in this work. However, the GCF-TF appears in the Climate Initiatives Platform as a Nazca initiative.

⁷⁵ See <https://www.theclimategroup.org/sites/default/files/under2-mou-with-addendum-english-a4.pdf>. Access on October 25th, 2020.

⁷⁶ See <https://www.theclimategroup.org/StatesandRegions#:~:text=Realizing%20the%20potential!%20Of%20sub.national%20governments%20from%20around%20the>. Access on August 17th, 2020.

emissions from deforestation and forest degradation, and advancing jurisdictional approaches to low-emissions development. One task force's fundamental point is that subnational governments "provide critical opportunities for policy innovation and leadership."⁷⁷ It claims to be the "world's largest subnational collaboration of tropical forests and provinces." Although its objectives are not conflictive with the broadly agreed-upon general objectives and core beliefs stated through the Nazca Platform, it is not formally related to any other transnational networks.

Consequently, we cannot assume that subnational actors' transnational networks generate an alternative set of norms and rules to the UNFCCC, but rather complement it and, consequently, complement inter-state cooperation (Hickmann, 2017). Chan et al. (2018: 32) consider that "there is a growing trend of UN and internationally led efforts to align transnational governance with global public goals.". Further research could try to relate each transnational network dynamics with the climate regime landmarks for subnational actors' engagement (COP 15, COP 16, COP 20, and COP 21, for example), and analyze their composition and specific commitments to understand the networks' interactions in the governance architecture. For now, it is relevant to notice that there is indeed a cooperative fragmentation in the governance architecture regarding transnational networks, even if there are no agreed-upon guidelines, metrics, and follow-up measures for non-state actors in global climate governance.

4.3 Climate federalism and climate paradiplomacy in Brazil

From a global to subnational perspective, this section resumes the periods of Brazilian climate policy in Chapter 1 with additional information about subnational dynamics to link subnational and national policies in this issue-area and the existence of intergovernmental mechanisms of cooperation between levels. It considers cooperative environmental federalism (national and subnational levels have concurrent legislative power and act towards a common goal), complementary paradiplomacy (exclusive foreign policymaking and implementation with the central government, and constitutional powers to sub-

⁷⁷ See <https://www.gcftf.org/about>. Access on October 31st, 2020.

state governments to conduct international relations), and the moderate support by Brazilian federal government, as defined in Chapter 2.

Hochstetler and Keck (2007) present one possible explanation for this configuration of the federal government and subnational governments dynamic when describing the context of what they call the third wave of environmental activism in Brazil (1980's till present). This wave encompasses the negotiations around the Federal Constitution writing. At this moment, the engagement in Brazil around environmental politics shifts from local - as in the second wave (1974 – 1980's), with the political engagement of environmental groups and action around emblematic episodes – to national, reinforced by the realization of Eco 1992 at Rio de Janeiro.

For Moreira (2013: 112-113 and 130), the political liberalization, institutional reform, and the economic opening in the 1990s in Brazil explain the increased agency of subnational governments in international affairs. For Amazonian states, the bilateral relationship with foreign frontier states is an alternative for development, considering the specific characteristics of the region – geographical position, territorial extension, a small number of living frontiers, low population density, and biophysical characteristics. However, these actions were concentrated on low politics activities – trade, investment, science and technology, culture, and education.

However, the process around environmental policies in Brazil is not linear, but permeated with institutional discontinuities, contingencies, and complex interactions of formal and informal processes among state, non-state and transnational actors. Understanding the interactions between levels is necessary to understand the overall process (Hochstetler and Keck, 2007). For that reason, Viola and Franchini's (2018) timeline for Brazilian climate commitment can be the basis for a closer look at climate federalism and climate paradiplomacy in Brazil.

a) Brazil as climate villain and paradiplomacy rising (1990-2004)

The first period (1990 to 2004) is when paradiplomacy is rising in Brazil. In the 2000s, subnational governments came to participate in delineating the Brazilian position in climate negotiations at a secondary role, together with the

Ministry of Environment (MMA) and some non-governmental actors (Viola and Franchini, 2018: 94). There were some relevant foreign policy initiatives at the national level within the UNFCCC, with marked federal domination and low diffusion to the subnational level (Rabe, 2011; Hochstetler, 2021; Pereira and Viola, 2021).

The federal government and subnational units had a conflictive relationship with the national standing at the UNFCCC regarding forests, which was considered a separate issue from climate change (Hochstetler, 2021). Interviewee B3 (see Appendix 4) mentioned that subnational governments' articulation around the forest issue began in the 1990s with the PPG7 Program. The federal government centralized the resources, but KfW and GIZ directed resources to Acre, Pará, and Amazonas. Also, this is a period that Viola and Franchini (2018) called "the Amazon impotence and paranoia" due to state incapacity to cope with high deforestation rates. As presented by GIZ (2020), the subnational units' competence for forests, land and natural resources protection, and nature conservancy is supplementary⁷⁸, resulting in bottom-up pressure based on climate federalism.

Although there is evidence of some subnational governments' initiatives emergence – ICLEI in the 1990s (Gupta, 2010), CDP in the 2000s, and NRG4SD in 2002, I could not find any specific action reported from these transnational networks in Brazil in this period. Also, it was not possible to identify when São Paulo made its adhesion to ICLEI (see also Setzer, 2013: 97).

b) Brazil as a climate leader and increasing actions at the subnational level (2005 – 2010)

In the next period, from 2005 to 2010, there was an alignment at both levels regarding commitment, with increased activity at the subnational level both in domestic policies and paradiplomacy regarding climate change issues. In 2005, São Paulo and California signed a Memorandum of Understanding recognizing

⁷⁸ For forests, pollution control, environmental protection, and some other issues, the federal government establishes general norms complemented by state-level specific laws.

both states as leaders in climate change policies, establishing targets, and encouraging the adoption of policies (Anderton and Setzer, 2018: 1277).

Although Hochstetler and Keck (2007) consider São Paulo's climate agenda a unilateral movement in Brazil during the 2000s⁷⁹, there were local developments in the period in other subnational units, especially the Amazonian states, which identified REDD+ as an opportunity to access international climate financing (Pereira and Viola, 2021). Between 2003 and 2010, PPCDAm, the NAFC, and the BR 163 plan (Cuiabá – Santarém) drew the relationship between subnational and federal governments closer, according to interviewee B3. From 2010 on, the relationship changed, and subnational governments exerted increased pressure. In the case of Pará and Mato Grosso, the subnational governments are politically opposed to the federal government, and the agribusiness group gains strength in the National Congress.

ICLEI inaugurated the State Climate Change Policies (SCCP) in 2008 in Pernambuco, Bahia and Mato Grosso states, with the British Government's Strategic Programs Fund and the British Embassy in Brazil support. The project focused on technical capacity building for inventories and state policies design. Although the SCCP project timeline was from 2008 to 2011, it was possible to find information on actions at Pernambuco and Mato Grosso until 2009 (ICLEI, 2008 and 2009). Also in 2008, Mato Grosso, Pará, Amazonas, Amapá, and Acre, together with the Indonesian states of Aceh and Papua, and the North-American states of California and Illinois, signed the agreement that created the Governors' Climate & Forests Task Force (GCF-TF)⁸⁰.

Viola and Franchini (2018: 108 and 115) consider an increased level of cooperation between subnational and national governments for deforestation control. Nevertheless, Amazon states continued to exert pressure on the national government for climate policy change, which is considered a driver for a different position in the federal government's international standing on forests and the support of REDD+. In July 2009, Mato Grosso and Amazonia governors

⁷⁹ For an in-depth analysis of the state of São Paulo, see Setzer (2013).

⁸⁰ See <https://www.gcftf.org/who-we-are/member-states/>. Access on May 2nd, 2021.

organized the Legal Amazonia Governors' Forum⁸¹, which presented a demand for the Brazilian delegation in COP 15 in the same year to accept REDD+ at the Clean Development Mechanism and avoided deforestation as a mitigation mechanism, which could open opportunities for international funding (Viola and Franchini, 2018: 124-125; Pereira and Viola, 2021).

There was substantial climate policy development at both levels – national and subnational, with some domestic processes that obliged compliance, like the Action Plan for the Prevention and Control of Deforestation in the Legal Amazon - PPCDAm (Hochstetler, 2021). The years 2009 and 2010 had the highest numbers of policy processes for climate change at the subnational level. This finding offers a complex drawing of climate commitment scaling up and down, together with the influence of external drivers and transnational networks, since Amazonian subnational states were considered a bottom-up driver of change in national policy at the domestic and international levels.

c) *Brazil as climate-negligent and institutionalization at the subnational level (2011-2016)*

Climate negligence in national domestic processes and domestic stagnation in climate policy (Pereira and Viola, 2021) characterize the period from 2011 to 2016. The creation of a Federative Climate Articulation Center (*Núcleo de Articulação Federativa para Clima – NAFC*) at the Executive Group of Climate Change in 2013 is one relevant marker. It was subordinated to the Interministerial Committee for Climate Change and was coordinated by the Ministry of Environment.

This Committee was in charge of elaborating, implementing, monitoring, and evaluating the National Plan for Climate Change (Speranza et al., 2017: 11-12). The NAFC objective was to manage climate change action and sector policies with other administrative levels (especially at the state level) and make technical recommendations to promote federative harmonization in selected themes. A representative of the Ministry of Environment at a webinar organized by the

⁸¹ Both Legal Amazon Governors' Forum and Council were present at the interviews as important national elements regarding climate change at the subnational level.

Brazilian Climate Center (CBC) and the Brazilian Forum on Climate Change (FBMC) about subnational climate ambition on December 17th, 2020⁸² considered the NAFC the unique initiative of climate federalism in Brazil.

The NAFC had three working groups⁸³:

i) The inventory working group coordinated by the Ministry of Science, Technology, and Innovation and the State of São Paulo;

ii) The emissions report working group, coordinated by the Ministry of Economy and the State of Rio de Janeiro; and

iii) The adaptation working group, which had the support of Amazonas, Ceará, Espírito Santo, Paraná, São Paulo, Minas Gerais, Goiás and Tocantins states to develop the National Adaptation Plan.

Although Brose (2019: 99) points out that the NAFC worked till 2015, there is evidence of its functioning till 2014, with reports of three meetings – one on February 21st, 2013, the second on September 25th, 2013, and the third on February 19th, 2014. The adaptation working group had two meetings: May 13th, 2014, and September 11-12, 2014. The reports mention the elaboration of a study about the harmonization of public policies for climate change, the organization of four workshops about measurement, reporting, and verification (MRV), the articulation of subnational units around the plans of deforestation combat and REDD+, and the difficulty to make a convergence of states policies because of the different registry systems. However, the Ministry of Science, Technology, and Innovation (MCTI in Portuguese) mentioned the possibility of data disaggregation to understand states activities' impacts on national inventory. SIRENE, the National Emissions Registry System, made available in 2016, now presents data for agriculture, livestock, and LULUCF⁸⁴ divided by federative units.

⁸² Available at <https://www.youtube.com/watch?v=hFDSA-CiPjs>. Access on April 21st, 2021.

⁸³ See <https://antigo.mma.gov.br/clima/grupo-executivo-sobre-mudanca-do-clima/grupo-executivo-sobre-mudan%C3%A7as-clim%C3%A1ticas/item/9109> and <https://antigo.mma.gov.br/clima/grupo-executivo-sobre-mudanca-do-clima/grupo-executivo-sobre-mudan%C3%A7as-clim%C3%A1ticas/item/10102.html>. Access on April 21st, 2021.

⁸⁴ See https://sirene.mctic.gov.br/porta1/openccms/paineis/2018/08/24/Emissao_por_Unidade_Federativa.html. Access on April 21st, 2021.

The NAFC, however, was unable to help design a unified strategy for climate action. In 2014, when Brazil refused to sign the New York Declaration on Forests, Acre, Amapá, and Amazonas became endorsers⁸⁵, showing evidence that the previous conflict between the levels regarding the international standing on forests was back. Cooperative climate federalism seems to be strongly related to the national GHG emissions profile – land use, land-use change, and forests. At the same time, paradiplomacy in this regard appears to be more conflictive.

In 2015, Decree n. 8,576 established the National Commission for the Reduction of Greenhouse Gas Emissions from Deforestation and Forest Degradation, Conservation of Forest Carbon Stocks, Sustainable Management of Forests and Increase in Forest Carbon Stocks (CONAREDD+). Subnational states were invited to be part of the commission, and the Brazilian Association of State Environmental Entities (Abema) was entitled to appoint two representatives and their substitutes (article 2). In its first extraordinary meeting⁸⁶, the commission defined three thematic consultative chambers, one of which had the mandate to address the relationship between subnational governments and the federal government (federative pact). The Thematic Consultative Chamber on the Federative Pact (CCT-Pact) had 17 subnational governments' participation and eight meetings from 2016 to 2018. It can be considered an initiative of policy coordination among the federal government and subnational units in climate federalism.

d) Brazil as climate negligent with deeper conservative dynamics and growing activism at the subnational level (2017 on)

Since 2017, there has been a decrease in governance processes at the subnational level, with plans and programs creation and implementation. Since 2019, however, there has been growing activism at the subnational level, bottom-

⁸⁵ See <https://forestdeclaration.org/about/nydf-endorsers>. Access on May 31st, 2021.

⁸⁶ See http://redd.mma.gov.br/images/publicacoes/conaredd_1e_ata.pdf, http://redd.mma.gov.br/images/publicacoes/conaredd_2o_membroscts.pdf and http://redd.mma.gov.br/images/conaredd/conaredd_ata_reuniao2.pdf. Access on March 9th, 2022.

up pressure on the federal government, and international engagement to compensate for the national conservative trend that has gained momentum with Bolsonaro's government.

The Brazilian Association of State Environmental Entities (Abema) established a Climate Technical Chamber in 2019 in its 89th ordinary meeting to assist subnational governments at the Brazilian Conference on Climate Change. The Brazilian Conference on Climate Change happened on 6-8 November 2019 at the city of Recife, Pernambuco State. The 26 states and the Federal District signed the "Letter from the state environmental agencies for climate"⁸⁷, which, according to Abema, demonstrates multi-level action and the strategic role subnational governments have in the Paris Agreement. This document was taken to COP 25 at Madrid in the same year.

The Brazilian Conference on Climate Change website and Instituto Ethos⁸⁸ information about the event highlighted the uncertainty of the national context and many drawbacks in national climate policy (e.g., the possibility of withdrawal from the Paris Agreement and dismantling of environmental laws). The position to uphold the conference was opposition by civil society organizations, social movements, indigenous peoples, private organizations, subnational governments, and scholars to the Brazilian federal government, which withdrew its commitment to host COP 25.

The following entities co-realized the conference: the Brazilian Climate Center (CBC), Dieese, FAS, FGV-EAESP, IPAM Amazônia, ICLEI, Ethos Institute, Saúde & Alegria (environmental non-governmental organization), UN Global Compact – Brazilian Network, WWF, Pernambuco state and Recife municipality. There was support from Anglo American, Cultural Center Brazil-Germany (CCBA in Portuguese), Climate and Society Institute, BYD, MRV, and Neoenergia. Other partners were: Accenture, Black Jaguar Foundation, Conexsus Environmental Connections Institute, Pernambuco Handicrafts, Delibera, Porto Digital State Technical School (ETE in Portuguese), Avina Foundation, Amazonia Conservation and the Sustainable Development Institute

⁸⁷ See <https://www.abema.org.br/noticias/258-conferencia-brasileira-de-mudanca-do-clima-6-a-8-11-2019-recife-pe>. Access on September 20th, 2020.

⁸⁸ See <https://en.climabrasil.org.br/contexto> and the above note. Access on October 4th, 2020.

(Idesam in Portuguese), the Amazonian Men and Environment Institute (Imazon in Portuguese), Alzirias Institute, Paço Alfândega, and Paço do Frevo, Porto Digital, Sinspire, SulAmérica, Talanoa Solutions, and Tembeci.⁸⁹

The conference was an opportunity to stress Brazilian commitment to climate change mitigation and adaptation by promoting dialogue between all kinds of stakeholders – non-governmental and civil society organizations, social movements, traditional communities and peoples' associations, subnational governments, the scientific community, public institutions, and public and private companies – and their commitment with the Brazilian NDC implementation, despite the federal government's setback.⁹⁰

The Letter from the state environmental agencies for climate phrases that multi-level governance, with actions from local to global, is necessary to tackle climate change. Subnational governments should recognize their strategic role in promoting adaptation to climate events and adopting a low carbon development model, which comprises the reduction of GEE emissions, job creation, natural resources conservation, inequality reduction, and the expansion of social progress, with attention to populations in a vulnerable situation.

The Letter refers to the 2030 agenda and the Paris Agreement. It stresses dialogue with other federated units while subnational governments are incorporated into the cooperation trajectory and global efforts. The document has 17 points that cover subnational governments' contributions to fulfill Brazilian NDC commitment, governance processes at the state level, the implementation of the Forest Code, efforts to curb illegal deforestation, the development of carbon market, transportation, energy, education, and low carbon infrastructure in the industry sector.

After the conference, members approved the Chamber's continuation to evaluate subnational governments' role in implementing the climate agenda and search for mechanisms to foster building and implementing climate policy at their level (Abema and GIZ, 2020: 9). The Chamber is currently presided by the Executive Secretariat of the State Secretariat for Environment of Pernambuco

⁸⁹ See <https://www.climabrasil.org.br/primeiraedicao>. Access on October 4th, 2020.

⁹⁰ See <https://www.ethos.org.br/conteudo/projetos/mudanca-do-clima/conferencia-brasileira-de-mudanca-do-clima/>. Access on October 4th, 2020.

and has developed a plan of action organized in three dimensions: i) knowledge building; ii) applying knowledge; iii) monitoring, disclosure, and evaluation. The first phase started in 2019. It collected information to a Strategic Partnerships for the Implementation of the Paris Agreement (SPIPA) study about the competence of subnational actors in responding to the Brazilian NDC and climate policy implementation in each subnational state.

In 2019, Decree n. 10.144 altered the CONAREDD+ composition. There is now one representative of subnational governments, which has to be a public servant from state environmental entities. A draw defines the representation among nominated options. The commission's new composition did not reestablish the CCT-Pact. Hochstetler (2021) characterizes the period from 2011 to 2018 as marked by backward steps from the federal government, followed by resistance from non-state actors and historically climate-focused institutions. Subnational and federal governments' dynamic for REDD+ is a piece of evidence of this assertion.

Finally, on October 29th, 2020, the Brazilian Climate Center (CBC in Portuguese), with the support of the Climate and Society Institute and the European Union SPIPA project, organized the First International Governors Meeting for the Climate⁹¹, in which the Governor's Council for Climate was launched. The event was wholly online due to the COVID-19 pandemic. The Council is expected to be a "supra party" arena for cooperation and proposition of actions. This discourse suits the Brazilian current political polarization and conflict between federated units and the federal government in some issues (e.g., measures to combat the COVID-19 pandemic, climate change, and deforestation).

The Governors for Climate Agreement Letter was signed by ten states till November 2020: Amapá, Distrito Federal, Espírito Santo, Maranhão, Piauí, Pernambuco, Pará, Rio Grande do Norte, Rio Grande do Sul, and São Paulo. It states that the initiative is a "nonpartisan coalition combining ideas, capabilities, and knowledge to confront this potent threat" and presents broad ideas for action

⁹¹ The event recording is available at <https://youtu.be/Y43KgH9ULws>. Access on June 4th, 2021.

regarding energy transition, reforestation, sanitation, bioeconomics, recycling, and low carbon agriculture.

4.4 The Subnational Climate Commitment Index: results for Brazil's 27 subnational units

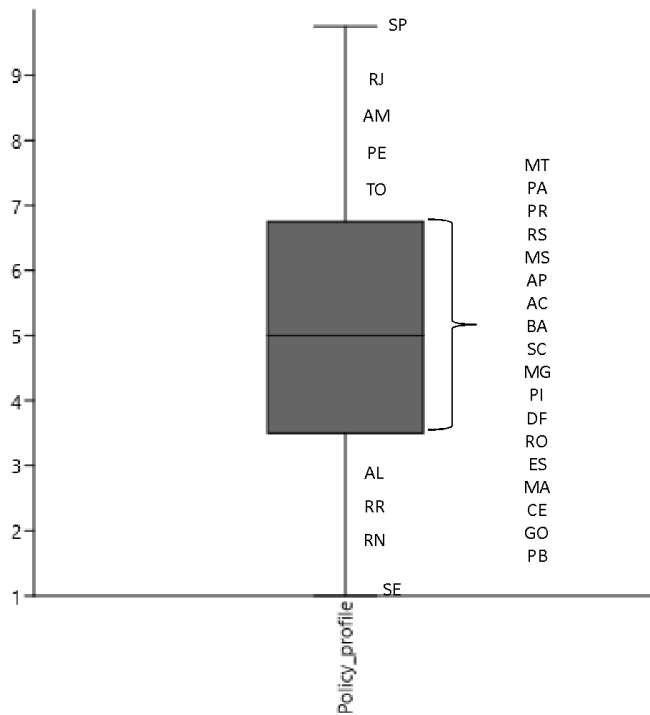
This section is a step forward in describing the 27 Brazilian subnational units' climate commitment through the Subnational Climate Commitment Index (SCCI), presented in Chapter 3. It covers the period from 2010 to 2018, in which subnational units' engagement in global climate governance through paradiplomacy gained a more conflictive than cooperative profile within climate federalism. Statistical description and the principal component analysis are the means to present the SCCI results.

4.4.1 Policy Profile

None of the Brazilian subnational units had the lowest (no governance process found) or the highest (all governance processes in place) scores. According to Table 18, Sergipe had the lowest record among the subnational units (1, due to a specific bureaucratic structure), and São Paulo had the highest (9.5, since it has no new bills on the issue). Hochstetler and Keck (2007) point out that the climate agenda in São Paulo saw an improvement during the 2000s. Also, the state environmental agencies have a substantial capacity (state bureaucracy), there is an expressive number of environmental activists (social movements agency) and environmental innovations taking place in the territory, as the efforts to curb pollution from transportation.

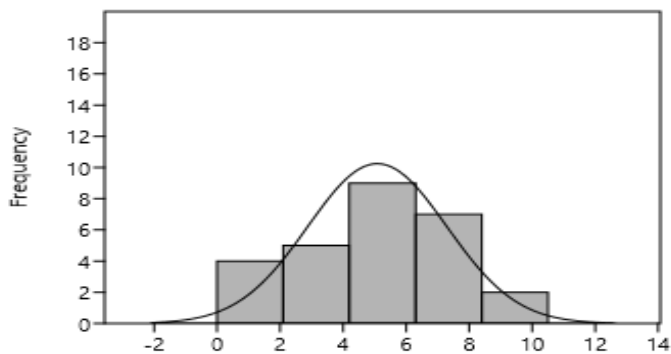
As presented in Graph 13, the scores mean and the median is 5. The scores distribution is close to a normal distribution (see Graph 14), the 25th percentile is 3.5, and the 75th percentile is 6.75, with 18 subnational units in this interval.

Graph 13 – Policy profile (PP) boxplot



Source: Author's elaboration using Past 4.06 (Hammer et al., 2001).

Graph 14 - Policy Profile (PP) histogram



Source: Author elaboration using Past 4.06 (Hammer et al., 2001).

Sergipe is the federated unit with the least available information, which explains why this subnational unit has the lowest score. It was necessary to make a formal request through the Right to Information Law (LAI). The answer reports

that there is a project to establish a state policy with a specific fund, a participatory forum, and goals to mitigate climate change. In April 2019, the state bureaucracy developed a report and delivered it to the State Public Ministry of Accounts, which surveyed both the state and its capital – the city of Aracaju (the survey was based on the Brazilian national law for climate change⁹²). The report, however, is not publicly available on the State Secretariat for Urban Development and Sustainability website.

Based on the results plotted in a histogram (Graph 14), if the subnational units were divided into four categories⁹³ of policy commitment, from low to a very high policy commitment, 21 subnational units would be a low to intermediary policy commitment (see Graph 15). The division of units into categories considered the range of the results (8.75), the number of categories (4), and the height between the categories (2.2).

According to Inoue's (2016: 93) definition of governance processes as the making of institutions and policies to answer to a problem, I built a timeline for subnational units' policy processes for climate change (Graph 16), considering some elements of the domestic policy profile: bills, laws and decrees and their modifications, state policies and GHG inventories year of publication and succeeding new editions; participatory forum year of establishment and eventual alterations; funds and plan/programs years of establishment.

There was a concentration of domestic governance processes at the subnational level in 2009 and 2010, the years of COP 15 at Copenhagen and the National Law on Climate Change (Law n. 12,187/2009) at the national level. Nine subnational units published climate change laws during this period, and seven subnational units established state policies, plans, or programs. One federated unit published a bill, and two a decree and GHG inventories. Seven subnational units established a participatory forum, while four established a specific fund or designated an existing one to the issue.

⁹² See <https://cnpqc.org.br/?p=3717>. Access on August 23rd, 2020.

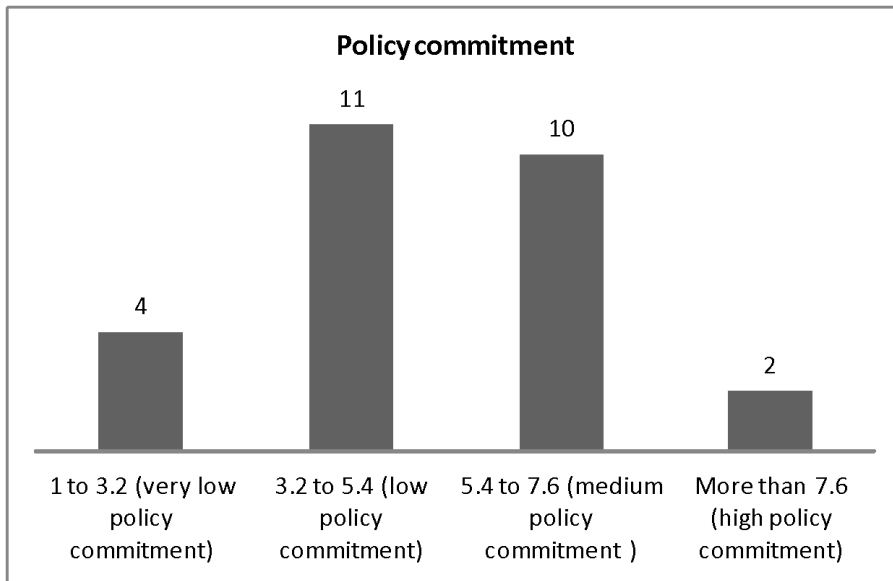
⁹³ The number of categories can be calculated according to Sturge's rule, resulting in 5 categories. I made the distribution into five categories (very low (n=4), low (n=7), medium n=8), high (n=3), and very high (n=5)) of policy commitment, but this classification did not match very well the reality of the Brazilian context as presented in Chapter 3. For that reason, I chose four categories as presented in Graph 14).

Table 18 – Policy Profile (PP) results

Federated Unit	Policy Profile
SP	9,75
RJ	9,00
AM	7,50
PE	7,50
TO	7,50
MT	6,75
PA	6,75
PR	6,50
RS	6,50
MS	6,00
AP	5,75
AC	5,50
BA	5,00
SC	5,00
MG	4,50
PI	4,50
DF	4,25
RO	4,25
ES	4,00
MA	3,75
CE	3,50
GO	3,50
PB	3,50
AL	2,00
RR	2,00
RN	1,50
SE	1,00

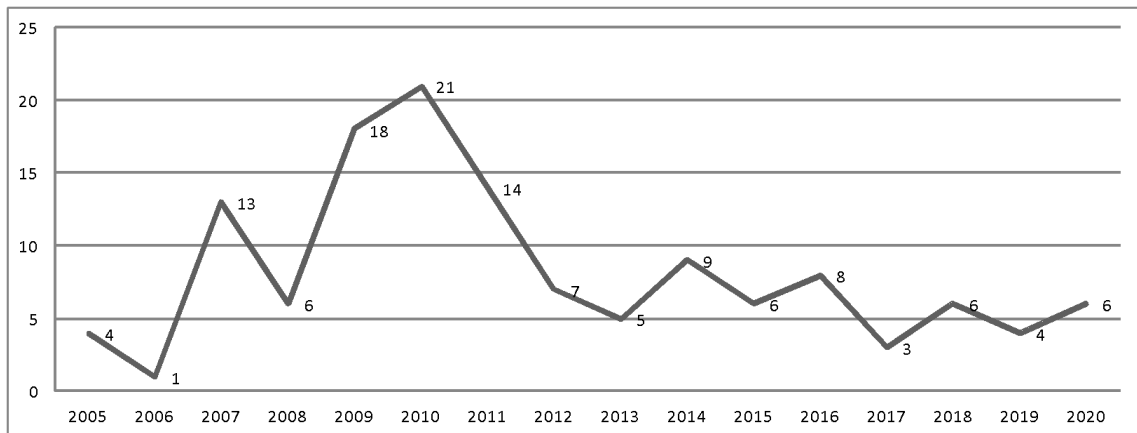
Source: Author's elaboration.

Graph 15 – Subnational units' policy profile categorized by policy commitment



Source: Author's elaboration.

Graph 16 – Quantity of domestic governance processes at the Brazilian subnational level by year



Source: Author's elaboration.

Romeiro and Parente (2011: 54) consider that, in 2011, the timeline of policy development between federal and local governments was evidence of a lack of convergence between levels. They use the case of São Paulo as an example since municipal and state legislation were elaborated before the national law. Brose (2019) also points out that the development of national climate policies, projects, and plans lacked coordination domestically.

Nevertheless, the development of governance processes is not expressed solely by the publication of a law or decree, which are, in fact, the result of more prolonged and broader processes. Therefore, there seems to be a slight convergence between sub-state and national dynamics regarding governance processes, even if they lack coordination.

From 2005 to 2011, 19 subnational units established a participatory forum about climate change. Most of the governance processes from 2005 to 2009 were related to the establishment of participatory fora (18 in total). The objective of these fora was to create an environment of cooperation among all stakeholders – government, private actors, and civil society – and between levels of government, to support the creation of state laws, plans, and projects, to support research about climate change and to obtain financial resources to back actions. This was the case of the Mato Grosso state forum, which was part of the development of REDD+ and climate change state laws, a long process of debate and negotiation till its publication in 2013 and 2017, respectively. The forum is still working as of today.

After this first push to create participatory arenas, most of the fora interrupted their activities. According to Speranza et al. (2017), the fora that remained active did so because of social capital in the territories and not because of incentives from the federal government or the Brazilian Forum on Climate Change (FBMC). From 2012 on, the activities related to these governance processes were to resume activities and update its name and composition. Interestingly, when established, five of these fora had a similar name, which embodied climate change and biodiversity. Activities were then interrupted, and when they were resumed, the names were usually updated with the elimination of the reference to biodiversity.

From 2009 to 2012, most governance processes related to creating laws, state policies (all 19 created by law), programs, and plans. The first state to create a specific law regarding climate change was Amazonas, while at Pará, the proposed bill in 2009 became law only in 2020. From 2005 to 2020, 21 subnational units created at least one law regarding climate change, with a peak in 2010, with six new laws in different states (Acre, Amapá, Pernambuco, Espírito Santo, Rio de Janeiro, and Rio Grande do Sul).

There are more subnational laws than decrees to tackle climate change at the subnational level. The executive power has engaged with 22 different plans or programs in 16 subnational units, including those related to curbing deforestation or the burning of Cerrado and Amazon biomes. Specifically about the deforestation plans, the establishment of a national plan about the deforestation of the Amazon biome – the PPCDAM – was an impulse to the creation of related state plans at the subnational level,⁹⁴ latter enforced by the rules of the Amazonia Fund, which made the state plan a condition to receive financial resources.

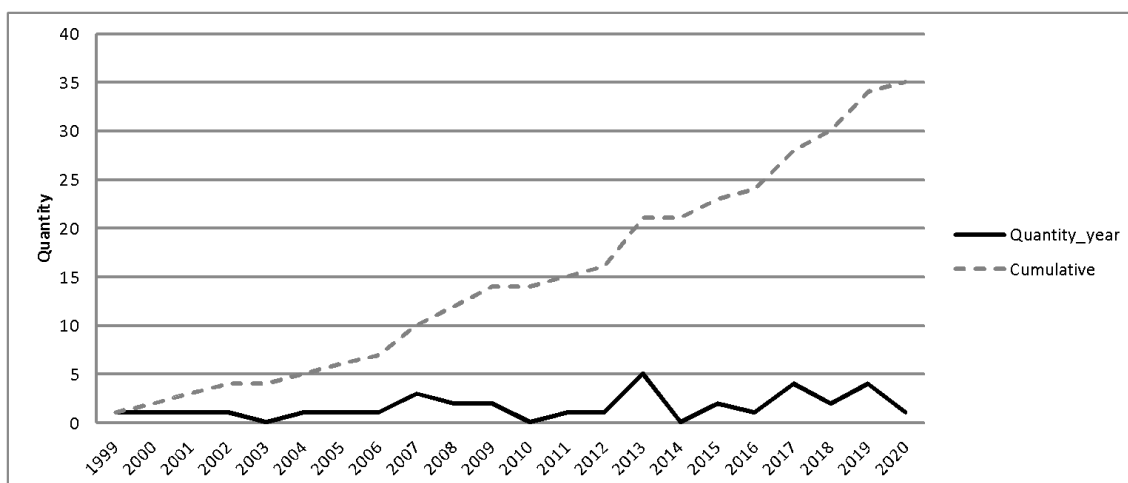
In fact, from 2015 on, most activities were related to creating plans and programs. The Brazilian subnational states' processes seem to follow the public policy cycle (Gueiros et al. 2021: 5), which embodies stakeholders consultation, the proposition of bills, creation of laws and state policies, the implementation of the laws and policies through plans and programs, and the evaluation of results. Therefore, it can be expected that a period of maturation or implementation would follow after the boom of laws and state policies.

The Grantham Research Institute on Climate Change and the Environment and the Sabin Center for Climate Change Law (2021) database of national laws about climate change (or related sectors, like energy, environmental education, forests, etc.) from 198 countries embodies executive and legislative motivated laws, decrees, plans, programs, orders, and ordinances. From 1947 (a Japanese disaster relief act) till March 2021, there were 2,118 laws and policies related to climate change (with three without specific year mentioned). The number by year increases from 1990 on, reaching peaks in 2009, 2013, and 2015, when a downward trend begins.

Data for Brazil (Graph 17) shows a different picture. The peak was in 2013, due to the publication of the sector plans (agriculture, industrial, mining, transportation, and health) established by the national climate law. Also, differently from the subnational level, half of the norms at the national level are from the executive power (decrees and plans), and the other half from the legislative.

⁹⁴Some of the interviews listed in Chapter 5 endorsed this information.

Graph 17 – Quantity of laws and policies in Brazil for climate change



Source: Grantham Research Institute on Climate Change and the Environment and Sabin Center for Climate Change Law (2021)

The Climate and Society Institute searched for keywords related to climate change in bills from 2015 to 2019 on subnational parliaments' websites and found out that most legislatures' bills use the keywords 'environment', 'sustainability,' and 'solar.' However, not a single bill in the subnational units assessed referred to the Paris Agreement in the last four years. This result enforces the findings for subnational units' policy profile that from 2015 to 2020, the number of governance processes remained steady, mostly related to the establishment of plans and programs and maturation or implementation of previous processes, with no visible direct impact by the Paris Agreement.

The evaluation of the legislative subnational action for climate change presented by the Climate and Society Institute had the following best positions: Espírito Santo (first), Minas Gerais (second), São Paulo (third), Santa Catarina and Mato Grosso do Sul (fourth) and Piauí and Paraíba (fifth). Pará is in the last position due to the non-operation of the parliamentary website⁹⁵.

Therefore, the hypothesis of norm diffusion and experimentation regarding the number of domestic processes does not seem to apply to the Brazilian subnational units. Therefore, it is necessary to look beyond the prevalence of processes and search for their qualitative characteristics, such as scaling down

⁹⁵ I also faced the difficulty of finding information for the policy profile of Pará. The state bureaucracy, though, answered my questions for data by e-mail.

and entrenchment (borrowed from Van der Ven et al., 2017) to understand better how this dynamic operates. The Climate and Society Institute results also show that if diffusion and experimentation are still happening today at the subnational legislative branches, it is in a more "theme diffused" way, not specifically related to climate change as the central issue. However, as has happened at the national level, maybe subnational legislative powers have considered that the theme is already addressed in terms of laws. For example, the case of PPCDAm, described in the interviews, may offer a clue.

Ten Brazilian Governors and Vice Governors⁹⁶ attended the First International Governors Meeting for the Climate on October 29th, 2020, either live or with a video record. In my analysis, four of the ten authorities had a more profound knowledge of the issue – São Paulo, Pernambuco, Espírito Santo, and Rio Grande do Sul – and cited state laws. The rest of them made broad statements and did not mention most of the governance processes in their territory. This absence is pertinent regarding the state laws since it can mean that the law was unknown or not considered relevant.

Regarding GHG inventories, ten subnational units have elaborated at least one inventory. The first federated unit was Rio Grande do Sul (with the support of the French Environment and Energy Management Agency, according to Brose (2019), and Pernambuco was the last among them to publish it, in 2019, at the Brazilian Conference on Climate Change. Rio de Janeiro and Paraná are the federated units that have produced more inventories – two each of them. In the case of Rio de Janeiro, there is evidence of a third GHG emissions inventory based on Conceição (2017) and Rio de Janeiro (2017), published in 2007, but it was not possible to find it.

The year 2012 is the base year considered by most federated units – Acre, Distrito Federal, and Paraná. The other federated units with inventories range

⁹⁶ Renato Casa Grande, Governor of Espírito Santo; João Doria, Governor of São Paulo; Hélder Barbalho, Governor of Pará; Wanderlei Barbosa Castro, Vice Governor of Tocantins; Marcos Vinicius Britto, Vice Governor of Distrito Federal; Flávio Dino, Governor of Maranhão; Paul Câmara, Governor of Pernambuco; Wellington Dias, Governor of Piauí; Fátima Bezerra, Governor of Rio Grande do Norte; and Eduardo Leite, Governor of Rio Grande do Sul.

from 2005 to 2008. Most federated units' inventories were published after the first national communication (Table 19).

Table 19 - List of GHG emissions inventories by federated unit, year of publication, and base year

Federated unit	Year of publication	Base year
Acre	2014	2012
Bahia	2010	2008
Espírito Santo	2013	2006
Minas Gerais	2008	2005
Rio de Janeiro	2007 2015	* 2015
São Paulo	2011	1990 1994 2000 2005 2008
Distrito Federal	2014	2012
Paraná	no date** 2014	2005 2012
Rio Grande do Sul	2005	2005

Source: Conceição (2017), Rio de Janeiro (2017), and author's research.

* It was not possible to find this document. The reference is in Conceição (2017).

** This document does not have a publication year available. 2009 is the last year mentioned with actions necessary to produce the inventory.

Twelve subnational units have a specific fund to support climate change mitigation and adaptation actions, but it was not possible to assess the number of resources they have received and applied so far. Five subnational units have established a target for GHG emissions reduction either by law or decree (see Table 20), but only one was able to reach it. Four of the targets are for global reduction of emissions. One is based on GHG intensity in GDP, and four have 2020 as the target year and 2005 as the base year⁹⁷.

⁹⁷ None of these targets were recognized in the New Climate Institute et al. (2021: 21) report of global climate action as an emissions reduction commitment since the report only considers post-2020 targets.

Table 20 – Subnational units’ GHG emissions reduction targets

Subnational unit	Target	Data in base year	Data in 2018	Target analysis
PB	Global reduction of 36,1% to 38,9% of projected emissions in 2020.	--	13.8 Mton CO _{2e}	The subnational unit does not have any inventories, nor was it possible to find projected emissions estimative. GHG emissions have increased 123% from 1990 to 2018, with higher levels between 2016 and 2018, making it less likely to achieve the target.
RJ	The carbon intensity (tCO _{2e} /GDP) in 2030 shall be inferior to the 2005 level.	--	0.2 ton CO _{2e} /US\$ 1,000	It was not possible to find GDP information for 2005. From 2010 to 2018, carbon intensity in Rio de Janeiro's economy decreased by 0.32%, a very slight decarbonization path. However, it is not possible to assess if the target will be met.
RS	Reduce total emissions at the state level, proportional to what is established at the national level, relative to the contribution of the State of Rio Grande do Sul in the national calculation for projected greenhouse gas emissions by 2020	95.2 Mton CO _{2e}	92.6 Mton CO _{2e}	By 2018, the subnational unit had a reduction of 2.73%, very far from the stated target to 2020. To reach the target, there would have to be a reduction of at least 32.6 Mton CO _{2e} from 2018 to 2020.
SP	Global reduction of CO ₂ emissions of 20% in 2020 with 2005 as the base year	139.3 Mton CO _{2e}	147.4 Mton CO _{2e}	There was an increase of 4.5% in GHG emissions from 2005 to 2018. To reach the target, the subnational unit has to attain 111.4 Mton CO _{2e} , meaning a reduction of 24.4% from 2018 to 2020.
MS	Global reduction of CO ₂ emissions of 20% in 2020 with 2005 as the base year	103.8 Mton CO _{2e}	71.65 Mton CO _{2e}	The subnational unit has reduced GHG emissions by almost 31% between 2005 and 2018. Therefore, it has reached its target before the deadline.

Source: Author's elaboration.

Some subnational units have committed to GHG emissions reduction targets due to their association with transnational networks, like the Under 2 Coalition, which can be very ambitious (a general commitment of 80-95% reduction till 2050 according to 1990 levels). In the case of the Under2 Coalition, most Brazilian subnational units that have signed the memorandum of understanding have

presented measures and plans already considered in the policy profile and have not specified new targets measured in emissions reductions.

Specifically, in the case of Mato Grosso, some interviews have mentioned a target for GHG emissions at the PCI Strategy. A search of the strategy website⁹⁸ resulted in targets for activities related to GHG emissions, but no official measure of GHG emissions reduction of base/target year. It only mentions a potential reduction of 6 GtonCO_{2e} due to deforestation control and a low carbon economy development. For that reason, the SCCI policy profile calculation for Mato Grosso did not consider it.

More than half of the subnational units (17) have a specific bureaucratic body to work with climate change. It is noteworthy that São Paulo's Secretary of Infrastructure and Environment hosts the Brazilian Climate Change Forum (Fórum Brasileiro de Mudança do Clima - FBMC).

Regarding paradiplomacy processes, four subnational units have at least one action registered at Nazca Platform (Amapá, Tocantins, Rio de Janeiro, and São Paulo), and 12 are part of at least one transnational network. The Governors' Climate and Forest Task Force (CGF-TF) is the network with the highest adhesion – 9 subnational units, followed by Under 2 Coalition (8 subnational units) and the R20 (5 subnational units). Only São Paulo is a member of Regions 4. Most of the transnational networks are public, with capacity building and implementation as the main functions.

The results in the paradiplomacy dimension show the fragmentation found in the overall transnational networks picture: participation at GFC-TF was not reported at GCAP. At the same time, the task force is present as a GCAP initiative, just like Regions Adapt (Regions 4) and Under 2 Coalition. However, there was some conflictive information about subnational units' participation in the networks.

Rio de Janeiro had contradictory information: at Nazca Platform, it informs that it is part of Under 2 Coalition, while the answer disclosed by state bureaucracy by the right to information law request only mentions participation at Regions 4. However, these initiatives' websites do not list the federated unit

⁹⁸ See <http://pci.mt.gov.br/>. Access on March 7th, 2021.

among signatories or endorsers. Therefore, participation in both initiatives was not considered.

Goiás was listed as a member of the former NRG4SD (now Regions 4) but not as a REGIONS4 member on the network's official website. So far, I have not found information about what happened during the transition, and the policy profile did not consider its participation. A similar situation of reported participation at transnational networks happened with Roraima, Ceará, Minas Gerais, Paraná, and Rio Grande do Sul, which mentioned participation at REGIONS4 at the Nazca Platform (GCAP). However, the network's official website does not mention the federated units. One possible explanation for these discrepancies is that some of the registries at Nazca Platform were not done by the subnational actors but incorporated from some other existing data platforms, like ICLEI and the Carbon Disclosure Project – CDP (Chan et al., 2016: 244).

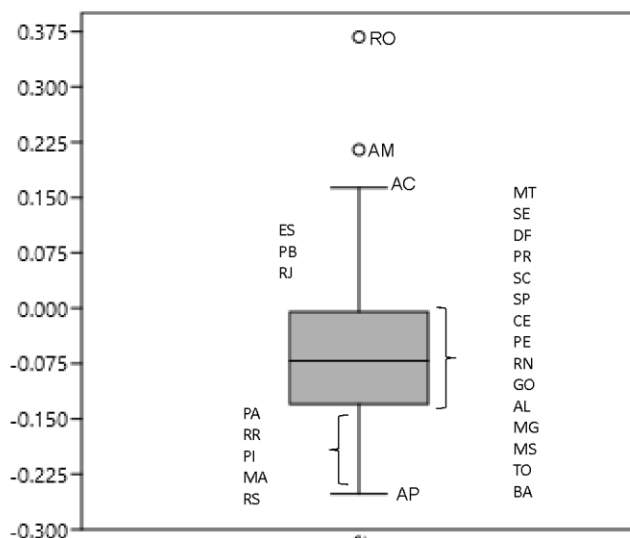
4.4.2 Emissions profile (EP)

The Emissions Profile (EP) results are presented on a scale in which the highest result means the more carbon-intensive profile. Rondônia and Amazonas are outliers among the Brazilian 27 subnational units (see Graph 18). Rondônia had the highest average GHG emissions geometric growth rate in the period 2010 to 2018 for GHG emissions (11%) GHG emissions per capita (9%), and average linear growth rate for GHG emissions intensity in GDP (90%). Amazonas had a geometric average growth of GHG emissions of 6% and GHG emissions per capita of 4%, and an average linear growth rate of GHG emissions intensity in GDP of 55%.

Both Rondônia and Amazonas have their GHG emissions directly linked with land-use change and forests – an average of 72% of total emissions for Rondônia and 81% for Amazonas from 2010 to 2018. The outliers' results can distort the analysis. However, considering their emissions profile, subnational units' absolute weight in the national emissions profile, and the recent increase in

deforestation and forest fires rates in Brazil, their results will be considered in the analysis⁹⁹.

Graph 18 – Emissions profile (EP) boxplot



Source: Author's elaboration based on SEEG data, World Bank (2020), and IBGE (2020) using Past 4.06 (Hammer et al., 2001).

The data for the 27 subnational units has a mean of -0.045 and a median of -0.071 , which means a general trend toward a less carbon-intensive profile. The 25th percentile is -0.13 , and the 75th percentile is -0.05 . Fifteen subnational units are between this interval. Consequently, the histogram (Graph 19) shows a distribution skewed to the left, showing a concentration of subnational units in less carbon-intensive profiles.

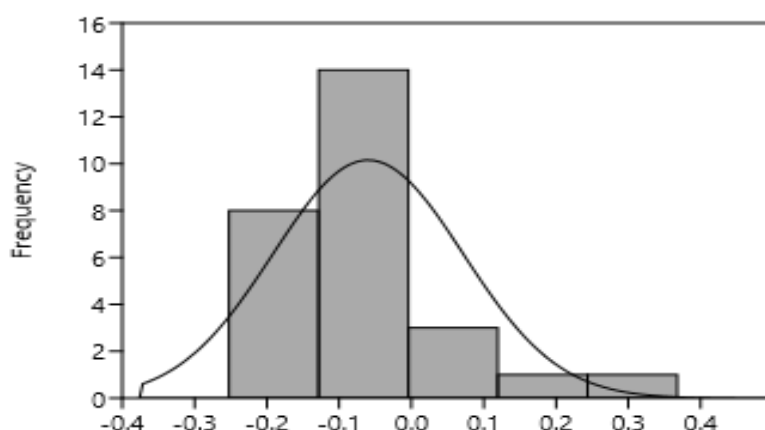
Acre has the third place, with a geometric average growth of GHG emissions of 6% and *per capita* emissions of 4%, and a linear average growth of GHG emissions intensity in GDP of 39%. GHG emissions at this subnational unit are mostly related to land-use change and forests. Surprisingly, Espírito Santo has a fourth place, mainly due to its high total GHG emissions intensity in GDP. The subnational unit emissions profile presented in SEEG shows that energy and

⁹⁹ Analysis without the outliers has a mean of -0.07 , a median of -0.08 , the 25th percentile of -0.14 , and a 75th percentile of -0.007 . However, the number of subnational units between this interval remains the same, with different positions in the ranking (from Distrito Federal to Roraima, according to the rank presented in Graph 18).

industrial processes have the most significant share in Espírito Santo's total emissions during the period from 2010 to 2018 (average of 77% for the two sectors), with a decreasing share of agriculture and livestock¹⁰⁰ from 20% to 15% in the same period.

Amapá had the least intensive average emission profile in the period in a decarbonizing trend and is the Brazilian subnational unit with the lowest GHG emissions in all years covered (an average of 4,5 Mton CO_{2e} emitted per year). Distrito Federal was the subnational unit with the least carbon-intensive EP by year (see Table 22) but had an upward trend in its results, which means that this subnational unit is going through a carbonizing path, with a slight decrease between 2017 and 2018.

Graph 19 – Emissions profile (EP) histogram

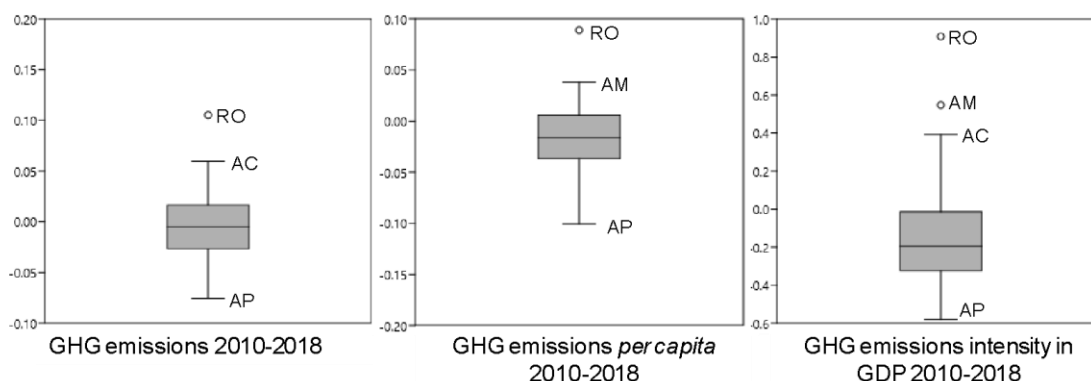


Source: Author's elaboration based on SEEG data, World Bank (2020), and IBGE (2020) using Past 4.06 (Hammer et al., 2001).

According to Graph 19, it is possible to notice that Rondônia was an outlier in all three of the emissions profile variables, while Amazonas was an outlier in GHG emissions intensity in GDP. The quantity of subnational units between the 25th and 75th percentiles for each variable is: 15 in total GHG emissions and GHG emissions intensity in GDP, and 16 in GHG *per capita*.

¹⁰⁰ See http://plataforma.seeg.eco.br/total_emission. Access on February 17th, 2020.

Graph 20 – Box plot for average GHG emissions, GHG emissions per capita, and GHG intensity in GDP for 27 Brazilian subnational units from 2010 to 2018



Source: Author's elaboration based on SEEG data, World Bank (2020), and IBGE (2020) using Past 4.06 (Hammer et al., 2001).

Graph 20 shows the three variables' different results. It is possible to notice that GHG emissions intensity in GDP shows different units' positions. Five subnational units¹⁰¹ have a more carbon-intensive profile regarding the GHG emissions intensity per unit of GDP (in tons of CO_{2e}/US\$ 1,000), but all the 15 subnational units (more than half) between the 25th and 75th percentiles are in a decarbonizing trend (negative results). For total GHG emissions and GHG emissions per capita, there are five and one subnational¹⁰² units respectively between the 25th and 75th percentile with carbonizing trends (positive results).

The understanding of GHG emissions intensity in GDP results has one limitation: the behavior in a specific period may be subject to other influences related specifically to the economic activity and not necessarily to climate commitment, like productivity or low economic activity due to crisis, illegal activities, like illegal deforestation, which increases GHG emissions but have no economic impact on the GDP. These elements, however, are beyond the model here presented and should be considered in a qualitative analysis of the results.

¹⁰¹ Rondônia, Amazonas, Acre, Espírito Santo, and Sergipe.

¹⁰² For total GHG emissions the subnational units are Paraná, Santa Catarina, Distrito Federal, Rio Grande do Sul and Ceará. Paraná is the subnational unit at the interval with a carbonizing trend for GHG emissions per capita.

The EP results¹⁰³ by year (Table 22) show that Pará had the more carbon-intensive profile in 2010, followed by Mato Grosso from 2011 to 2015 and in 2017, and Rondônia in 2016 and 2018. Even if Rondônia had the highest score in just two years during the period evaluated, it has a carbonizing GHG emissions trajectory (77% increase in EP profile from 2010 to 2018) compared to Pará and Mato Grosso. These last two subnational units started with higher absolute numbers, but their trajectory was of a smaller carbonizing path for Mato Grosso (8% average between EP results in 2010 and 2018) and a decarbonization for Pará (-29% average of EP results in the same period). In 2018, both Pará and Mato Grosso had a smaller EP than Rondônia.

Rondônia, however, has a small share in Brazilian total GHG emissions (5%), in the population (0,8%) and GDP (0,6%), and the comparison with other Brazilian subnational units demonstrates its smaller weight. Pará and Mato Grosso are the two subnational units with higher GHG emissions in Brazil and, therefore, have higher impacts on the Brazilian emissions profile and in absolute - independent measurement (Table 21).

It is relevant to stress that, although both Pará and Mato Grosso have a better EP result than Rondônia, the measurement unit of the EP is an average rate of emissions profile in a specific period (measured in percentage points) and not an absolute measurement. For that reason, the results need a parsimonious reading bearing in mind the absolute weight of the subnational unit in a given dimension – either national or international (in the case of comparison between subnational units of different countries).

Table 21 – Subnational units share in Brazilian measures in 2018 in percentage (%)

Federated unit	Total GHG emissions	Population	GDP
Rondônia	7	1	1
Mato Grosso	12	2	2
Pará	13	4	2
São Paulo	8	22	32

Source: Author's elaboration based on SEEG data, World Bank (2020), and IBGE (2020).

¹⁰³ The EP results by year are the result of Equation 1 with the absolute values for each variable in the given year from 2010 to 2010 with adjustment (Equation 4).

São Paulo, for example, has the twelfth more carbon-intensive profile among Brazilian subnational units, with a trend of carbonization between 2010 and 2014 and decarbonization from 2015 to 2018. However, considering the GHG emissions intensity in GDP, there is a decarbonization path of 11% from 2010 to 2018. For the total GHG emissions and GHG emissions *per capita*, there was a slight change between 2010 and 2018. Considering that São Paulo represents 32% of the Brazilian GDP, the results of decarbonization in this subnational unit gain relevance in a national perspective trend towards economic decarbonization (see Table 23).

The good news is that Pará and Mato Grosso have also shown a decarbonizing profile in at least one of the emission profile variables trajectory (see Table 23). Pará EP in 2010 had the highest score among all subnational units from 2010 to 2018 (EP with adjustment = 91,73). From 2011 to 2015, when it reached its smallest score (EP with adjustment = 54,43), it had a decarbonizing emission profile, followed by a carbonizing trend till 2018.

Table 22 - Emissions Profile (EP) scores by year 2010 – 2018 with adjustment

Fed unit /Year	2010	2011	2012	2013	2014	2015	2016	2017	2018
AC	46,48	48,91	57,24	30,86	48,37	34,09	47,33	38,18	55,52
AL	1,86	1,89	2,29	1,63	1,86	1,51	1,57	1,75	1,56
AM	21,96	18,47	24,25	18,91	20,94	22,00	32,33	32,11	31,58
AP	10,00	11,42	6,64	4,13	6,34	3,42	2,29	3,16	2,81
BA	17,15	21,55	28,73	23,12	23,36	18,83	15,71	15,64	13,72
CE	5,76	5,22	7,64	6,46	7,80	6,62	6,31	7,11	6,13
DF	0,39	0,27	1,02	1,06	1,27	1,11	1,04	1,01	0,80
ES	6,45	6,95	9,10	7,56	9,50	8,02	7,62	8,80	7,79
GO	24,45	22,18	29,22	29,03	28,67	22,66	18,25	22,12	19,81
MA	42,75	32,18	34,37	32,44	37,18	27,34	23,01	28,55	25,46
MG	23,22	27,26	40,60	35,31	39,60	26,76	20,95	24,11	21,53
MS	36,87	32,07	41,30	31,90	34,85	32,38	31,19	31,25	27,60
MT	72,56	80,36	82,62	81,45	84,80	87,94	78,22	87,75	78,15
PA	91,73	78,07	63,90	60,69	62,82	54,43	68,13	64,16	65,13
PB	3,53	3,40	4,61	3,43	4,35	3,81	5,45	4,80	4,21
PE	3,64	4,47	5,86	4,67	5,95	4,62	4,28	4,31	3,80
PI	21,64	25,25	28,05	25,53	27,58	17,00	16,38	15,33	12,39
PR	9,13	10,11	15,43	12,36	14,91	11,50	11,03	12,29	11,38

Fed unit /Year	2010	2011	2012	2013	2014	2015	2016	2017	2018
RJ	7,82	8,88	14,76	12,79	14,51	11,34	9,43	11,53	9,87
RN	3,47	3,48	5,13	4,50	5,59	3,72	3,52	3,18	2,81
RO	46,88	72,41	76,69	63,87	62,61	65,83	82,21	82,73	83,03
RR	56,25	30,58	30,44	28,20	43,96	25,17	32,15	23,22	29,62
RS	27,18	28,45	41,23	28,68	31,47	18,97	16,47	18,52	16,51
SC	7,02	7,03	10,28	8,58	10,05	7,66	7,55	8,45	7,78
SE	3,25	3,17	4,21	2,96	3,60	3,04	3,23	3,23	3,14
SP	16,63	20,85	31,98	25,45	29,39	21,64	18,70	22,34	19,73
TO	70,16	66,40	75,37	81,33	78,21	77,04	47,47	53,07	45,83

Source: Author's elaboration based on SEEG data, World Bank (2020), and IBGE (2020). The adjustment means that scores were transformed to a rank between 0 to 100 using Equation 4 to facilitate the results reading and comparison between subnational units. The highest scores per year are in gray.

According to Table 24, Rondônia, Mato Grosso, and Tocantins had the highest absolute *per capita* emissions and were well above the Brazilian average (9,8 tonCO_{2e} *per capita* average by year from 2010 to 2018). Both Rondônia and Mato Grosso had a carbonizing trend in *per capita* emissions (8.9% and 2.5% geometric averages, respectively), while Tocantins had a decarbonizing *per capita* emissions trend (-2.6% in geometric average).

Table 23 – Average results for each variable in % from 2010 to 2018

Total GHG emissions		GHG emissions per capita		GHG emissions in GDP	
Rank	Geometric Average	Rank	Geometric Average	Rank	Linear Average
RO	10,52	RO	8,89	RO	90,84
AC	5,95	AM	3,80	AM	54,71
AM	5,88	AC	3,72	AC	39,21
MT	4,16	MT	2,53	ES	21,34
ES	2,41	PB	1,28	SE	0,05
PB	2,04	ES	0,85	RJ	-0,32
PR	1,62	PR	0,57	PB	-1,44
SC	1,12	RJ	-0,34	DF	-2,66
DF	0,83	SC	-0,44	PR	-6,24
RJ	0,54	CE	-0,45	MT	-8,13
CE	0,45	DF	-1,03	SC	-9,24
SE	-0,14	SE	-1,35	SP	-9,68
MS	-0,33	PE	-1,47	CE	-15,07
PE	-0,52	AL	-1,61	PE	-19,45
SP	-0,54	MS	-1,75	RN	-20,68
AL	-0,84	SP	-1,76	GO	-22,24

Total GHG emissions		GHG emissions per capita		GHG emissions in GDP	
Rank	Geometric Average	Rank	Geometric Average	Rank	Linear Average
TO	-1,13	RN	-2,30	MG	-23,17
RN	-1,15	TO	-2,57	AL	-24,90
GO	-1,52	MG	-3,09	MS	-30,67
MG	-2,22	GO	-3,25	TO	-32,36
RR	-2,67	PI	-3,69	BA	-32,38
PA	-3,00	BA	-3,75	PA	-35,29
BA	-3,09	PA	-4,36	RR	-35,61
PI	-3,14	MA	-4,97	PI	-44,83
MA	-4,15	RR	-5,61	MA	-45,90
RS	-5,97	RS	-6,64	RS	-48,05
AP	-7,59	AP	-10,05	AP	-58,00

Source: Author's elaboration based on SEEG data, World Bank (2020), and IBGE (2020).

Table 24 – Per capita emissions (ton CO_{2e} per capita) for Mato Grosso (MT), Rondônia (RO), Tocantins (TO) and Brazil (BRA) from 2010 to 2018

Year	MT	RO	TO	BRA
2010	54.2	37.2	49.6	10.4
2011	60.6	57.7	47.3	10.1
2012	51.7	52.8	47.8	9.5
2013	66.9	55.6	69.5	10.4
2014	58.0	44.7	54.7	9.6
2015	76.7	59.6	69.3	9.9
2016	70.7	73.9	43.2	9.8
2017	69.9	68.0	43.8	9.3
2018	66.2	73.5	40.3	9.3

Source: Author's elaboration based on SEEG data and IBGE (2020).

Rondônia and Tocantins also had the highest GHG intensity in the GDP per US\$ 1,000. Rondônia has a carbonizing path, while Tocantins had a decarbonizing trend in the same period (see Table 25). Amazonas has smaller absolute results but has a steeper carbonizing trend than Tocantins, as demonstrated in Table 25. In Brazil, the general trend was of decarbonization of 12.34% (linear average).

Table 25 - Emissions (ton CO2e) per US\$ 1,000 of GDP for Rondônia (RO), Tocantins (TO), Amazonas (AM), and Brazil (BRA) from 2010 to 2018

Year	RO	TO	AM	BRA
2010	3.370	5.813	1,331	0.706
2011	4.856	5.324	1,057	0.655
2012	4.479	5.265	1,170	0.617
2013	5.250	7.339	1,155	0.668
2014	4.167	5.672	1,089	0.612
2015	5.735	7.219	1,540	0.672
2016	7.144	4.476	2,333	0.687
2017	6.161	4.345	2,035	0.640
2018	6.209	3.758	2,059	0.619

Source: Author's elaboration based on SEEG data and World Bank (2020).

4.4.3 SCCI Results

The Subnational Climate Commitment Index is an aggregate result of the policy and emissions profiles. A positive correlation between both profiles can be expected: the highest the results at the policy profile (existing laws, plans, programs, and paradiplomacy) would have, as a consequence, better results at the emissions profile.¹⁰⁴ However, the policy profile may have a negative correlation with the emissions profile (favorable or unfavorable¹⁰⁵), due to other factors such as the role of local political leadership, local capacity building, association to municipal networks, or different weights to the policy profile variables, an explanation which the multi-level architecture of global climate governance permits.

One limitation of the SCCI is that it assesses governance processes' prevalence, not their quality or effectiveness. Nevertheless, an analysis based on processes prevalence does not invalidate the correlation expected between both profiles since the policy profiles of the 27 Brazilian subnational units showed a

¹⁰⁴ It is important to remember that the EP scale is inverted to the PP scale – the highest the result at EP, the more carbon-intensive is the profile, while the highest score at PP means a higher commitment. For that reason, the SCCI equation uses the EPesi – the EP with scale inversion. To assess the hypothesis mentioned here, PP results must be comparable with EPesi results.

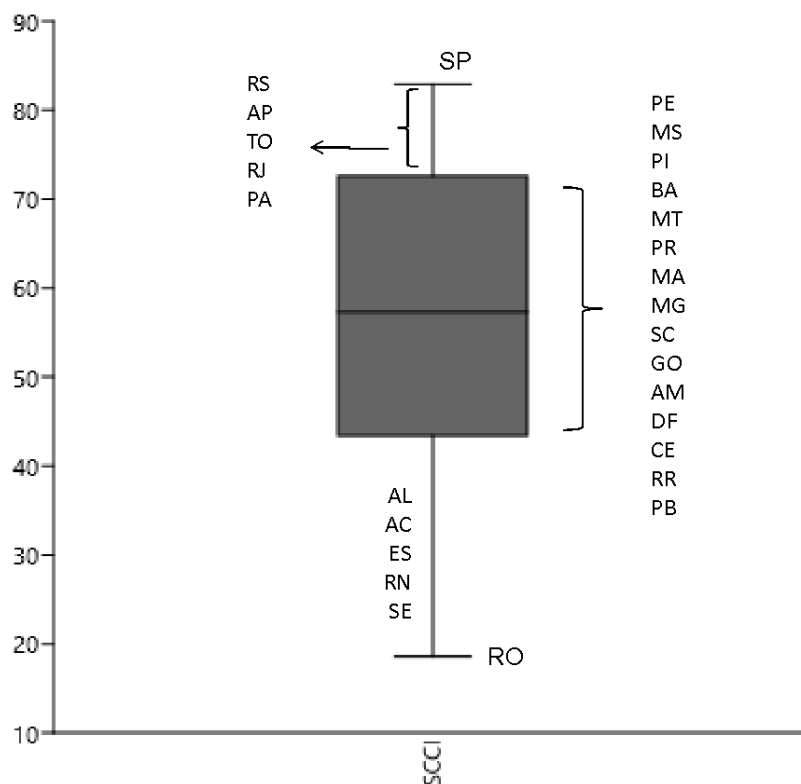
¹⁰⁵ I avoid using positive or negative terms since a negative result (<0) at the emissions profile means a decarbonizing trajectory. At the SCCI calculation, there is a scale inversion, which could confuse the reader in which direction the positive or negative trajectory would lead. Therefore, a favorable variation is a decarbonization trajectory, while an unfavorable variation is a carbonizing trajectory.

concentration of governance processes in 2009 and 2010. It can be expected that emissions profiles would vary favorably or unfavorably from 2010 on.

Based on Equation 6, São Paulo is the subnational unit with the highest climate commitment among the 27 Brazilian federated units, while Rondônia is the one with the lowest result. This does not mean that São Paulo has an absolute high climate commitment, but it had the best result compared to the other 26 subnational units.

The mean result is 56.58, and the median is 57.31. The distribution is skewed to the right (see Graph 22). The 25th and 75th percentiles are 43.43 and 72.56, with 15 subnational units in this interval (see Graph 21). From the total of 27 subnational units, 14 had a final score above the mean.

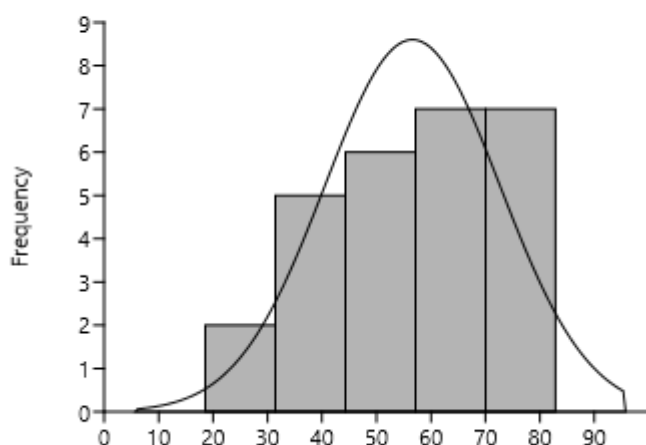
Graph 21 – SCCI Box plot



Source: Author's elaboration based on SEEG data, World Bank (2020), and IBGE (2020) with Past 4.08 (Hammer et al., 2001).

Looking at the extremes of the boxplot diagram is a test of the expected correlation between the profiles. In the case of São Paulo, the policy profile had a more considerable weight than the emissions profile, which varied from 2010 to 2018, with a peak in 2012 (see Table 22). However, the high commitment policy profile did not necessarily translate into a steep decarbonizing path since São Paulo ranked sixteenth place in EP_{esi} results. In the case of Rondônia, the worst emissions profile among the subnational units also had a low score on the policy profile – it has four items of the domestic policy profile and one of the paradiplomacy. Nevertheless, it did not have the last place in the policy profile rank, which is Sergipe's.

Graph 22 – SCCI histogram



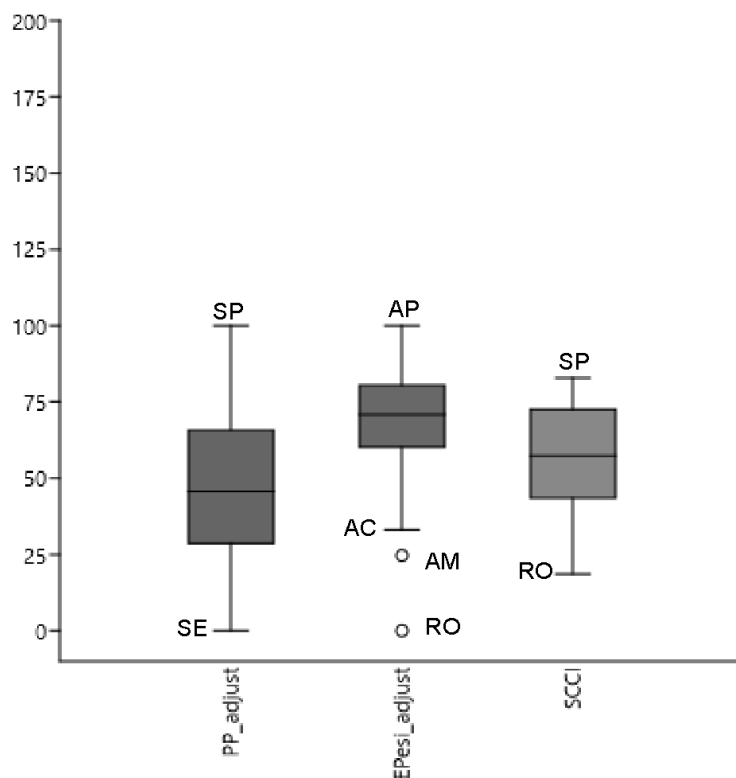
Source: Author's elaboration based on SEEG data, World Bank (2020), and IBGE (2020) using Past 4.08 (Hammer et al., 2001).

A comparison of the three results (PP, EP_{esi} , and SCCI) may help understand the dynamics between the policy profile with adjustment, the emissions profile with adjustment and scale inversion, and the SCCI final result (Graph 23).¹⁰⁶ The policy profile has a broader distribution, with the 25th and 75th percentiles between 28.57 and 65.71, with 18 federated units at this interval. The emissions profile

¹⁰⁶ The adjustments and scale inversion, as previously explained, are necessary in order to make the profiles comparable.

has two outliers, with the 25th and 75th percentiles between 60.08 and 80.04, with 13 federated units at this interval.

Graph 23 – Policy profile, emissions profile with scale inversion, and SCCI boxplots



Source: Author's elaboration based on SEEG data, World Bank (2020), and IBGE (2020) using Past 4.08 (Hammer et al., 2001).

The commitment definition (Viola and Franchini, 2018), which refers to the engagement with global climate governance, is a measurement of the level of assimilation of climate change as a main civilization driver based on the prevalence of governance processes related to climate action (policy profile) and the climate situation according to emissions trajectory (emissions profile). The climate commitment composition allows an interaction between both profiles. On average, the federated units had a low to medium policy commitment, which would lead to an unfavorable variation in the emissions profile (carbonizing trajectory). Nevertheless, the emissions profile mean result is of favorable variation – a decarbonizing trajectory.

4.5 Principal Component Analysis

Therefore, SCCI's final results show that the policy profile is not necessarily translated into the emissions trajectory, meaning a positive correlation between them, either favorably or unfavorably. Therefore, multivariate analysis can bring more elements to the analysis. The principal component analysis is done with the correlation matrix and calculated with the Past 4.06 software (Hammer et al., 2001). The variables, as explained in the methodology section, are the following:

- Deforestation rates for Amazon and Cerrado (2010-2018)
- Total GHG Emissions rate (2010-2018)
- GHG emissions per capita rate (2010-2018)
- GHG emissions per GDP unit rate (2010-2018)
- Policy profile score in % of the total possible score
- 2018 GHG emissions in % of the national total¹⁰⁷

The first principal component (PC1) and the second principal component (PC2) respond for 84% of the total variance (

Table 26). Therefore, the model covers a good percentage of variance. PC1 is mainly determined by deforestation rates and the emissions profile variables. In contrast, PC2 is mainly determined by the policy profile and GHG emissions in 2018 (see loadings in Table 27), which works as a "correction variable" in the model since the emissions profile variables present a behavior from 2010 and 2018 and the actual position in 2018 offers information about the subnational unit impact in overall national scenario.

¹⁰⁷ According to SEEG methodology, 96% of national emissions are at the subnational level.

Table 26 - Eigenvalues and variance of the model

PC	Eigenvalue	% variance	%_cummulative
1	3.6119800	60.2	60.2
2	1.4510300	24.184	84.4
3	0.5546100	9.2435	93.6
4	0.2957000	4.9283	98.6
5	0.0760201	1.267	99.8
6	0.0106629	0.17771	100.0

Source: Author's elaboration with Past 4.06 (Hammer et al., 2001).

Table 27 - Loadings

Variable	PC 1	PC 2	PC 3	PC 4	PC 5	PC 6
Def_Simple_rate	0.45409	-0.051487	-0.31012	0.81299	-0.18424	0.0086226
GHG_growth_rate	0.51375	-0.050767	0.10948	-0.29495	-0.24091	-0.75926
GHG_pc_geo	0.50884	-0.039818	0.1108	-0.35129	-0.44144	0.63948
GHG_GDP_rate	0.50621	-0.085014	0.13223	-0.049072	0.83792	0.12047
PP_new_rank	0.051948	0.71233	0.65063	0.25376	-0.046568	-0.0024602
GHG_2018_%_nat	0.10951	0.69177	-0.66239	-0.24869	0.094125	-0.00093203

Source: Past 4.06 (Hammer et al., 2001)

The positions on axis Y are related to PC2, and on axis X are related to PC1. Units positioned at higher values in axis Y have a better policy profile and higher GHG emissions in present values measured as a percentage of the national total. Policy profile loading is higher than 2018 GHG emissions, and this last variable seems to work well as a correction index. Units positioned in higher values in axis X have a more carbon-intensive profile, and all variables have similar loadings.

Better positions regarding climate commitment are in Quadrant 2, while worse positions are in Quadrant 4. Quadrants can be read as follows (see Graph 24):

- Quadrant 1: better policy profile, bigger GHG emissions in 2018 in national percentage, and worse emissions profile;

- Quadrant 2: better policy profile, bigger GHG emissions in 2018 in national percentage, and better emissions profile;
- Quadrant 3: worse policy profile, smaller GHG emissions in 2018 in national percentage, and better emissions profile;
- Quadrant 4: worse policy profile, smaller GHG emissions in 2018 in national percentage, and worse emissions profile.

Policy profile and GHG emissions in 2018 seem to be independent of emissions profile variables in this model, as is presented in the vector projections and their positions in the bi-dimensional graph. Therefore, PCA does not prove the expected correlation at the subnational level between policy processes, which had a peak in 2009 and 2010, and the emissions profile between 2010 and 2018. A year-by-year analysis between the PP and EP could be performed. However, considering that policy processes may need heterogeneous periods to produce impacts (policies, plans, etc.), such an endeavor would have to be individualized by federated units and policy processes.

Nevertheless, a concentration of subnational units in the quadrants represents a better commitment, especially for subnational units with higher GHG emissions. Nine subnational units are in quadrant 2, and seven are in quadrant 3, which means sixteen subnational units have a better emissions profile. Three are in quadrant 1, and eight are in quadrant 4, which means eleven have a worse emissions profile.

Pará, with higher GHG emissions and medium policy profile, has the highest position on axis Y. São Paulo, which has the best policy profile and the third position in GHG emissions in 2018, has the second position on axis Y. Mato Grosso has the second higher GHG emissions in 2018, a similar policy profile as the state of Pará, but has a more carbonizing emission profile, which positions it in third place in axis Y but at a very different position in axis X.

Rondônia has the most carbon-intensive profile of the 27 subnational units, a small percentage of total GHG emissions in 2018 (6.7%, while Pará has 13.4%) and a low policy commitment (4.25 out of 10.5). Amapá, at the other extreme of the graph, has a better policy profile than Rondônia (5.75), represented less than

1% of national total GHG emissions in 2018, and had a decarbonizing path from 2010 to 2018. Amapá's position in quadrant 2 is due to its small share in total national emissions and its smaller impact. Graph 25, then, presents a good representation of the separated results of the policy and emissions profile depicted previously.

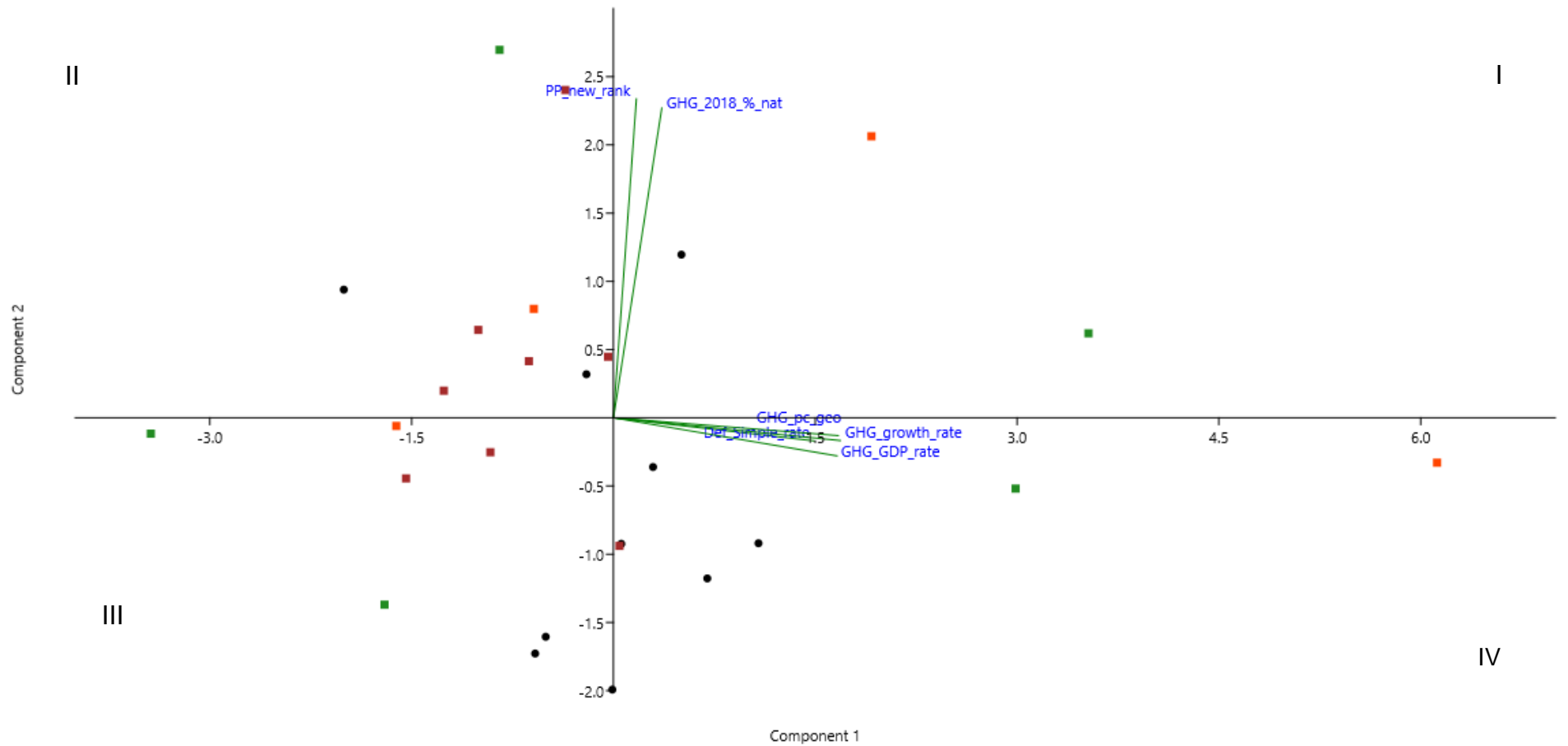
Subnational governments represented in squares are those that have either the Amazon biome (green), the Cerrado biome (represented in brown), or both (orange). Therefore, units with colored squares have the deforestation rate as part of their positionings. Subnational units represented as black circles have null deforestation rates in the model. As expected, deforestation rates are closely related to the emissions profile variables. However, there is a clustering of federated units with the Cerrado biomes in Quadrants II and III. Domestic and paradiplomacy dynamics reported in the literature and presented by participation in transnational networks, however, made more reference to a possible cluster of subnational governments with the Amazon biome in their territory.

If the best position were plotted in Graph 25 according to the Brazilian NDC commitment (which could be linearly downscaled, assuming that each subnational unit would change its behavior accordingly), it would have:

- a diminishing rate of 96% for deforestation since the NDC goal is to curb illegal deforestation and, according to Mapbiomas (2020), 96% of deforested areas in 2019 were illegal;
- diminishing rate of 43% of total GHG emissions;
- diminishing rate of 65% of GHG *per capita* emissions;
- diminishing rate of 75% of GHG emissions per unit of GDP;
- total score in the policy profile.

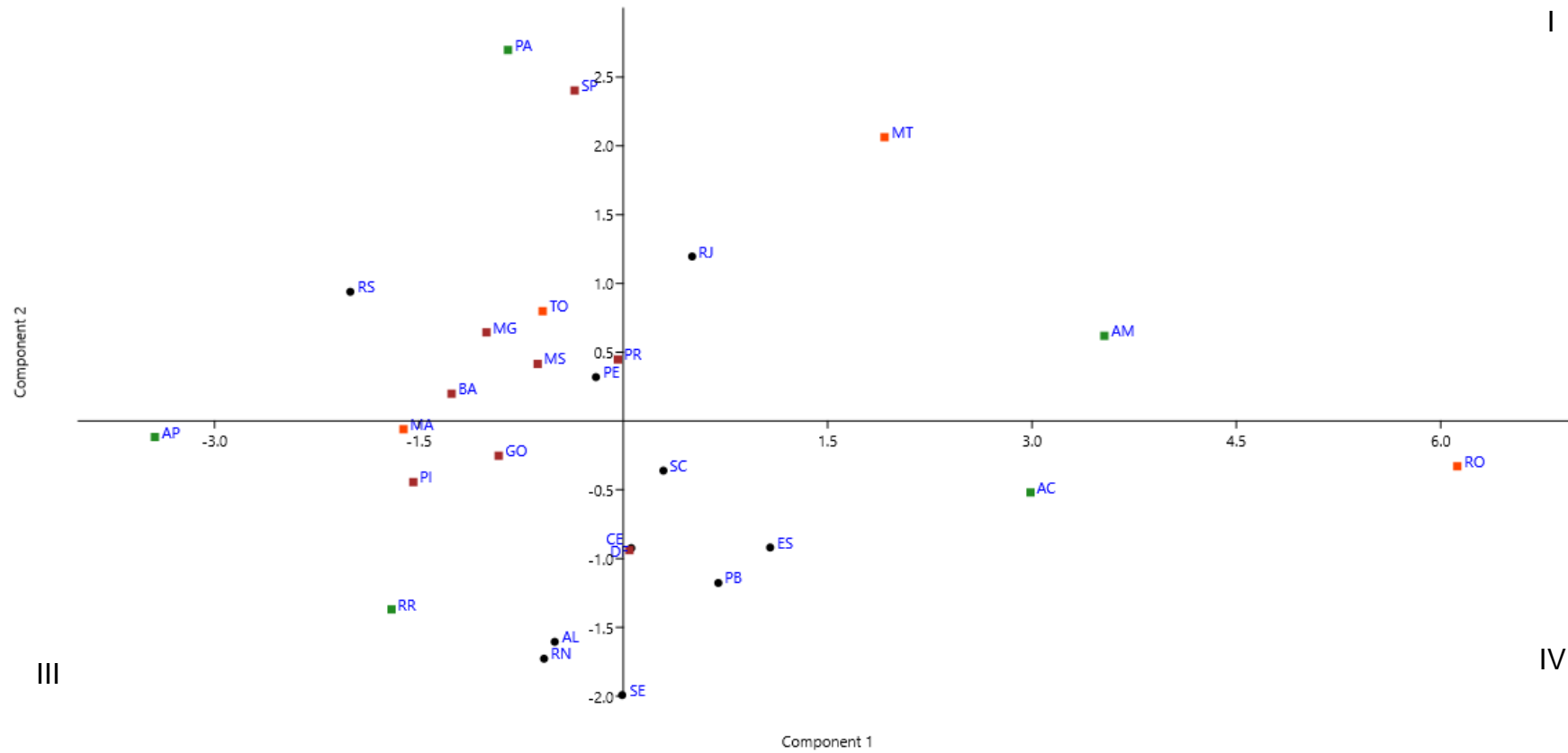
This best position is at Quadrant II, at the edge of the X-axis, and a little higher than São Paulo at the Y-axis.

Graph 24 - Vectors in the scatterplot



Source: Past 4.06 (Hammer et al., 2001)

Graph 25 - Subnational units' positions



Source: (Hammer et al., 2001)

4.6 Conclusion

Subnational actors' engagement in the UNFCCC date from its beginning, in the 1990s, but their recognition as relevant stakeholders is recent, with a concentration of COP decisions and landmarks in the last decade. The Marrakech Partnership for Global Climate Action can be considered the referent for subnational units' commitment to global climate governance.

Considering the framework presented in Chapter 2, the multi-level approach better describes the development of the governance architecture: even though most of the actions registered at the GCAP are cooperative initiatives in transnational networks, there are no well-established mechanisms beyond monitoring. Non-state actors and subnational units have fought for recognition, but their participation in global climate governance is still predominantly mediated and seen as complementary to nation-states.

The Nazca Platform (now GCAP), the central locus for reporting and engagement, does not offer standards for action registering, and there is a lack of transparency in data showcasing. In the case of Brazilian subnational governments, it was possible to identify incongruities between cooperative initiatives registry, what subnational governments report on their official websites, interviews with public servants, and what is reported by transnational networks on their official websites.

According to the six dimensions depicted in Chapter 2, the finding that there was no transnational network of subnational actors with rule-setting as its main function supports the hypothesis that global climate governance has a more multi-level than polycentric architecture for Brazilian subnational governments. Most of the transnational networks were public with capacity-building and implementation functions or hybrid with information-sharing functions. Identifying leading subnational actors is a point for further research through network analysis and a more in-depth analysis of each transnational network's definition, mission statement, and functioning.

Regarding climate federalism and paradiplomacy, the period from 1990 till today can be divided into two main categories: the first, from 1990 to 2010, is of convergence between climate federalism and paradiplomacy, with some

conflictive points regarding the national position about forests in the international arena. From 2011 on, as Brazil became climate negligent, governance processes at the subnational level went towards institutionalization, and, from 2017 on, climate paradiplomacy became an opposition instrument to the federal government positions.

The Subnational Climate Commitment Index (SCCI) attempts to analyze subnational units' commitment to climate change mitigation according to the actual climate governance architecture. It covers the period from 2010 to 2018, in which paradiplomacy, a means of engagement in global climate governance, gained a more conflictive profile regarding climate federalism in Brazil.

The SCCI is based on the definition of climate commitment as institutional outcome and is related to policy and emissions situations as presented by Viola and Franchini (2018), with the due adaptations to the subnational level. It offers a unidimensional description of its distribution among the 27 Brazilian subnational units, based on a scale that allows for comparisons of the policy profiles, the emissions profiles, and the final measurement of commitment. The two main reasons for this index proposition are the possibility of comparison of subnational units' relative position and a broad understanding of climate commitment at the subnational level.

For the policy profile, the result is that most subnational units have a low to medium policy commitment. Also, the PP results point to climate governance processes concentrated around 2009 and 2010, while the Climate and Society Institute survey demonstrates that legislative action today is happening in a more theme-diffused manner (with the keywords 'environment', 'sustainability', and 'solar'), which is expected in Brazilian environmental federalism. Moreover, even if there is a conflictive trend between subnational governments and the federal government, in the sense that subnational governments could try to compensate for the lack of a national commitment, this conflict was not directly translated to a national-wide policy commitment at the subnational level in the last decade.

The comparison of the timelines of Brazilian national and subnational climate governance processes does not corroborate a hypothesis of diffusion and experimentation based on the number of processes. The case of PPCDAm mentioned in interviews and in the Climate and Society Institute survey points to

the search for specific dynamics and engagement of actors at different levels to understand how scaling down and entrenchment of processes from national to local scales happen.

Nevertheless, considering the lack of mention of the Paris Agreement in recent legislative activity and the historical description of subnational engagement within UNFCCC and at parallel networks, the Brazilian national engagement in COP 15 in 2009 and national legislation and plans of implementation seemed to have more influence on subnational units than the road to Paris, described with momentum from 2014 to 2016, evidence that fits the multi-level architecture concept. Finally, the policy profile's paradiplomacy dimension demonstrates that Brazilian subnational units have favored the adhesion to alternative transnational networks over the GCAP, especially the GCF-TF and Under 2 Coalition.

The emissions profiles have shown an average trend towards decarbonization for Brazilian subnational units, but with two outliers with deep carbonization dynamics in the last decade – Rondônia and Amazonas. Considering the Brazilian emission profile, these outliers are related to land use and land-use change.

The results, however, have to be read carefully because they present a relative position in a specific period (2010 to 2018). Also, if the results are to be read considering the subnational unit independently from the national context, the absolute numbers in terms of population, GHG total emissions, and GDP should be taken into account for a complete understanding of the subnational unit position according to the governance architecture theoretical lens.

The SCCI final result does not validate the expected correlation between the profiles (the better the policy profile, the better the climate situation through the EP profile. The results pointed to the opposite, with most federated units combining lower policy commitment and a decarbonizing emissions profile, as presented in the principal component analysis.

For Chan et al. (2016), while the Nazca Platform and the Paris Agreement offer recognition and visibility for non-state actors' actions, there are challenges in measuring their impact and success (transparency and credibility, attributable

impact). A framework for credibility and effectiveness of actions is yet to be developed, and the multiplicity of platforms, networks, and types of actors (fragmentation) make it a tough challenge to overcome. Bearing in mind that UNFCCC parties are national states, other stakeholders (like subnational governments), although recognized, do not participate in negotiations. Therefore, developing an evaluation framework for subnational governments within the UNFCCC seems unlikely if it is not going to be a "parallel" effort (see Chan et al., 2016: 247).

Although it cannot measure the absolute impact of subnational actions, the commitment approach is an alternative that presents a behavior related to global climate architecture. This assumption presumes a causal chain that places processes before impact (Van der Ven et al., 2017). The SCCI results, with the due limitations, achieved the double purpose of providing a comparison of subnational units' relative positions and offering a broad understanding of climate commitment at the subnational level. SCCI is not a measure of impact but a measure of outcome.

Also, although the policy profile measures only the prevalence of climate governance processes, the correlation assessment between both profiles can offer a clue over these processes' implementation – the wider the gap between the profiles' results (good score on PP and a bad score on EP_{esi}), the worst the policy implementation would be, considering the time frame of the profiles.

Mazzega et al. (2019: 245) state that most indexes “are published without an estimate of their accuracy or associated confidence intervals.” Such confidence (error estimation) and robustness (if any variable is changed, what are the impacts?) tests are relevant if an index is going to be used for policymaking. However, the SCCI did not go through such tests. According to the index's methodology and its results through the principal component analysis, a robustness test implies a total reassessment of the index, which is beyond the scope of this dissertation.

Therefore, one recommendation for the further development of the SCCI is to undergo such tests. Also, there are some other improvements:

- a) The inclusion of subnational units' vulnerability to climate change in the emissions profile¹⁰⁸;
- b) The inclusion of Schiavon's (2019) matrix for central-local interaction as a correction index in the policy profile if the SCCI is employed for comparative analysis of subnational units from different countries;
- c) The inclusion of GHG emissions reduction targets accepted in transnational networks in the paradiplomacy profile;
- d) The testing of different weights for the emissions profile intensity measurements (GHG emissions *per capita* and GHG emissions in GDP) in order to address justice and equity values or the possibility of carbon leakage between subnational units;
- e) The SCCI could be adapted to the climate commitment approach proposed by Frachini (2016) and Viola e Franchini (2018) to the national level, comparing national and subnational results to assess processes scaling up or down and entrenchment dynamics.

¹⁰⁸ Embrapa assessed vulnerability in terms of crops patterns change. See <https://www.embrapa.br/busca-de-publicacoes/-/publicacao/954568/avaliacao-da-vulnerabilidade-e-impactos-das-mudancas-climaticas-na-agricultura-brasileira>. Access on June 19th, 2022. There is also a project by Fio Cruz, with support from the Amazon Fund, to develop a vulnerability index for Brazilian municipalities in six different states – see <https://projeto-vulnerabilidade.fiocruz.br/>. Access on June 19th, 2022.

CHAPTER 5 – CAUSAL MECHANISM FOR MATO GROSSO AND PARÁ

Beach and Pedersen (2013: 7) consider that explaining-outcomes process-tracing "cannot be meaningfully combined with other research methods" because it includes non-systematic, case-specific parts, the inclusion of which limits the generalizability of results." However, they orient the use of this variant of process-tracing when there is an "interesting and puzzling outcome to be explained" (Beach and Pedersen, 2013: 164), which is the case in this research. Chapter 3 explained how to mind the gap between descriptive statistics and explaining-outcome process tracing – the first method demonstrates how SCCI variables behave and the position of the statistical units regarding these variables and a specific population. The former searches for a causal mechanism for the specific case of Brazilian subnational governments departing from the statistics results.

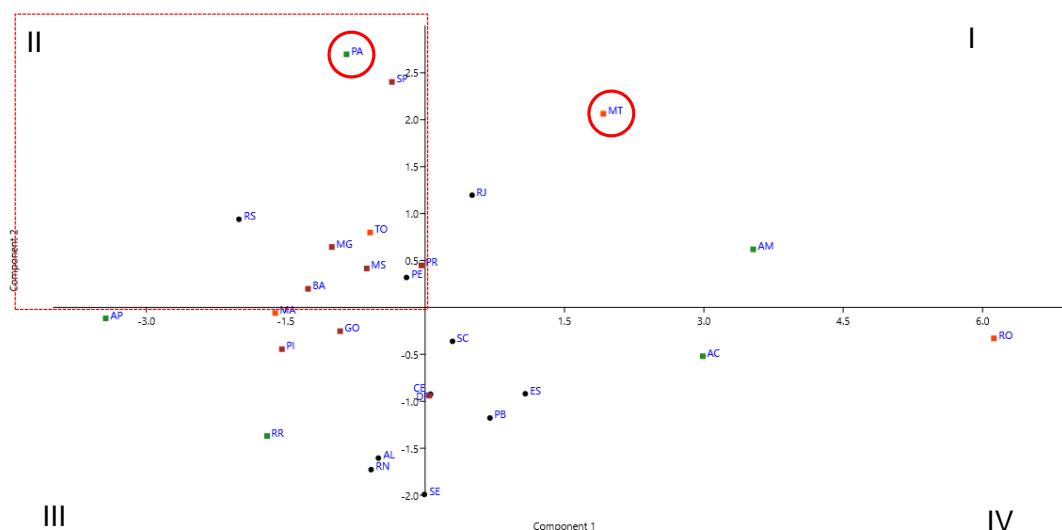
The combination of SCCI results and the principal component analysis in Chapter 4 is the base for case selection. Nevertheless, it is relevant to remind that PCA and process-tracing have distinct objectives and that the reading of the PCA results needs to consider these differences. If this research were searching for a causal mechanism to explain the relationship between the policy (independent variable) and the emissions profile (dependent variable), quadrant II would offer the set for the cases since it is where both variables are present.

The cases of Pará and Mato Grosso have the same score for the policy profile with adjustment (65.71), with different emissions profiles with adjustment and scale inversion: Pará has 82.24, and Mato Grosso has 60.1. They also have the two highest GHG emissions in the country¹⁰⁹, implying that their behavior significantly impacts the Brazilian national profile. Consequently, these two

¹⁰⁹ Pará's GHG emissions were the highest in Brazil from 2010 to 2018, except in 2015, when Mato Grosso had the highest emission (250 MtonCo2e), and Pará emitted 216 MtonCO2e. Pará's average GHG emissions from 2010 to 2018 were 245 MtonCO2e per year. Considering the increase in deforestation in Brazil in 2019 and 2020, it is expected that Pará's emission profile will probably present higher scores in the following years. Mato Grosso had the second-highest emissions for six years from 2010 to 2018 (2010, 2011, 2013, 2016, 2017, and 2018), with an average of 206 MtonCO2e per year.

cases, which have positions in different PCA quadrants (see Figure 6 and Table 28), require a more thorough explanation of a similar policy profile combined with varying emission profiles and different SCCI results.

Figure 6 – Principal component analysis by statistical units' position



Source: Author's elaboration using Past 4.06 (Hammer et al., 2001).

Table 28 – Comparison between Pará and Mato Grosso scores

Federated Unit	Policy profile	Emissions profile	SCCI
Pará (PA)	65.71	82.24 (decarbonization trend in the period 2010-2018 – quadrant II)	73.98
Mato Grosso (MT)	65.71	60.71 (carbonization trend in the period 2010-2018- quadrant I)	62.90

Source: Author's elaboration. The scores in this table have been adjusted according to the methodology in Chapter 3 for a range between 0 and 100. The emissions profile score has also undergone the necessary adjustment to allow the comparison between both profiles.

Resuming previous chapters, there are four observable manifestations of the question of *how subnational actors commit to global climate governance*. The expected manifestations are:

- a) The multi-level is the adequate approach to analyze global climate governance architecture at the subnational level in Brazil (analytical lens). Governance is centered on the UNFCCC as the overarching rules, with attempts by subnational governments' transnational networks to align (Chan et al., 2018).

- b) The Brazilian national state is mainly a gatekeeper of subnational actions, which complement the national standing.
- c) From the 1990s until about 2010, Brazilian subnational units had an increasing role through domestic actions and paradiplomacy, supported by cooperative environmental federalism. Since 2010, subnational units' climate paradiplomacy and climate federalism have had a more conflictive relationship, while domestic actions at the subnational level went through stabilization and institutionalization.
- d) As a measure of institutional outcome, the SCCI has demonstrated a change in the behavior of Brazilian subnational units, evidenced by a slight decarbonization trend on average. Nevertheless, the emission profile is not necessarily related to the policy profile.

Table 29 summarizes a literature review of causal relationships between response and commitment to global climate governance at national, subnational, and local levels. There is a diversity of choices for dependent and independent variables, with different outcomes but no incommensurability between them.

Table 29 - Mapping of explanatory and dependent variables to national and subnational governments' response to global climate governance

Explanatory variable(s)	Dependent variable	References
Systemic factors - interdependence and globalization	Subnational governments' engagement in international issues	Rosenau (2000) Moreira (2013) Schiavon (2019)
Active participation of subnational governments in multilateral decision-making	Influence of international policies	Happaerts (2012)
Transnational engagement	Climate challenge internalization in the municipal agenda	Macedo and Jacobi (2017)
The country has hosted annual COPs		
International commitment with binding obligations	Increase in the quantity of national legislation about climate change	Fankhauser et al. (2016) Iacobuta et al. (2018)
The country has assumed global leadership		
Internal dynamic –the overall legislation number has increased		
	Differences among national environmental policies	Selin and VanDeveer (2012)
Central-local division of power (characteristic of the domestic system)	Subnational governments' engagement in international issues	Schiavon (2019)

Explanatory variable(s)	Dependent variable	References
Domestic context of lower-level governments	Impact of international organizations' pressure on lower-level governments	Happaerts (2012)
Territorial identity / identity issues	Subnational climate action / Subnational government engagement in international issues	Happaerts (2012) Keating (2013)
Partisanship	Differences in national environmental policies Subnational engagement with climate agenda	Selin and Van Deveer (2012)
Competitive interests Associated co-benefits Compensation for the lack of an overarching national policy	Subnational climate initiatives	Rabe et al. (2006, cited in Jørgensen et al., 2015: 237) Rabe (2011)
Strategic economic advantage Strategic political advantage (policy champion/entrepreneur)	Climate policy at the state level	Rabe (2011)

Source: Author's elaboration based on the references mentioned.

This review shows many possible causal relationships from national to local levels. However, none of them have a similar research question on *how subnational actors commit to global climate governance* (the subnational level as the intermediary between the national government and municipalities/cities). Therefore, Table 29 offers some references for developing a causal mechanism to understand how two Brazilian subnational units commit to global climate governance, with the due adaptations between levels and bearing in mind the research's theoretical framework and the formal model.

One implication of the PCA conclusion (Chapter 4) for the research question is that subnational units with similar policy profiles are not expected to have similar emissions profiles as Mato Grosso and Pará. Also, considering the definition of commitment as an institutional effectiveness outcome, subnational units' commitment must be related to international institutions. Finally, considering the multi-level architecture of global climate governance, commitment must happen through "layers," defined by a territorial authority and power dynamics.

Based on Beach and Pedersen's (2013) guidance on performing an explaining-outcome process-tracing, the causal mechanism to explain subnational units' commitment is based on systematic components. Because it is a case-centric approach, it tries to craft a "minimally sufficient explanation of a

particular outcome” (Beach and Pedersen, 2013: 19). A situation mechanism, which links the macro to the micro-level¹¹⁰ (Beach and Pedersen, 2013: 42), is the reference to answer this research question. The assessment of the two cases can bring up non-systematic elements, which will be confronted with the mechanism design.

The sources for data collection are the literature review of both cases, official governmental reports, quantitative and qualitative data gathered through the SCCI, the author's participation in webinars and virtual meetings, and interviews made during October 2020 and April 2021.¹¹¹ This diversity of sources allows for evidence triangulation to increase reliability.

The webinars and events attended were:

- a) Brazilian states' strategies in the climate agenda – renewable energy and productive sectors, on June 5th, 2020, promoted by the Brazilian Association of State Environmental Entities (Abema in Portuguese).
- b) Challenges and perspectives for a climate agenda at the subnational level, on June 19th, 2020, promoted by Brazilian Climate Center (CBC in Portuguese for Centro Brasil no Clima)¹¹².
- c) Dialogues about the Brazilian NDC, on July 13th, 2020, promoted by the Brazilian Forum on Climate Change (FBMC in Portuguese)¹¹³.
- d) Seminar Innovations for Climate – State strategies to build a carbon-neutral Brazil, promoted by CBC on September 29th, 2020.

The interviews sampling was based on literature review, participation in the webinars and events mentioned above, and snowballing, which can reveal networks (Bleich and Pekkanen, 2013: 91). According to Lynch (2013: 32-41), interviews made with non-random sampling can be used to verify and validate information generated with other methods, using triangulation, enhancing the

¹¹⁰ According to Beach and Pedersen (2013: 42), situational mechanisms are related to the agent-structure debate and focus on how macro-social structures constrain and influence actions at the micro-level.

¹¹¹ The University of Brasilia Ethics Committee for Human Sciences approved the interviews instrument and method in this research under process number 34785920.8.0000.5540 on September 24th, 2020.

¹¹² Available at <https://www.youtube.com/watch?v=4PbCgoPbfgs&t=1s>. Access on September 30th, 2020.

¹¹³ Available at <https://www.facebook.com/forumclima/videos/1232196440444978/?t=5998>. Access on September 30th, 2020.

internal and external validity of the data gathered. Non-random sampling can also be used with process-tracing and interpretivist work, searching for causal process observations (CPOs) with information about context, process, or mechanisms.

Interview reporting included sample representativeness, type and quality of information obtained, and accuracy (Bleich and Pekkanen, 2013; Martin, 2013). The interviews script is available in Appendix 4. However, interviews transcriptions are not available because they were all conducted in Portuguese. The transcription would entail a translation effort, for which there were not enough resources.

There were 29 interviews requests made through e-mail, contact sections of websites, and WhatsApp. There were no refusals, but the contacted people answered the request in four cases but never scheduled the interview. The other four attempts, all made through institutional channels (either e-mail or website contact sections), had no answer: the Ministry of Environment, the Green Municipalities Program of Pará, the Socioenvironmental Institute (Instituto Socioambiental in Portuguese), and the Earth Innovation Institute.

All 21 conducted interviews were online and followed by a written report. Three of them were not recorded: two people explicitly requested not to be registered, and one interview had a technical problem. All interviewees were collaborative, and one of them asked for confidentiality. More than half of the interviewees were male (53%), and the average time of the interviews was one hour (with a minimum of 40 minutes and a maximum of 2 hours).

There was at least one interview by governance level (international, national, and subnational) and by institutional association (government, civil society, international and foreign organizations). There were no interviews with multinational corporations or private enterprises since none were cited in webinars and snowballing (see Table 30).

Table 30 – List of interviews by type of interviewee association

Code	Type of association	Quantity
A	National-level – government	1
B	National level – civil society	4
C	Subnational level – government	7

Code	Type of association	Quantity
D	Subnational level – civil society	1
E	International level – international organization	1
F	International level – foreign organization	3
G	International level - transnational network	2
H	International level – civil society	2

Source: Author's elaboration.

This chapter is organized into two sections, beyond this introduction and the conclusion. The first presents the causal mechanism and each of its parts. The following section introduces the cases and analyzes each causal mechanism's elements. Finally, the conclusion answers whether the behavior of the cases throughout the period corroborates or defies the research findings and the causal mechanism.

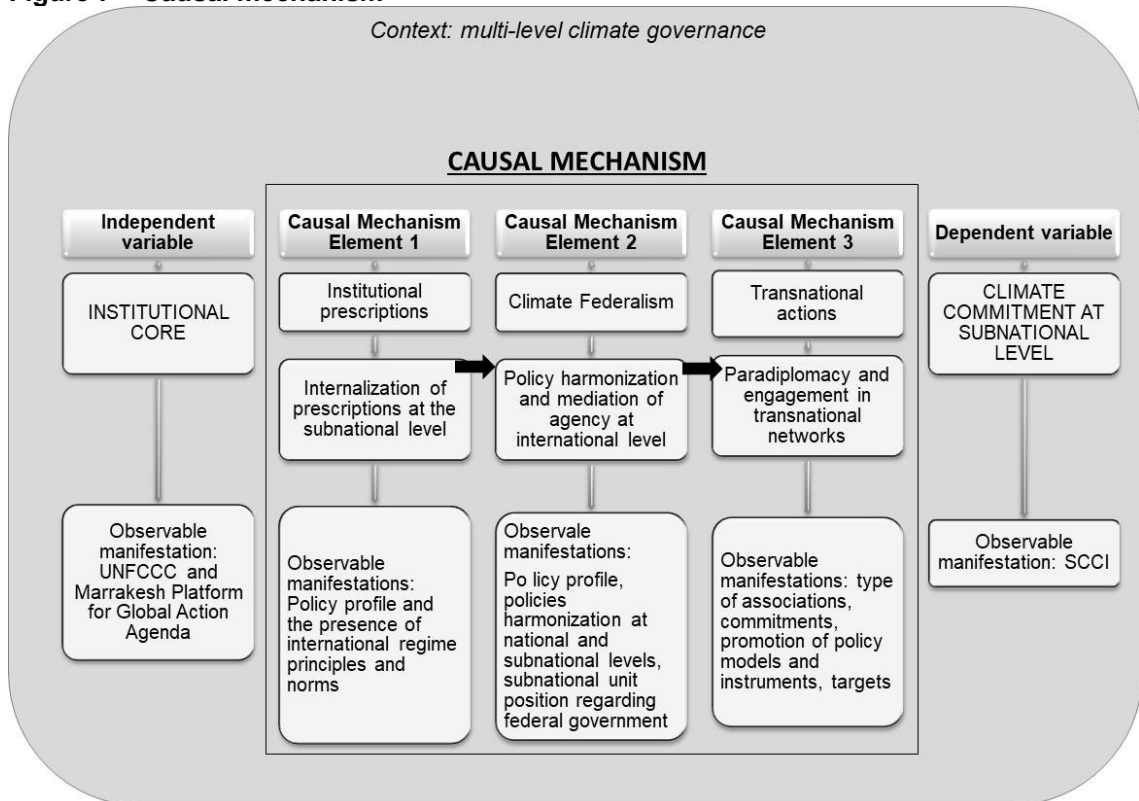
5.1 Causal Mechanism

The causal mechanism has two assumptions. The first, explained in Chapter 2, is that international institutions are intervening variables between the international political economy of climate change and climate commitment. The second is that the definition of commitment as an institutional outcome leads to climate commitment at the subnational level (dependent variable) as responsive to the overarching international rules (independent variable) in a multi-level fragmented global climate governance. Consequently, a link from the macro to the micro-level – the behavior of subnational units as the outcome of institutional effectiveness due to a multi-level architecture – goes through layers: institutional prescriptions at the global level, the Brazilian national government as a gatekeeper for subnational units' engagement in global climate governance, and the characterization of their transnational actions in a more independent mode.

Beach and Pedersen (2013: 29) orient that the causal mechanism in process-tracing should have a mechanistic approach. The elements of a mechanism transmit causal forces between the dependent and the independent variables. According to the lens of the multi-level global climate governance architecture (see Chapter 2), the three elements can be viewed as intertwined layers, especially elements #1 and #2. Element #3 can be an alternative to

elements #1 and #2, but they are complementary according to the transnational networks profile depicted in Chapter 4. Also, I assess each element according to the definitions of necessity and sufficiency presented in Chapter 3.

Figure 7 – Causal mechanism



Source: Author's elaboration.

a) Institutional prescriptions

Governance processes are expected to be present at the subnational level and, consequently, are a piece to explain climate commitment at this level (Rosenau, 2000; Moreira, 2013; Schiavon, 2019). The analysis of these processes differs according to theoretical instructions. The first element/layer of the causal mechanism is related to the general influence of the overarching rules on subnational policy profiles.

The definition of climate commitment as an institutional outcome means that the level of assimilation of climate change as a main civilizational driver follows institutional prescriptions – norms and principles. As they result from states' interactions, rules and decision-making procedures are not directed to

subnational units because they are not the main stakeholders. Therefore, they are not considered in the mechanism to avoid a problem of fit.

Subnational actions have permeated the governance architecture since the 1990s, and there has been pressure for recognition as accredited observers (Setzer, 2015). The works of Happaerts (2012), Selin and Van Deveer (2012), Keating (2013), and Macedo and Jacobi (2017), for instance, indicate some possible causal relationships of subnational engagement with international issues (see Table 29). However, to enquire how subnational actors have influenced governance architecture requires a different causal mechanism, while recent developments represent a broader opening for such players.

From the point of view of nine interviewees, international landmarks related to UNFCCC developments are relevant to the climate change agenda at the subnational level, with eight of them pointing specifically to the Paris Agreement (COP 21). When considering relevant governance processes for subnational governments' commitment to climate change mitigation and adaptation, two interviewees out of eight who answered this question pointed to international targets, and two mentioned international events.

Interestingly, the tipping point of subnational policy processes in Brazil happened before the international landmarks of subnational action institutionalization as hailed in the literature: the Nazca Platform and the Lima-Paris Action Agenda in 2014, the Paris Agreement in 2015, and the Marrakesh Platform for Global Action Agenda in 2016. This finding shows that the interviewees' perception is that subnational processes' response to institutional prescriptions is a recent phenomenon, as presented by Chan et al. (2018). The Brazilian cases offer ground to question this perception.

Conceptually, a multi-level architecture indicates a low degree of overlap between different levels (national, regional, local), and the federal government regulates authority diffusion. Relational power dynamics recognize mutual influence between state, subnational governments, and non-state actors. However, subnational governments and non-state actors have a more limited agency due to a mainly vertical, integrated, and strong interaction with national governments and the lack of procedures and rules for their engagement at the global level.

Happaerts (2012) provides some components from the policy convergence literature that are adequate to examine element #1: international harmonization and the promotion of policy models – the adoption of specific policies and conformity to certain behaviors. For international harmonization, the analysis focus on institutionalization at the subnational level through the influence of principles and norms. His model applies to national states, and in the case of subnational units, the rules and procedures (such as reporting) do not apply. He considers that international influence in sustainable development is more substantial in policy framing and policy goals and weaker in operational goals and instruments (Happaerts, 2012: 139). Therefore, his findings adaptation for the subnational level arguably does not result in conceptual stretching.

Considering Table 29, the interviews, and Happaerts' (2012) components of policy convergence, the pieces of evidence considered for element #1 are:

- the time frame of policy development at the subnational level and relationship with international events and institutional prescriptions;
- how international norms and principles permeate the policy profile;
- the issue definition at the subnational level (convergent or not with overarching rules);

b) Climate federalism

Both multi-level and polycentric approaches to global climate governance host Rabe's (2011: 494-495) assertion that climate change is not solely an intergovernmental issue. It also has an intergovernmental dimension related to which factors foster or hinder policy development at multiple levels and the dynamics between governmental levels. This assertion is especially relevant for federated countries. Climate federalism in Brazil is grounded on cooperative environmental federalism – national and subnational levels act in complementary ways, according to constitutional powers defined for each issue (forests, transportation, agrarian issues, among others).

The second element/layer, climate federalism, is mediated by the Brazilian national standing in global climate governance, jointly with climate cooperative

federalism. It considers the dynamics between climate federalism and paradiplomacy (see Chapter 4) and if there are elements of policy harmonization and policy coordination mechanisms (Happaerts, 2012).

The Ministry of Foreign Affairs (MRE) representative at the event Dialogues about the Brazilian NDC said that the national state is responsible for formulating Brazilian commitment and actions in the Paris Agreement and at the UNFCCC. MRE is the focal point, but other Ministries share the authority to address the issue internally, like the Ministry of Environment (MMA in Portuguese) and the Ministry of Science, Technology, and Innovation (MCTI in Portuguese). The role of civil society and the private sector is to implement the Brazilian NDC.

Nevertheless, Abema and Giz's publication (2020: 98) reported that Gustavo Saboia Fontenele, from the Ministry of Economy, has stated that the federal government recognizes the importance of the subnational government's role as a partner in the climate agenda (webinar promoted on June 15th, 2020). Finally, Emilio La Rovère, from COPPE/UFRJ, at Abema's webinar, compared the Brazilian context with the USA. He considers that Brazilian federated units have less autonomy than their American counterparts, but national setbacks in national policy result in subnational states' commitment increased importance in both countries. José Sarney Filho, a former Ministry of Environment and currently the Environmental Secretary of Distrito Federal, stated in a similar tone at the CBC's webinar that subnational governments' role has gained importance considering the setbacks in national environmental policy. Therefore, they have a supplementary responsibility to maintain this policy.

The overall context for element #2 is where the authority to deal with the climate issue is located (Selin and Vandeever, 2012), which are the cooperation mechanisms between the levels (Brown 2012), and the eventual scaling-up or entrenchment of subnational actions (capacity to become entrenched in social, political, and economic institutions) (Van de Ven et al., 2017) as evidence of climate cooperative federalism.

Hochstetler (2021) has pointed out that from 1990 to 2002, Brazilian institutional development for tackling climate change reflected the international negotiations. From 2003 to 2010, compliance requirements for the subnational level marked domestic policies development. This is the case of PPCDAm scaling

down to subnational Amazonian governments. The subnational forum of Amazonian governors appeared as an essential variable in domestic dialogue and paradiplomacy in the interviews.

The first decade of the 2000s was also the period of subnational policy development concentration, with the publication of 14 laws out of the 21 federated units with the total of 22 laws from 2005 to 2020 (see Appendix 3 for governance processes by federated unit and year). Mato Grosso has two laws – one from 2013 about REDD+ and one from 2017 about state policy for climate change. Coercion and collaboration (as defined by Gordon, 2015) seemed to be, in general, the two pathways for coordination of climate federalism in Brazil. There is also evidence of subnational pressure that resulted in a change in Brazil's international position (entrenchment), as in the case of forests and the REDD+ mechanism.

Tosun (2018: 162) points out that vertical diffusion needs a convergence of policy preferences. Consequently, a climate conservative federal government is expected to give little inducement towards commitment, and a reformist government creates more incentive for commitment at the subnational level. In the case of Brazil, emulation seems to be the primary mechanism for policy diffusion both from the international and the national level. However, the patterns of commitment are very heterogeneous and do not allow for such a generalization.

The interviews, in general, did not indicate a conflictive or dysfunctional relationship between the federal government and subnational units. However, recently (from 2019 onwards), there has been a growing opposition between subnational governments and the federal government in some stances – the Ministry of Environment – while there is closer cooperation in other issues, such as the development of inventories for the subnational level by the Ministry of Science, Technology, and Innovation, through SIRENE.

The pieces of evidence considered for element #2 are:

- the time frame of policy development at national and subnational levels;
- cooperation mechanisms between national and subnational levels;
- compliance mechanisms in national norms for subnational governments;

- scaling-up and entrenchment of subnational actions;
- the type of relationship between subnational governments and the federal government;
- issue saliency in political juncture.

c) Transnational actions

Finally, the third element/layer is transnational actions through paradiplomacy and participation in transnational networks – how they engage in the international arena and express their commitment to the overarching rules. The observable manifestations of this element are broader than the foreign dimension of the policy profile: the types of paradiplomacy actions, association in transnational networks, commitment to targets, policy models, and instruments promotion and adoption. According to the multi-level architecture approach, subnational actors' participation is mediated by their national governments (element #2) through climate federalism, and that multi-level architecture influences their perception of opportunities and constraints (Brighi and Hill, 2008: 122-123).

According to the theoretical framework for Brazilian subnational units, climate paradiplomacy and climate federalism should have a positive and reinforcing linkage. Notwithstanding, paradiplomacy can also be a means for subnational actors' independent engagement in the international realm since a transnational action is not controlled by central policy organs (Setzer, 2013: 37). Also, there is no clear regulatory framework and moderate support from the Brazilian federal government for paradiplomacy, and transnational action can also be an alternative for engagement in the case of national paralysis or conflict between national and subnational actors.

As for transnational networks, Finnemore and Sikkink (1998: 902) consider that they can foster processes of international socialization to adopt norms and monitor compliance, being a mechanism of norm cascading. Four interviewees indicated that transnational networks are relevant to the climate change agenda at the subnational level, and five out of eight people that answered the specific

question about which governance processes are relevant for climate commitment at the subnational level pointed out association to transnational networks.

Happaerts (2012) also indicates that the diffusion of policy models is a role of transnational networks in the case of subnational actors since the UNFCCC framework does not provide any guidance beyond reporting. Brazilian federated units are associated chiefly with transnational networks with capacity building and implementation as the primary governance functions. There was no transnational network with a rulemaking governance function, limiting subnational actors' feedback to the institutional core.

Nevertheless, element #3 is where "polycentric drivers" may appear. They are defined as interactions with multiple governing authorities (including civil society and private actors) in an autonomous fashion, based on self-organization and coordination dynamics and motivations related to the overarching rules but not limited to them.

The pieces of evidence considered for element #3 are:

- the type of paradiplomacy actions – objectives, channels, relationship characteristics, and instruments;
- participation in international processes at the institutional core (COPs) and outside it;
- association to transnational networks by the type of governance primary function and targets.
- relevant dynamics beyond elements #1 and #2.

Table 31 – Causal mechanism description

Elements' conceptualization	Predicted evidence	Type of evidence used to measure prediction
#1 - Institutional prescriptions (norms and principles) are internalized at the subnational level	Expect to find institutional predictions in laws, decrees, bills, programs, and other policy profile elements.	Policy profile documents Interviews

Elements' conceptualization	Predicted evidence	Type of evidence used to measure prediction
#2 - Climate cooperative federalism and paradiplomacy encourage commitment at the subnational level and mediate subnational units' commitment at the global level	Expect to see policy harmonization at the national and subnational levels and cooperation between the subnational unit and federal government.	Policy profile documents Governance processes timetable Interviews
#3 - Transnational actions through paradiplomacy and transnational networks (agents of socialization)	Expect to see subnational units' paradiplomacy actions and participation in transnational networks according to their type of association, targets, promotion of policy models, programs, and instruments, and access to funding.	Policy profile documents Paradiplomacy actions Adhesion documents to transnational networks Interviews
SCCI reflects the engagement with institutional predictions, climate federalism, paradiplomacy, and participation in transnational networks	Expect to see the outcome according to commitment to each part of the causal mechanism.	SCCI and principal component analysis

Source: Author's elaboration.

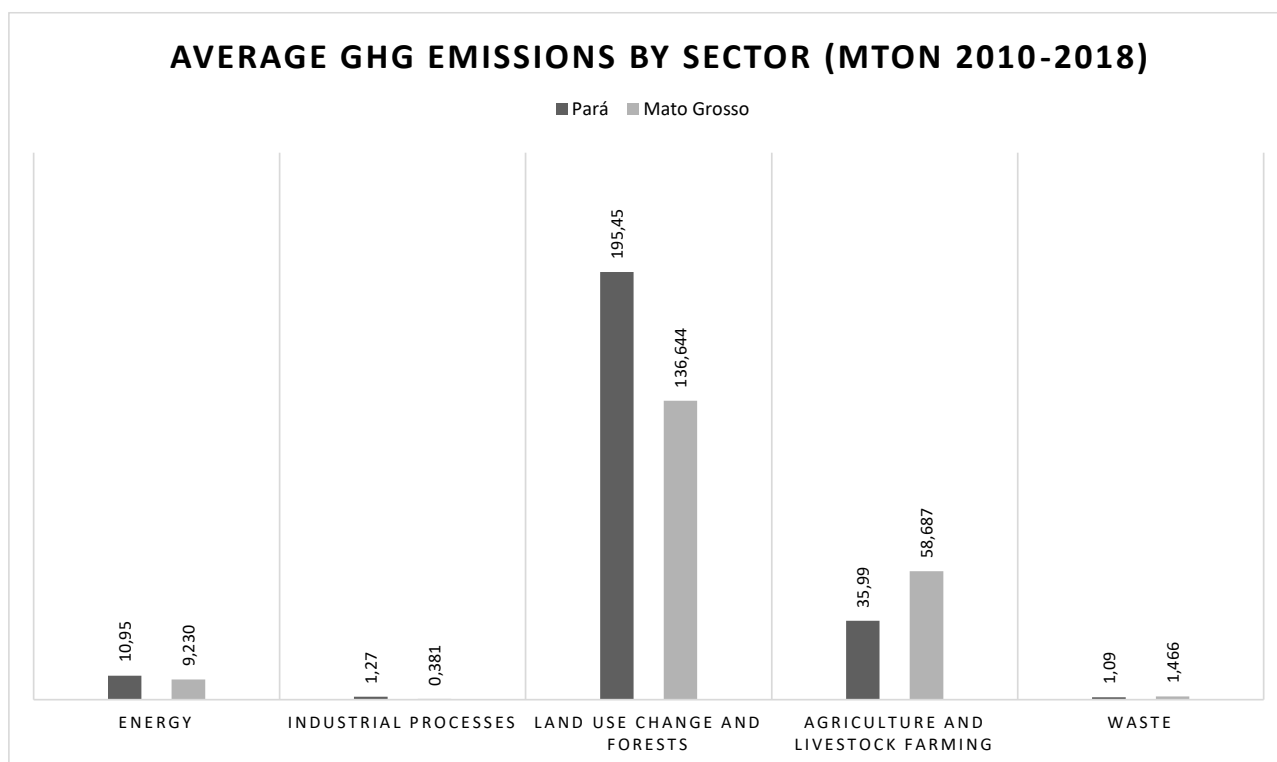
5.2 Mato Grosso and Pará climate commitment

The state of Pará has 1.2 million km², and 71% is covered by forests (Cenamo and Soares, 2014). The population in 2018 was 8.5 million people and GDP US\$ 72.15 billion, with an average growth of 21% from 2010 to 2018. Mato Grosso has 0.9 million km² with 60% of remnant forests. The population in 2018 was 3.4 million people and the GDP US\$ 61.5 billion, with an average growth of 51% from 2010 to 2018.

The economic profile¹¹⁴ demonstrates that the agriculture and livestock farming is stronger in Mato Grosso. The subnational unit has the largest soy production and the biggest cattle herd in the country. In 2010, both subnational units had a similar amount of revenue from this sector – R\$ 8 billion. In 2018, Mato Grosso reached R\$ 25.7 billion while Pará had about R\$ 15 billion. Pará (R\$ 45.5 billion) has a bigger revenue from the industrial sector than Mato Grosso (R\$ 19.4 billion). The services sector has the largest share in both subnational economies – R\$ 56.3 billion in Mato Grosso and R\$ 54 billion in Pará.

¹¹⁴ Data source is IBGE, available at https://www.ibge.gov.br/estatisticas/economicas/contas-nacionais/9088-produto-interno-bruto-dos-municipios.html?=&t=series-historicas&utm_source=landing&utm_medium=explica&utm_campaign=pib and <https://www.fapespa.pa.gov.br/sistemas/pcn2021/>. Access on May 1st, 2022.

Graph 26 – Average GHG emissions by sector (CO_{2e} Mton 2010-2018) for Mato Grosso and Pará

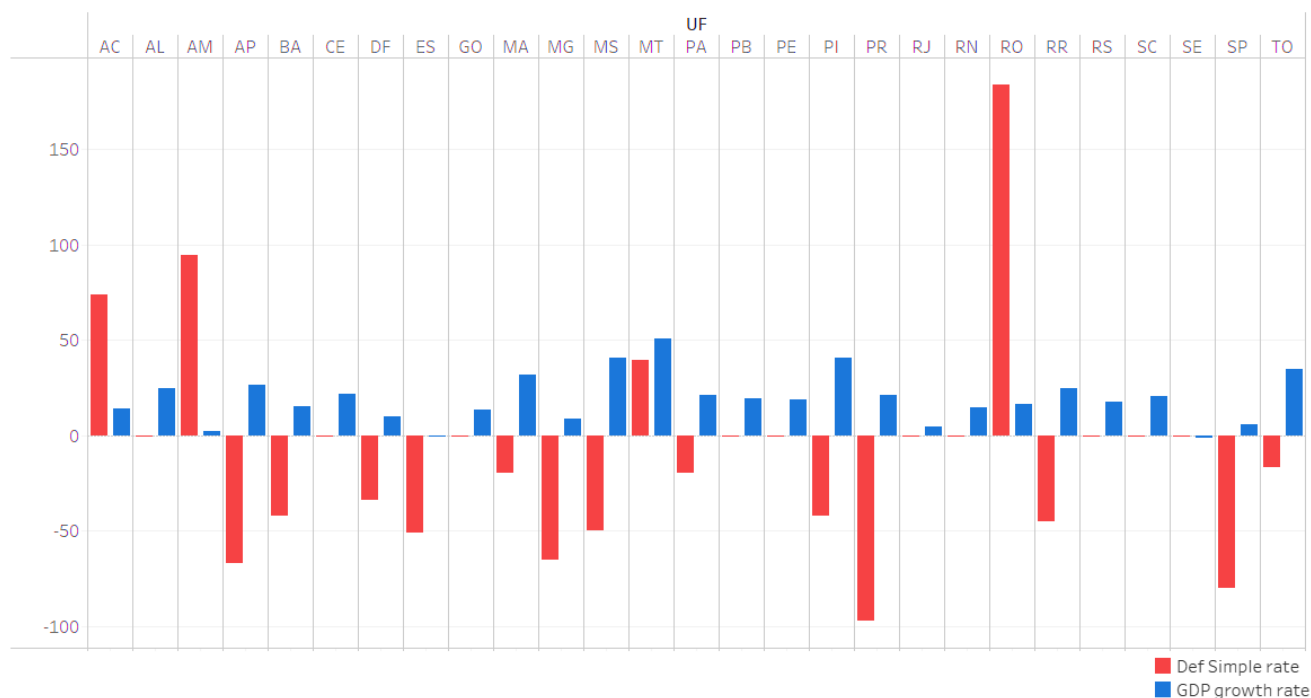


Source: Author's elaboration based on SEEG data.

The two subnational units have the higher GHG emissions in Brazil. From 2010 to 2018, Mato Grosso had an increase of 4% in GHG emissions, with an average of 206 MtonCO_{2e} per year, representing 10,5% of Brazilian emissions. Deforestation in the Amazon and Cerrado biomes increased by almost 40%. GHG emissions in Pará decreased by 3% in the same period, with an average of 244.8 MtonCO_{2e} per year (12.4% of national emissions). Deforestation also decreased by 19.5% in the Amazon biome.

Regarding the GDP, Mato Grosso had an increase of 50.8% from 2010 to 2018, with an average of US\$ 53.03 billion per year (in 2018, the state's GDP was US\$ 61.46 billion). The GHG emissions intensity in the GDP (tonCO_{2e} per US\$ 1,000) decreased by 8%, with an average of 4 tonCO_{2e} per US\$ 1,000 in the period. Pará had a lower economic growth (21.2%) but a steeper decarbonization trend: a reduction of 35.2% of GHG emissions intensity in the GDP. The state's GDP average was US\$ 67.5 billion (US\$ 72.15 billion in 2018) and had an average of 3.6 tonCO_{2e} per US\$ 1,000 in the period.

Graph 27 – Comparison between deforestation and GDP growth rates between 2010 and 2018 in %



Source: Author's elaboration based on World Bank (2020) and data from Prodes.

Pará's results do not necessarily mean a decoupling of the state's economy with GHG emissions since the emissions profile is mainly related to agribusiness and land-use change, which is not the main sector in the subnational unit's economy. As indicated by Viola and Franchini (2018: 98), "economic activities related to deforestation and land conversion in the Amazon ... were not an important driver of economic growth" since a very significant percentage of deforested areas is illegal (Mapbiomas, 2020). In the case of Mato Grosso, a group of agribusiness industries has assimilated technological innovations towards increased productivity, with a closer relationship with international markets. The soy moratorium also has a relevant role in the state's decarbonization trend.

GHG *per capita* emissions had a decrease of 4.3% in Pará and an increase of 2.5% in Mato Grosso. The average emissions were 30.5 CO_{2e} tons *per capita* in Pará and 64 CO_{2e} tons *per capita* in Mato Grosso. At the same time, both states had a similar population growth in the period: 1.4% in Pará and 1.6% in Mato Grosso, but Pará has more than two times the population of Mato Grosso.

Both states had the same policy profile score - 65.7 – a medium policy commitment. In the case of Pará, located in quadrant-II, there seems to be a positive relationship between policy and emissions profile. For Mato Grosso, quadrant-I's position refers to a better policy with a worse emissions profile. Although they have the same score, Mato Grosso has a structured climate policy around REDD+ and the PCI Strategy, while Pará has scattered actions since 2009 (Sousa et al., 2015: 17). Therefore, the causal mechanism analysis will address each case specifically to understand how these subnational units commit to global climate governance and explain the difference between their final scores.

5.2.1 Layer #1 – Institutional prescriptions

International pressure, international targets, and international cooperation are motivators listed by eight interviewees to explain why subnational governments have included climate change in their agenda. Ten interviewees also mentioned the opportunity to have access to financial resources. Interviewee B1 was the sole one to mention that subnational governments struggled for recognition at the institutional core due to national governments' resistance.

Deforestation was a relevant domestic driver for action at both national and subnational levels but is not always acknowledged as related to climate change. Interviewee B3 pointed out deforestation as a unifying theme for Amazonian states, and interviewees H1 and H2 stressed that it also had a local to global convergence with incentive from REDD+, especially considering access to financial resources.

Emissions reduction from deforestation appeared on the UNFCCC agenda for the first time in 2005, brought up by Costa Rica and Papua New Guinea, and civil society organizations. In 2007 (COP 13), the concept was broadened to Reducing Emissions from Deforestation and Forest Degradation and other activities, thus becoming REDD+ (Shin et al. 2022) concerning the following five activities: reducing emissions from deforestation, reducing emissions from forest

degradation, conservation of forest carbon stocks, sustainable management of forests, and enhancement of forest carbon stocks.

The REDD+ Taskforce set up by the Brazilian presidency according to the Amazonian Governors' Forum demand, which recommended in its report, published in 2009 that the Brazilian government should make an effort for the inclusion of REDD+ within the UNFCCC.¹¹⁵ It also recommended the participation of the Amazonian governors in COP 15, together with the president, to make a stand regarding forests and climate change. Interviewee C2 indicated the connection between Amazonian states' demand and REDD+ debates within the UNFCCC.

According to the UNFCCC REDD+ information hub, UNFCCC parties adopted 13 decisions regarding REDD+ from 2007 to 2013¹¹⁶. For Azevedo et al. (2013), REDD+ development within the UNFCCC faced delays in international negotiations. In COP 19 in 2013, the parties approved the Warsaw Framework, which allowed the development of a market approach for REDD+. However, according to Hoff et al. (2015: 43), UNFCCC's REDD+ would be, at least until 2020, a "result-based non-market mechanism that depends mainly on donations to the Green Climate Fund."

The Brazilian reporting to the UNFCCC information hub has mainly the governments of Norway, Germany, and the United Kingdom as the entities that pay for the results. The Green Climate Fund had a share in payments from 2014 to 2015, and resources from Petrobrás, a national state company, in 2006.¹¹⁷ Speranza et al. (2013: 76) report that by 2013 Acre, Amazonas, Pará, and Mato Grosso have raised funds for REDD+ projects. Brazil has one REDD+ approved project with resources from the Green Climate Fund and the UNDP as the accredited entity.¹¹⁸ It entered the pipeline in 2018 and was approved in 2019

¹¹⁵ See point 12 of the task force report, available at <https://www.terra.com.br/noticias/ciencia/sustentabilidade/relatorio-da-forca-tarefa-sobre-redd,f838a4b635aab310VgnCLD200000bbcceb0aRCRD.html>. Access on March 30th, 2022.

¹¹⁶ See <https://redd.unfccc.int/fact-sheets/unfccc-negotiations.html>. Access on April 21st, 2022.

¹¹⁷ See <https://redd.unfccc.int/submissions.html?country=bra>. Access on April 21st, 2022.

¹¹⁸ See <https://www.greenclimate.fund/project/fp100> and <https://www.greenclimate.fund/sites/default/files/document/funding-proposal-fp100-undp-brazil.pdf>. Access on March 19th, 2022. This evidence is also present in CONAREDD+ meetings

with a total value of US\$ 96.5 million for results-based payments for results achieved in Brazil in 2014-2015 in the Amazon biome. Only Acre and Mato Grosso have been eligible to access resources from results-based payments (CONAREDD+ Resolution n. 10). The Ministry of Environment (MMA) and the Amazon Fund are the other two institutions that can receive resources. Nevertheless, according to information in the Brazil Information Hub, resources from the GCF were directed to the MMA Project called Forest+.¹¹⁹ Resources to subnational units were from REDD+ for Early Movers (REM) projects with KfW and the Government of the United Kingdom.

The internalization of norms and principles from the institutional core in the cases of Mato Grosso and Pará were mainly related to forests. Mato Grosso had issued a state law for REDD+ before a state policy for climate change. Azevedo et al. (2013: 4) inform that Mato Grosso's REDD+ law development started in 2010 with public hearings. The bill was developed within the state climate change forum, and REDD+ state law approval was in 2013 (9,878/2013). The law's principles and objectives (articles 3 and 4) refer to international agreements about forests, climate change, biodiversity, and traditional and indigenous communities' rights that Brazil is a signatory, to the National Policy for Climate Change (PNMC), and state plans and programs. There is no direct mention of international elements from global climate governance. Article 32 allows cooperation agreements with foreign public and private institutions to implement the REDD+ state system's objectives. In 2014, REDD+ was a recurrent theme at the State Climate Forum meetings.¹²⁰ Interviewee C3 declared that Mato Grosso had high hopes for the REDD+ mechanism, and interviewee D1 considered that being part of the REDD+ debate was relevant for capacity building in the state.

In 2015, Mato Grosso presented the PCI Strategy at COP 21, in Paris.¹²¹ The strategy has three axes – production, conservation, and inclusion - and 21

reports and GCF-TF's report on the status and needs for REDD+ in Brazil, Peru, Mexico, and Indonesia (Murray et al., 2015).

¹¹⁹ See <https://infohubbrasil.mma.gov.br/pt/resultados-e-pagamentos>. Access on March 19th, 2022.

¹²⁰ See documents from the Climate Change Forum from Mato Grosso - <http://www.sema.mt.gov.br/site/index.php/decisao-colegiada/forum-de-mudancas-climaticas>. Access on March 15th, 2022.

¹²¹ See <http://pci.mt.gov.br/> and <https://www.pcimt.org/images/flyerPCI.pdf>. Access on April 23rd, 2022.

targets that impact GHG emissions. The strategy's governing structure was a state committee composed of 43 entities from government, private sector, and civil society. In 2019, a Decree established a private association called the PCI Institute¹²² to promote coordination between the stakeholders, identify opportunities, implement the actions, and monitor the programs. The climate change state law in Mato Grosso was approved in 2017. The law's objective is to be part of the global effort to reduce emissions and attain the necessary conditions to adapt to climate change impacts. The law also acknowledges (art. 25) programs and projects created within the Clean Development Mechanism or a subsequent mechanism created in the international regime and their implementation in the state.

Pará had difficulty establishing a climate agenda (Gueiros et al., 2021), having diffused policies, programs, and actions from 2009 to 2019, with low institutionalization and mainly related to the forest issue (Sousa et al., 2015). Interviewee B3 mentioned that the publicization of deforestation rates by the federal government (the fire arc) exerted pressure on some subnational governments. This was the case of Pará and the Green Municipalities Program, which started as a municipal-level program in 2008 and became a state-level program in 2011 (Decree 54/2011¹²³). Lucas do Rio Verde municipality in Mato Grosso, and Paragominas municipality in Pará were leaders in developing solutions to curb deforestation and promote local development. These initiatives – the Environmental Rural Registry (CAR) in Mato Grosso and the Green Municipalities Program in Pará – became national and state policies, respectively (Viana et al., 2016).

The Green Municipalities Program focused on curbing deforestation and on sustainable rural production through land regularization and environmental management at the local level (Pará Government, n.d)¹²⁴. Since 2013, it has been supported by the Amazon Fund (Gueiros et al., 2021: 15-16). However, land regularization in Pará has stalled due to the lack of technical support (Gueiros et al., 2021, and interviewees B4 and C4). The Green Municipalities Program was

¹²² See <https://www.pcimt.org/index.php/pt/>. Access on April 23rd, 2022.

¹²³ See <https://www.semam.pa.gov.br/2011/03/30/9715/>. Access on April 23rd, 2022.

¹²⁴ See <https://www.municipiosverdes.pa.gov.br/>. Access on March 19th, 2022.

not mentioned, or only mentioned by incentive, in interviews with public servants from Pará. Interviewee C6 noted that the Program's format has changed. Interviewee B4 made some critics about the Program since it became a project supported by the Amazon Fund because it lost its characteristic of a public policy and became a project.

Interviews did not report a relevant engagement of Pará with REDD+. Sousa et al. (2015: 33 and 50) reported 24 REDD+ projects in Pará until 2012, but it was not possible to identify specific information about these projects. Their recommendation for REDD+ in the state of Pará is to follow safeguards recognized by Brazil in international agreements. The state's climate law, published in 2020, recognizes the common but differentiated responsibilities principle (art. 2) and indicates that the state climate policy joins the global effort for climate change mitigation (art. 5).

Table 32 – Element #1 evidences for Mato Grosso and Pará

Expected evidence	Mato Grosso	Pará
- the time frame of policy development at the subnational level and relationship with international events and institutional prescriptions;	- REDD+ Law (n. 9,878/2013) is prior to REDD+ national strategy and national committee (2015). - The PCI Strategy was launched in 2015. - Climate change state law in 2017 (n. 582/2017).	The state had multiple actions from 2009 to 2019 related to different issues but did not articulate a climate agenda. - 2011 – Green Municipalities Program - Climate change state law in 2020 (9,048/2020)
- how international norms and principles permeate the policy profile;	Law 9,878/2013 REDD+ - principles and objectives (articles 3 and 4) are related to international agreements about forests, climate change, biodiversity, and traditional and indigenous communities' rights that Brazil is a signatory, and the National Policy for Climate Change (PNMC). - Law 582/2017 State Climate Policy – the law's objective refers to the global effort to reduce emissions and acknowledges programs and projects created within the international regime.	- Law 9,048/2020 – the state climate policy joins the global effort for climate change mitigation and acknowledges the common but differentiated responsibilities principle.
- the issue definition at the subnational level (convergent or not with overarching rules);	- REDD+ at the subnational level is convergent with international debates (Hoff et al. 2015: 42). - PCI Strategy was inaugurated at COP 21.	- State law does not mention the international climate regime directly but refers to its principles.

Expected evidence	Mato Grosso	Pará
	- State Law refers to the international climate regime mechanisms.	

Source: Author's elaboration.

Finally, element #2 describes how subnational units and the federal government positions have a long-time disagreement about REDD+ and carbon markets based on different discourses (Hoff et al., 2015). Centro Brasil no Clima (CBC) is now supporting a governors' coalition which requests the establishment of a regulated carbon market¹²⁵ and international negotiations around Article 6 of the Paris Agreement will influence policy processes at the subnational level.

5.2.2 Layer #2 – Climate federalism

Hochstetler and Keck's (2007) description of national environmental politics and policies considers that national factors had more influence on the development of national institutions and environmental policies in Brazil than international drivers. Interviews mentioned that constitutional responsibility is a relevant motivation for subnational units to include climate change as an issue in their agenda. However, they show a heterogeneous perception of the relationship between subnational governments and the federal government. They cite financial dependency of subnational governments, independent relationships, good relationships, alignment *versus* low integration, hostility, and anomaly. Financial dependency was also considered an impediment to climate commitment at the subnational level (interviewee A1), and some interviews mentioned dialogue in specific instances and an issue-based relationship.

The characterization of the relationship between levels was not related to the type of actor interviewed, but civil society interviewees were the only ones who perceived an independent relationship. The state of affairs between the federal government and subnational units was generally considered better from 2003 to 2018, with a deterioration since 2019. The dialogue varied between different

¹²⁵ See <https://exame.com/negocios/governadores-vao-a-cop-e-querem-lei-do-mercado-de-carbono/>. Access on March 19th, 2022.

national instances – the Ministry of Environment, Ministry of Foreign Relations (MRE), and Ministry of Science, Technology, and Innovation. Interviewees H2 and E1 mentioned that the MRE did not have good relationship with subnational governments, while subnational governments representatives have not made relevant remarks about actions with MRE. Therefore, this finding confirms the theoretical view about climate paradiplomacy that there is no established framework or guidance from the federal government to subnational units.

It was possible to identify the following cooperation mechanisms: the Brazilian Forum on Climate Change – FBMC (2000), the PPCDAm (2004), the Amazon Fund (2008), the NAFC (2013-2014), and CONAREDD+ (2015). State governors are considered invited members of the FBMC, not as effective members. PPCDAm, the Amazon Fund, and the NAFC are top-down processes, while CONAREDD+ is an answer to a bottom-up pressure. One interviewee (B3) also mentioned the Pilot Program for the Protection of Brazil's Tropical Forests (PPG7), which involved the Brazilian national government, G7 countries, state governments, and civil society as a coordination mechanism. The Program lasted from the 1990s to around 2010. Finally, interviewees mentioned that subnational actions were contingent on financial resources from the federal government, and PPCDAm, the Amazon Fund, and CONAREDD+ are elements that condition or regulate resources destination.

Interviewee F1 considered the PPCDAm the main element to motivate a response to UNFCCC principles. Both states – Pará and Mato Grosso - have plans to reduce deforestation in the Amazon Biome - Action Plan for the Prevention and Control of Deforestation and Forest Fires in Mato Grosso and the Plan to Prevent and Combat Deforestation Actions in Pará.

According to the available reports, Mato Grosso is not mentioned in any of the NAFC meetings, while Pará participated in one meeting. The Amazon Fund offered strategic support for subnational governments to curb deforestation and climate change (Speranza et al., 2013: 40). Both states have three projects each

approved in the Amazon Fund¹²⁶ - Mato Grosso with the total amount of R\$ 120,434,200.09 from the Amazon Fund and Pará R\$ 108,050,079.12.

The implementation of REDD+ in Brazil is related to climate federalism, but subnational actions were previous and informed the development of the national strategy (Speranza et al., 2013: 43). Nevertheless, the relationship between the federal government and subnational actors was sometimes conflictive regarding specific issues, such as carbon markets. For Murray et al. (2015), there was low coordination between federal and subnational governments and a lack of information sharing in REDD+. The CCT-Pact of CONAREDD+ had efforts to gather information about subnational governments' REDD+ actions to foster coordination between them and ENREDD+, which the Federal Government presented at COP 21 in 2015.

According to Hoff et al. (2015), the federal government had a discourse grounded on sustainable development, and REDD+ would offer financial support to existing national policies, such as PPCDAm. The practical dimension of this discourse is the centralization of projects and the distribution of financial resources through the Amazon Fund, which received US\$ 1,2 billion from Norway and Germany (through the German Development Bank - KfW) and resources from Petrobras.¹²⁷

Nevertheless, subnational states have a discourse of carbon commodification, which means carbon-offset trading in voluntary markets. This debate dates since the Palmas Letter in 2009, when Amazonian subnational governments pressured the federal government to support the creation of a market-based REDD+ scheme in COP 15 (Sousa et al. 2015: 30 and May et al., 2016: 63 and reported in CONAREDD+ and CCT-Pact meetings¹²⁸).

May et al.'s (2016: 62-66) chronology for REDD+ in Brazil demonstrates the opposition between the discourses and how subnational projects (around 2007-2008) and subnational laws (2010-2013) are prior to the definition of a national

¹²⁶ See Amazon Fund projects - <http://www.fundoamazonia.gov.br/pt/home/#>. Access on March 19th, 2022.

¹²⁷ See <http://www.fundoamazonia.gov.br/pt/fundo-amazonia/doacoes/>. Access on March 19th, 2022.

¹²⁸ See CONAREDD+ meetings reports - <http://redd.mma.gov.br/pt/reunioes>. Access on March 9th, 2022.

strategy (first debates around 2010 and the strategy's publication in 2015). The sustainable development discourse has a dominant position, and Brazil was able to scale up the Amazon Fund governance structure at the UNFCCC framework for REDD+ at COP 19 – the Warsaw Framework for REDD+ (Hoff et al., 2015: 43).

For interviewee B3, CONAREDD and the National Strategy for REDD+ have influenced the development of state policies for climate change. Pará and Mato Grosso have participated in CONAREDD+, where Mato Grosso had a leading role as the appointed representation of state governments. Mato Grosso and Acre have REM Programs, and the PCI Strategy development in Mato Grosso was independent of the federal government.

Sousa et al. (2015: 29) mention that the Forum of Amazonian State Secretaries for the Environment was also a locus for dialogue between subnational and national levels. The Forum was a product of Brazilian states' articulation within GCF-TF and had the task force's support through a local facilitator – the non-governmental organization Institute of Conservation and Sustainable Development of the Amazon (IDESAM). Other subnational elements, such as consortiums and the Brazilian Association of State Environmental Entities, were also mentioned in interviews (B2, B3, B4, C1, C2, C3, C5, C6, E1, F3, and H1) as related to global climate governance at the subnational level.

In the case of Pará, the Federal Prosecution Service (Ministério Público Federal) has a relevant role in policy processes at the subnational level. It acts in federal cases, independent of the executive, legislative, and judicial powers. Sousa et al. (2015) and Gueiros et al. (2021) consider that Conduct Adjustment Agreements (Termos de Ajuste de Conduta – TAC) regarding cattle raising and soy production, and the Green Protocol for Grains were important for deforestation reduction in Pará. These agreements had the support of Greenpeace and had the state government, private companies, supermarket chains, slaughterhouses, and big farms as parties.

Six interviewees (C3, C5, C7, D1, F3, and G2) presented information about Mato Grosso but none cited the Soy Moratorium (conduct adjustment agreements for soy production) impact on the subnational unit. However, they mentioned that private markets and access to financial resources were

motivators for commitment. Mato Grosso and Pará also signed the Commitment for Zero Illegal Deforestation till 2020 with the Ministry of Environment at a parallel event in COP 21 in Paris in 2015.¹²⁹ However, this commitment was not mentioned in the interviews or in other primary or secondary sources.

Interviewee B1 critiqued polycentric governance on normative grounds because his/her position was based on a regulatory perspective, which points to a closer relationship between subnational units and the federal government. At the national level, interviewee A1 considered that the national state is a gatekeeper because of the global status of climate change. However, the states of Pará and Mato Grosso's actions question the economic power structure of the Brazilian federation because their economic activities are not directly related to other subnational units, there is room for conflict between economic elites in the country, and they influence decision-making at the national level.

Table 33 - Element #2 evidences for Mato Grosso and Pará

Expected evidence	Mato Grosso	Pará
- the time frame of policy development at national and subnational levels;	- REDD+ policy development at the subnational level was prior to the national level. Nevertheless, state law's principles relate to state and national laws and policies, like PPCDAm. Regarding international agreements, it refers to those in which Brazil is a signatory (accordingly to climate federalism).	- Scattered actions strongly related to federal programs and policies, like PPCDAm, Low Carbon Agriculture, Green Municipalities Program, and Conduct Adjustment Agreements.
- cooperation mechanisms between national and subnational levels;	Representation of subnational governments at CONAREDD+ from 2016 to 2018 (same technical staff in 7 of 8 meetings) Participation in the CONAREDD+ Thematic Consultative Chamber on the Federative Pact – same technical staff in all meetings. The subnational unit focused on REDD+ cooperation mechanisms (interview C5) 3 Projects approved by the Amazon Fund (R\$	Civil society participation in the CONAREDD+ Thematic Consultative Chamber on the Federative Pact Representation of subnational governments at CONAREDD+ as a surrogate. Participation in 4 of 8 meetings, with a change of technical staff in the last meeting in 2018. Participation at the NAFC (one meeting)

¹²⁹ See <http://redd.mma.gov.br/pt/component/k2/item/498-desmatamento-zero-ate-2020-no-ac-e-mt>. Access on March 19th, 2022.

Expected evidence	Mato Grosso	Pará
	120,434,200.09) between 2012 and 2018; one is finished.	3 Projects approved by the Amazon Fund between 2010 and 2014 (R\$ 108,050,019.12); two are finished. The Green Municipalities Program is the sole ongoing project in the Amazon Fund. Project approval was in 2014.
- compliance mechanisms in national norms for subnational governments;	PPCDAm Amazon Fund CONAREDD+ issued resolutions about eligibility, monitoring, and limits. Art. 25 of REDD+ state law foresees the possibility of using REDD+ units in carbon markets. This was a contentious issue at CONAREDD+ between subnational governments and the federal government, which opposed these terms.	PPCDAm, the Amazon Fund, and the Conduct Adjustment Agreements are the more relevant.
- scaling-up and entrenchment of subnational actions;	REDD+ projects and subnational government positions.	Green Municipalities Program
- the type of relationship between subnational and federal governments;	According to interviewees C3 and C5, the relationship happens when necessary (e.g., REM Program) and is not specific to the climate issue (deforestation, land regularization, etc.). Subnational governments from 2003 to 2019 varied in their parties position to the federal government. Interviewee F2 reported that the PCI Strategy development was independent of the federal government.	Interviews reported that, in general, there is a good relationship and a financial dependency. From 2007 to 2011, the state government was from the same political party as the federal government. From 2003 to 2007 and 2011 to 2019, it was an opposition relationship between parties at subnational and national levels. The newly elected state government (2018) has a more evident opposition to the federal government.
- issue saliency in political juncture.	The climate forum at the subnational level was active in developing the REDD+ and climate state policy bills. Transitions in governments did not have a high impact on policies continuity.	Transitions in government had a high impact on policies fragmentation and continuity. However, the state climate policy is recent, and it has been challenging to integrate actions.

Source: Author's elaboration.

Finally, partisanship had different dynamics in Mato Grosso and Pará. In the former, the subnational government did not directly align with the federal government, which was from the Workers' Party (PT). From 2003 to 2010, the state governor was Blairo Maggi from the Popular Socialist Party (PPS), followed by Silval Barbosa from the Brazilian Democratic Movement Party (PMDB) from

2010 to 2015, and Pedro Taques from the Brazilian Social Democracy Party (PSDB) from 2015 to 2019.

In Pará, the governor from 2003 to 2007 was Simão Jatene, from PSDB. Ana Julia Carepa, from the Workers' Party (PT), was the state governor from 2007 to 2011 when there were more climate-related subnational processes (participatory forum, plans, programs, and adherence to transnational networks). From 2011 to 2019, she was followed by Simão Jatene from PSDB. It is possible to question if the party alignment was a relevant driver for the impact of climate federalism in Pará.

5.2.3 Layer #3 – Transnational actions

According to interviewees G1, B3, and C4, the climate agenda is a means for subnational leaders to gain visibility and political leverage. Interviewee G1 also considers that Amazonian governors act cohesively and that subnational governments join transnational networks that offer support and secure financial resources. Interviewees H2, C5, C7, and D1 listed the private sector among the motivations for the inclusion of climate change in the agenda at the subnational level, particularly for Mato Grosso.

In 2007, the states of Mato Grosso, Pará, Amazonas, and Amapá signed a Memorandum of Understanding with the states of California, Illinois, and Wisconsin at the Governor's Climate Summit for cooperation on climate change and commitments to develop regulations to reduce deforestation (May et al., 2016: 63). In 2009, Amazonian governments debated a unified position for COP 15¹³⁰ at the Katoomba Meeting in Brazil.

The Governors' Climate & Forests Task-Force (GCF-TF), established in 2008, was the transnational network most cited in interviews (B3, B4, C3, C5, C6, D1, G1, G2, H1, and H2) and by secondary sources (Azevedo et al., 2013; Speranza et al., 2013; Sousa et al., 2015; Gueiros et al., 2021). The network focuses on capacity building, management, and creating networks and opportunities. Acre was the forerunner, followed by Amapá, Mato Grosso,

¹³⁰ See <http://www5.sefaz.mt.gov.br/-/governadores-de-mt-pa-am-e-ap-discutem-agenda-comum-para-o-cop-15>. Access on March 31st, 2022.

Amazonas, and Pará. The Rio Branco Declaration,¹³¹ which resulted from an annual network meeting in 2014, mentions that subnational governments have made an essential contribution to reducing deforestation but have not received adequate financial support for these actions. Therefore, REDD+ projects would be a means to be awarded for their performance. This narrative is supported by interviewees C3, C5, F1, and G1. However, the commitment to reduce deforestation by 80% until 2020 included in the Declaration is conditioned on receiving support through market and non-market sources.

Interviewee C3 considered the GCF-TF a relevant actor for climate governance, with more than a decade of partnership with the state of Mato Grosso. Interviewee H2 brought up other initiatives such as the 'We are still in' movement in 2016 after Trump's election in the United States and the Alliances for Climate Action, a more recent movement. In the case of the Under 2 Coalition, the adhesion to the transnational network means a commitment to more ambitious targets than the expected share in the Brazilian commitment by its NDC, as indicated by interviewee F1. Mato Grosso is part of the Under 2 Coalition, the R20, and the GCF-TF, while Pará is part of GCF-TF and R20.

Gueiros et al. (2021), in their assessment of the climate agenda in Pará, did not mention the alignment of subnational actions with international elements beyond the GCF-TF network, a perception endorsed by interviewee B4. Interviewee B3 also mentioned that parallel activities supported by civil society that promote debate about policies and actions at the subnational level had attracted the private sector. Moreover, international events that unfold from conferences of the parties were considered less attractive to subnational actors.

In 2010, a private commitment landmark regarding commodities production chains was the Consumer Goods Forum Zero Net Deforestation (ZND) commitment by 2020, which led to the New York Declaration on Forests in 2014 (Jopcke and Schoneveld, 2018). According to interviewee C5, this process had more influence on Mato Grosso than the national policy of 2009. The New York Declaration of Forests also marks a conflictive position between subnational and

¹³¹ See https://www.gcftf.org/wp-content/uploads/2020/12/Rio_Branco_Declaration_ENG.pdf. Access on March 19th, 2022.

federal governments in Brazil since the country did not sign the Declaration, and many subnational governments did.

In the case of Amazonian states, transnational actions supported their pressure on the federal government, especially regarding REDD+. Hoff et al. (2015: 42) report that Amazonian states have also organized parallel activities with carbon traders at COP 20 in Lima. According to UNFCCC archives, the event had the title 'Scaling Up REDD+: Catalyzing jurisdictional leadership with new finance sources and mechanisms'.¹³² The government of Acre, a frontrunner among subnational actors, presented the state's actions.

Also, the CONAREDD+ Thematic Consultative Chamber on the Federative Pact (CTC-Pact) debated in its first meeting about how subnational norms for REDD+ had an interpretation of REDD+ as an instrument not limited to the UNFCCC. The participants mentioned REDD+ jurisdictional programs with cap-and-trade systems and internationally certified projects directed to voluntary carbon markets. The CCT-Pact also elaborated a survey about its activities according to its members' perceptions. The results showed how subnational governments' demands conflicted with the Executive Secretariat because they wanted to address REDD+ beyond the UNFCCC and the ENREDD+ (national strategy). However, this demand was considered to be beyond the CCT scope. This conflict was considered one of the reasons for the decreasing attendance of CCT members in the meetings. Nevertheless, the CCT was able to produce guidance for convergence and harmonization of subnational and national policies for REDD+.

The state of Acre had REDD+ policies prior to the ENREDD+ (see the CONAREDD+ fourth ordinary meeting report¹³³). The first actions of the REM Program with the support of the German government are from 2012. The project's second phase has support also from the British government and technical support

¹³² More information is available at <https://seors.unfccc.int/applications/seors/reports/archive.html>. Access on Marth 19th, 2022.

¹³³ CONAREDD+ 4th ordinary meeting on December 7th, 2017 - http://redd.mma.gov.br/images/conaredd/conaredd_reuniao4_memoria.pdf Access on March 13th, 2022.

from GIZ (see the CONAREDD+ fifth ordinary meeting report¹³⁴). Although Mato Grosso's law for REDD+ was also prior to the national strategy, the REM Program development started after a KfW presentation at CONAREDD+'s first extraordinary meeting in 2016. The project development considered climate federalism and has also gained support from the British government.

Therefore, there is evidence of REDD+ at the subnational level that escapes climate federalism: some REDD+ actions at the subnational level are prior to the national strategy, subnational units perceive REDD+ beyond the UNFCCC and ENREDD+ and, according to Hoff et al. (2015: 39-40), subnational governments have a discourse for REDD+ as carbon commodification, which is aligned with international debates on REDD+ but not with the federal government discourse. Also, subnational states declared that funds raised for REDD+ not related to markets represented only 6% of the total resources of projects in the Amazon from 2006 to 2015 (Hoff et al., 2015). This evidence shows the strength of market dynamics in REDD+ projects in the region, especially for Mato Grosso.

Subnational governments have established independent agreements for REDD+ projects. Germany is one supporter of the climate agenda in Brazil in three different ways: through donations to the Amazon Fund; GIZ projects with subnational units, like the project with Abema, and support to Pará eligibility for REDD+ (interviewee F1), and the German Development Bank (KfW) negotiations with subnational units, in the case of Acre and Mato Grosso in REM Programs (Hoof et al., 2015).

The project REDD+ for Early Movers (REM) is commissioned in Brazil by the German Federal Ministry for Economic Cooperation and Development (BMZ) and financed by German Development Bank KfW.¹³⁵ In the projects in Acre and Mato Grosso, the Ministry of Environment runs the project jointly with subnational governments. According to Brazil Info Hub, Acre and Mato Grosso have already received resources from KfW for their results.¹³⁶ In the case of Mato Grosso, it

¹³⁴ CONAREDD+ fifth ordinary meeting on April 24th, 2018 - http://redd.mma.gov.br/images/conaredd/conaredd_memoria_5areuniaordinaria.pdf. Access on March 13th, 2022.

¹³⁵ See <https://www.giz.de/en/worldwide/73732.html>. Access on March 19th, 2022.

¹³⁶ See <https://infohubbrasil.mma.gov.br/pt/resultados-e-pagamentos>. Access on March 19th, 2022.

was US\$ 14.6 million from KfW and US\$ 22.3 from the Government of the United Kingdom.

According to interviewee B3, international cooperation and private investment from agribusiness were relevant drivers for climate commitment in Mato Grosso. At the same time, in Pará, it was a matter of governmental decision to curb deforestation, attract investments and gain political leverage at national and international levels. For interviewees B4, F2, and H1, the private sector had different roles in both states – while in Mato Grosso it was an active player, it was difficult to promote private engagement in Pará.

Interviewee B4 indicated that the state of Pará did not have an interest in the REM Program because its perspective was that the financial resources would not be received. The context described by interviewee A1 can complement this perception: while in Mato Grosso the agribusiness is market and export-driven, with high technology, focused on productivity, and more sensitive to the international context, agribusiness in Pará is associated chiefly with smaller businesses with a closer link to the internal market, and to illegal activities related land grabbing, cattle, mining, and timber. This last group is antipathetic to international commitments and regulations.

Table 34 – Element #3 evidences for Mato Grosso and Pará

Expected evidence	Mato Grosso	Pará
The type of paradiplomacy actions: objectives, channels, relationship characteristics, and instruments;	<ul style="list-style-type: none"> Actions focus on REDD+ - 2016: REM Program after eligibility approval at CONAREDD+. - State REDD+ system tries to validate carbon credits of forest carbon from state initiatives. - Project REDD+ for EARLY MOVERS (REM) US\$ 36.9 million in payments for results. 	<ul style="list-style-type: none"> Participation in transnational networks and international events. The state did not have a strong link with international elements.
- participation in international processes at the institutional core (COPs) and outside it;	<ul style="list-style-type: none"> - MT at COP 21 – PCI Strategy - Alignment with the private sector through TFA and PCI Strategy - Katoomba meeting in 2009: capabilities for technical staff. - Participation in COPs 	<ul style="list-style-type: none"> -In 2009 and 2010, Pará hosted the GCF-TF meetings and was the task force secretariat - Katoomba meeting in 2009. - Participation in COPs
- association to transnational networks by the type of governance primary function and targets.	<ul style="list-style-type: none"> GCF-TF: founding member GCF-TF Project 'Valuing the forests of Mato Grosso - (climate change state forum meeting 	<ul style="list-style-type: none"> GCF-TF: founding member GCF-TF Project – Window A: support for the elaboration of state law for climate change,

Expected evidence	Mato Grosso	Pará
	report 2019). Resources from NORAD – Norway. Focus on capacity building, technical information about REDD+ initiatives and financial flows of investments, the indigenous consultations of REM Program, and climate vulnerability. Local support from civil society (ICV).	the East Amazon Fund, the PEAA (State Plan Amazonia Now). Local support from TNC.
- relevant dynamics beyond elements #1 and #2.	Support from European countries Resources from private companies	

Source: Author's elaboration and GCF-TF project description available at <https://www.gcftf.org/where-we-work/brazil/>. Access no Marth 16th, 2022.

Mato Grosso's PCI Strategy is supported by the Tropical Forests Alliance (TFA)¹³⁷ and by the REM Program with financial resources. Interviewee F2 also reported that Mato Grosso received €9 million from European governments to invest half in the PCI strategy structure and the other half in agriculture and livestock projects through a memorandum of understanding with the Sustainable Trade Initiative (IDH)¹³⁸ in 2017. According to interviewee C3, the PCI Strategy "is almost like a regional NDC," with bold targets. The combination of the PCI Strategy and the adherence to the UNDER 2 Coalition should have resulted in a comparatively better SCCI result in Mato Grosso when compared to Pará.

Interviewee F2 also pointed out that the IDH-Trade had programs in both states. In the case of Mato Grosso, it was possible to establish a dialogue with many stakeholders (public and private), with state government leading municipalities (top-down governance). In Pará, the strategies are fragmented, and the focus is mainly on conservation. Compared with the PCI strategy, the integration with production (markets) and social inclusion are not well developed.

Interviewees B3, D1, and H2, all from civil society, highlighted that economic motivation was the main incentive for action at the subnational level. Interviewees C7, a governmental actor, and G2, also stressed this motivation. This is an important difference between both states: IDH-Trade and the PCI Strategy show a link with the private sector in Mato Grosso that has no equivalent in the state of

¹³⁷ See <https://www.tropicalforestalliance.org/en/our-work/latin-america/>. Access on March 20th, 2022.

¹³⁸ See <https://www.idhsustainabletrade.com/news/government-mato-grosso-idh-join-forces-sustainable-production-forest-protection/>. Access on March 19th, 2022.

Pará. Interviewee C5 indicated that TFA was a relevant network to link actions to the private sector - companies such as Cargill, Carrefour, Mondelez, Nestle, Marks and Spencer, among others that have a potential to "shape rules in high forest risk commodity global value chains" (Jopcke and Schoneveld, 2018: 9).

Finally, interviews (C4, C7, F1, and G1) mentioned private actions directed to the subnational level: the JBS slaughterhouse proposal to create a fund and private banks' reduction of interest rates (Bradesco, Itaú, and Santander) related to climate actions. Azevedo et al. (2013: 4) also point out commitments related to a zero-deforestation supply chain of commodities and facilitated access to national and international credit for sustainable production.

5.3 Conclusion

The interviewees' perceptions of subnational governments' actions varied. One person (B1) was skeptical about action at the subnational level and polycentric governance. The other (A1) considered that because climate change is a global issue, the national government necessarily mediates action at the subnational level. Other interviews (C1 and B2) stressed the role of subnational actors and that they can act independently from the federal government. In the case of Brazil, and specifically Mato Grosso and Pará, there is room for climate action and the improvement of climate commitment. However, the focus on climate federalism and forests conditions this space while the federal government acts as gatekeeper.

According to this statement, it would be expected that since 2011 there would be a deterioration in climate commitment at the subnational level following the conservative trend of the Brazilian national commitment. However, there was climate policy institutionalization at the subnational level, contentious points between subnational and the national governments and a steeper reaction since 2019 when Brazil became climate negligent toward a deeper conservative trend. Also, subnational units had a slight decarbonization emissions profile on average. This finding demonstrates that although climate federalism somehow conditions climate commitment at the subnational level, it is not the only element related to

it, close to the necessity criteria - if there is climate commitment at the subnational level, there must be climate federalism.

Most cooperation mechanisms between levels are related to the forest issue. Consequently, there was more concertation for climate commitment between Amazonian subnational units. Interviews and secondary sources (see Azevedo et al. 2013) addressed the claim for recognition by some subnational units of their efforts to curb deforestation and a deserved compensation since the Amazon buffer (Viola and Franchini, 2018) would hold the pressure for action over other subnational units.

In both Mato Grosso and Pará, international institutional prescriptions were more relevant regarding REDD+ or other mechanisms related to deforestation. The UNFCCC was mentioned in state norms mostly regarding its principles and financial mechanisms to address forest conservation or restoration adequate to subnational conditions and according to the Brazilian national position at the international level. Mato Grosso has a more structured policy profile, centralized in REDD+ and the PCI Strategy. Pará had a scattered policy profile with disjunct actions. Therefore, institutional prescriptions are relevant, but not necessary nor sufficient, especially because of how the problem is translated at the subnational level (mostly related to the forest issue) and the emissions profile for both cases.

Climate federalism was very strong in the case of Pará. The Green Municipalities Program, the PPCDAm, the soy moratorium, the Conduct Adjustment Agreements for cattle raising, and the Green Protocol for Grains were the most relevant actions for curbing deforestation. Interviewee B4 called Pará's actions an alignment with independency, and all of these elements are related to actions at the national level. In the case of the Green Municipalities Program, Gueiros et al. (2021) consider that the program implementation has not achieved a greater impact than the federal actions already in place (such as PPCDAm implementation at the state level). Also, the Green Municipalities Program continuity was mostly due to external resources and accountability conditions from external actions – the federal government and foreign funders through the Amazon Fund.

Recently, Pará has been undergoing a process of policy structuring with the Amazon Now Program, which has four streams of action: command and control

to reduce deforestation and burning, land dimensions and environmental regularization, technical support for productive restoration and efficient land use, and the East Amazon Fund, to raise funds from private investors. Pará government presented the Amazon Now Program at COP 25 in Madrid and the the Green Municipalities Program is not part of the new program. The Amazon Now Program structure resembles the PPCDAm (Speranza et al., 2013: 35) and, according to interviewees C4 and C6, is a substitute for the deforestation program at the state level, which ended in 2020.

REDD+ determines climate federalism in the case of Mato Grosso. The subnational government had active participation in CONAREDD+ until 2018, unlike the NAFC. Nevertheless, the subnational government has a different position from the federal government regarding carbon offsets and voluntary markets. International negotiations of Article 6 of the Paris Agreement are relevant for developments at the subnational level. CONAREDD+ meetings reports, the state forum meeting reports, and interviews evidence this opposition.

Specifically for REDD+, it was possible to find a double dynamic: subnational governments that were early movers, like Acre and Mato Grosso, and Amazonian governments in general, through the Amazonian Governors' Forum, exerted pressure on the Brazilian government's position for REDD+, while CONAREDD+ and the National Strategy for REDD+ influenced subnational policies for climate change.

Climate federalism is a necessary element for both cases – if there is climate commitment at the subnational level, there must be cooperative climate federalism. The interplay between subnational and national powers through partisanship was more relevant in the case of Pará. Mato Grosso's policy initiatives in REDD+ and PCI Strategy were not conditioned by the federal government, thought also not conflictive.

Transnational actions and cooperation with private actors were more relevant in the case of Mato Grosso, mostly the REDD+ for Early Movers (REM) and external funding by the German Development Bank – KfW and the British and Norwegian governments. It also received foreign resources for the PCI Strategy, which is independent of the federal government and presented by the

subnational government at COP 21 in Paris. The GCF-TF was the most relevant transnational network for both states.

Transnational actions are sufficient to climate commitment at the subnational level for Mato Grosso and Pará considering their adherence to specific transnational networks, the transnational networks' profile and the dynamics of Amazonian states, like the organization of the Forum of Amazonian State Environmental Secretaries with the GCF-TF support.

One caveat of this causal mechanism is that it does not address civil society actions individually (as one element in the causal mechanism), even though interviews mentioned that it offered technical support in different times and circumstances for subnational governments. This caveat is due to the governance architecture assumption - that global climate governance is more multi-level than polycentric for subnational governmental actors – and to the mapping of explanatory and dependent variables to national and subnational governments' response to global climate governance (Table 29). However, I acknowledge that they can influence the internalization of international prescriptions, climate federalism and transnational actions. For further research, civil society organizations and individual actions may be the units of analysis through the same mechanism.

In the case of Pará, climate federalism was the element with more weight, and it possibly explains the emissions profile, resulting in a better SCCI score. However, according to Gueiros et al. (2021: 27) assessment of climate actions in Pará, the emissions profile results can be attributed to the national government's actions. In the case of Mato Grosso, climate federalism had a smaller weight, while transnational actions and political economy drivers (agribusiness) were more relevant. Partisanship profiles at the subnational level may be part of this finding. Mato Grosso had a more coordinated policy profile than Pará, with REDD+ and the PCI Strategy. Nevertheless, the policies, programs, and actions did not get translated into the emissions profile, which is worse when compared to Pará.

The results of Jörgensen et al.'s (2015) research on subnational governments in different countries pointed out that the level of subnational governments' effort for innovation and experimentation is not proportional to

subnational political and financial autonomy. It does not seem the case for the two cases under study. In Mato Grosso, changes in government did not disrupt the climate agenda. Instead, there was a diversity of projects with financial resources from Europe, the GCF-TF, the REM Program, and innovations, such as the PCI Strategy governance transition to a private association – the PCI Institute. In the case of Pará, the conditions from external resources, like the Amazon Fund, were a relevant driver to guarantee the continuity of the actions, and many interviews declared that government transitions impacted the climate agenda negatively.

In conclusion, for the two cases – Pará and Mato Grosso – subnational climate commitment is explained mainly by climate federalism – national position in global climate governance and how international prescriptions are internalized, having the national government as a gatekeeper. For instance, in issues that subnational governments oppose the national position – REDD+ financial mechanisms – the federal government has succeeded in dominating the national discourse (Hoff et al., 2015) and cooperation mechanisms. Recently, actions have been undetermined or stalled. This is the case of Acre and Mato Grosso, which, according to the federal government in the third ordinary meeting of CONAREDD+ on December 15th, 2020, have not yet received a performance proof certificate from the Ministry of Environment to obtain KfW refund in the REM 2020. According to the Ministry of Environment, the certificates would be issued according to the UNFCCC schedule. Following meetings did not address if the certificates had been issued, but according to the Info Hub Brasil, hosted by the Ministry of Environment, the REM Program in Mato Grosso has received US\$ 36,9 million so far.¹³⁹ No other subnational governments beyond Acre and Mato are eligible at the Info Hub Brasil. This delay in receiving the resources and the changes in CONAREDD+ could represent a disincentive for actions at the subnational level through REDD+ for other subnational units, as mentioned by interviews in the case of Pará.

¹³⁹ See https://infohubbrasil.mma.gov.br/pt/?option=com_projeto&view=projeto&layout=detalhes&id=2. Access on March 28th, 2022.

Finally, data sources presented other relevant findings for further development regarding Mato Grosso and Pará's climate commitment. First, most financial resources for action at the subnational level came from European governments (Norway, United Kingdom, and Germany), while subnational actions from the United States inspired the more recent models for alliances - We are all still in and alliances for climate action (interviewees B2 and H2). Second, the literature mentions identity claims from subnational governments. Only one interview (B1) mentioned this variable and how it makes national governments resist subnational action at the international level.

Third, Amapá, which has a good SCCI score and the best emissions profile score, was mentioned by interviewee B2 as a positive experience. The interviewee quoted that a standing forest is an international asset that is not used, and the subnational government can be an example of environmental protection economic growth. This acknowledgment reinforces SCCI results.

Finally, land use in the two subnational units is very different. In Pará, the federal government is responsible for 40% of the land (according to interviewee C2), and 70% of the territory is federalized (interviewee C4). In Mato Grosso, 40% of the land is in productive areas.¹⁴⁰ This information was stressed by interviewees from the state of Pará, but not Mato Grosso. Regarding land use, the relationship with indigenous peoples was most cited in the case of Mato Grosso, as they are part of the REM Program.

¹⁴⁰ See <https://www.pcimt.org/images/flyerPCI.pdf>. Access on April 23rd, 2022.

CONCLUSION

The introduction presented three main hypotheses to answer the research question of *how subnational actors commit to global climate governance* for two Brazilian cases – Mato Grosso and Pará.

H1: *Subnational actors' commitment is related to the global governance institutional core, represented by the UNFCCC;*

H2: *Subnational actor's commitment is complementary to national positions;*

H3: *Subnational actors commit to global climate governance through transnational actions.*

The broad research context considers a perspective of an endangered world in the Anthropocene, as characterized by Steffen et al. (2015a), Viola and Basso (2016), Pereira and Viola (2019 and 2020), Lövbrand et al. (2020), and IPCC (2022) in which there is increased human pressure on Earth systems, the crossing of planetary boundaries, a path from dangerous to catastrophic climate change and increased risks for ecosystems and human systems. Research about subnational commitment aims to investigate alternatives for global governance and political coordination at the global level in this new context posed by the Anthropocene, which requires new capacities and governance elements for mitigation and adaptation.

For Jäcnicke (2017:118), "Global climate policy occurs in a system of multi-level and multi-sectoral governance." What are the implications for acknowledging that global climate governance is multi-level? Global governance theoretical approaches – multi-level and polycentric – present different analytical and normative perspectives on climate change mitigation. It was possible to identify at least six dimensions in the literature to differentiate them: governance architecture, the dynamics of power, authority diffusion, processes around the overarching rules, increased interaction between state and non-state actors, and transaction costs.

The approaches also have different leading research questions: multi-level governance addresses the adequate level for action, considering that the atmosphere is a global public good (or a common-pool resource). Adler (2008), in this regard, considers the vices of climate federalism: the problem of fit between the global nature of climate change and action at the local level. Interviewee A1 presented a similar perspective for climate commitment at the subnational level in Brazil.

Based on Ostrom's position, the polycentric approach questions the global level as the only adequate locus of action considering the challenge posed by global climate change. However, all levels refer to standard overarching rules. Some of the advantages are experimentation and learning (Ostrom, 2010), while the limitations are free-riding and the measurement of cost and benefits (Dorsch and Flachslan, 2017: 56-57). Many interviewees, especially government representatives at the subnational level, stressed the role of subnational actors in global climate governance.

Distinguishing both approaches does not mean that global climate change is purely polycentric or multi-level. For Brazilian subnational governmental actors, the architecture is perceived as mainly multi-level, which reduces overlapping jurisdictions since the authority borders are more rigid and, consequently, limits responsibilities for each level, as defined by climate federalism and paradiplomacy concepts.

Assuming a more multi-leveled governance implies that the system has a more hierarchical architecture. Nation-states formulated the main institutional elements and are the main players. Therefore, although not exclusively, the impulses are directed mainly from these elements and actors. Another implication is that power is better perceived through a distributional account, having institutional elements as the power core. Non-nation-states, including subnational governments, try to influence the main actors, but their agency as 'governors,' as with their transnational networks, is still restricted.

Notwithstanding, it is not possible to make a strict separation between top-down and bottom-up dynamics in both approaches. This interplay between levels is relevant considering the role of federated countries in the international system: they were six out of the ten major GHG emitter countries in 2018 (CAIT Data Explorer, 2019). The theoretical framework and the context-specific design can

be applied to the other countries in this rank for cross-country and climate federalism research. It also allows the comparison of subnational commitment between countries of different regimes to address the impact of climate federalism. Brazil is the fifth among the six and, as Indonesia, has a relevant share of GHG emissions related to deforestation.

According to research question of *how subnational governments commit to global climate* governance, I demarcated the research from a top-down perspective. A bottom-up point of view would impact the research question and result in different inferences. The climate power approach presented by Viola and Franchini (2018) is also based on a distributional account of power. The theoretical framework in Chapter 2 complements the distributional point of view with a relational perspective. This perspective encompasses bottom-up dynamics, like the use of the climate agenda for independentist claims in transnational networks, bottom-up pressures in domestic policies, and conflictive relationships between subnational governments and their respective nation-states in specific instances, like the case of California in the United States and of Amazonian states in Brazil.

The understanding of power exercise is relevant to identifying which theoretical lenses apply to a specific snapshot of a phenomenon in global climate governance. For Brazilian subnational actors' climate commitment, UNFCCC is not so polycentric as hailed, and transnational networks for subnational actors are strongly related to information sharing and capacity building functions. The institutional core persists as a locus of power exercise, and the hierarchical architecture biases and limits the possible actions of governmental subnational actors. Also, the system's key features, the characteristics of the issue addressed, institutional context, and the behaviors of the actors involved limit scaling up and down and generalization of solutions (Young, 2017: 37, 63-64).

Finally, there are epistemological and methodological implications that ensue from the theoretical framework. Although both approaches (multi-level and polycentric) have a close institutionalist root, they lead to different research questions, and, consequently, to different methodological choices and their employment. Dorsch and Flachsland (2017) works, which characterize climate governance as polycentric, and Jänicke (2017), for whom global climate governance is multi-level, are good examples of such implications.

The multi-method framework developed in Chapter 3 addressed the research questions through different lens: institutionalist and national context-specific perspectives with the diagnostic method, followed by statistical inferences with a formal model to address the 27 Brazilian subnational units and process-tracing to apply a causal mechanism to two specific cases chosen by a most-similar design. It is a problem-oriented design, in which theory is prior to data (Snidal, 2004) and the conclusion show a convergence between the results.

Young's diagnostic method (2008a and 2019) helped the development of a historical perspective of global climate governance institutional elements through a subnational lens. Chapter 4 presented how institutional prescriptions for subnational actors have grown since 2009 at the global level, with momentums at COP 15 in 2009, COP 21 in Paris in 2015, and the Marrakesh Platform for Global Action Agenda in 2016. The Nazca Platform, now called the Global Climate Action Portal, is a showroom for subnational and non-state actors. However, it lacks transparency, and the database has many inconsistencies, as demonstrated by Brazilian federated units' registered actions, especially regarding cooperative actions – the participation in transnational networks.

Data triangulation about transnational networks also showed inconsistencies. For example, it was difficult to draw a timeline, understand the dynamics of their development and change, and draw a 'network of networks' according to subnational units' association. I recommend this development to complement the understanding of global climate governance architecture through a subnational actors' lens.

According to the available data, subnational actors' transnational networks landscape did not present an alternative center where subnational actors would gravitate beyond the UNFCCC. Instead, they are linked to the institutional core since none had rule-setting as their main function. Hickmann (2017) endorses this finding in three case studies at the subnational level (ICLEI, the Gold Standard for Carbon Offsets, and the Greenhouse Gas Protocol): private non-profit and business actors, and transnational governance arrangements rely on and navigate around the UNFCCC.

In the cases of Mato Grosso and Pará, the UNFCCC was a reference, but it was translated chiefly through REDD+ in the former case and by national policies, such as PPCDAm and the Amazon Fund in the last. Also, according to Brose

(2019: 93), most initiatives of climate change policies monitoring and evaluation in Brazil have the support of international technical and financial cooperation by Germany, the Netherlands, Denmark, Sweden, and the United States. Chapter 5 presented evidence of support by Germany through the Amazon Fund, GIZ and KfW, the Netherlands, and the United Kingdom. Nevertheless, the models recently established for alliances between subnational governments allude to North-American experiences.

Pará and Mato Grosso are part of the Governors' Climate & Forests Task-Force (GCF-TF) and R20. Mato Grosso made adherence to the Under 2 Coalition. The GCF-TF was the most cited transnational network in interviews, primary and secondary sources as a relevant driver for action at the subnational level. It was a locus for concertation between subnational actors in Brazil. This kind of concertation was present for Amazonian subnational units but had no equivalent in other regions or among Brazilian subnational units in general until very recently, with the creation of Abema's Climate Technical Chamber and the Governor's Council for the Climate.

The literature (Happaerts, 2012 and Keating, 2013) also addressed territorial identity and identity issues as an explanatory variable to subnational climate action and subnational government's engagement in international issues. Subnational actors have claimed recognition throughout time, and interviewee B1 pointed out that nation-states have resisted, even if the results of parties' engagement are ahead of the necessary actions for climate change mitigation, with a call to non-party stakeholders to act. In the Brazilian case, such claims were not identified.

Consequently, a comparison between the multi-level and the polycentric approaches through the diagnostic method presents a clear board of opportunities and limitations for subnational actors: they are not a substitution, but complementation for NDCs, with no clear regulation, measurement, and procedures for eventual conflicts or overlapping. They refer to the overarching rules, but these rules are translated at the domestic level by a gatekeeper. Subnational actors' role as governors is limited, but they can also act through paradiplomacy and transnational networks. Therefore, global climate governance is not as polycentric as sometimes it is claimed or wished. Perhaps a transition towards a polycentric architecture can foster climate action and commitment

beyond the limitations of the UNFCCC and with more guarantees for the non-party stakeholders since rule development is more organic. However, it risks reaching a lower common denominator.

The inclusion of the climate commitment approach in the theoretical framework results in a governance architecture picture that does not downsize institutional elements (Ribeiro and Inoue, 2019) while recognizing they are not a sufficient explanatory variable. A modified structural position (Krasner, 1982), which places international institutions between the political economy of climate change and climate commitment, addresses this complex phenomenon. This choice fits Young's (2017) definition of climate governance, and there is no incommensurability between this definition and Viola et al. (2013) and Viola and Franchini's (2018) definition of climate commitment, climate powers, and the international system of conservative hegemony. Suppose institutions' effectiveness is low and is not translated into climate commitment. In that case, the international system will result predominantly in a conservative hegemony, the same result that Viola et al. (2013) and Viola and Franchini (2018) arrived at according to individual actions based on political and economic dynamics.

Suppose also that the polycentric approach offers more room for non-nation-states actors. In that case, it should not "disregard the key role of traditional powerful actors with legitimate legal and financial competence, such as sovereign nation-states and intergovernmental organizations" (Dorsch and Flachsland, 2017:59). This assertion is valid for Brazilian subnational units and for policy recommendations to foster climate commitment at the subnational level in the country since interviews and secondary sources highlighted subnational dependency on financial resources from the federal government and how it impacted climate commitment at the subnational level.

The cases of Mato Grosso and Pará also demonstrated that the Brazilian national position, downscaled through climate federalism, was a relevant element between the institutional core and climate commitment. In this case, it does not mean that polycentric dynamics cannot be found, as demonstrated by Mato Grosso's case, and they can be perceived as complementary (Dorsch and Flachsland, 2017:60 and Kuramochi et al., 2020) but do not necessarily guarantee a more reformist climate commitment. Perhaps for other types of

actors, polycentric dynamics may prevail. For that, the framework sketched in Chapters 2 and 5 is useful.

The polycentric dynamics found in the case of Brazilian subnational units were: the signing of the New York Forests declaration in 2014 by Brazilian subnational governments and not by the national government, the Forum of Amazonian State Secretaries for the Environment as a product of the GCF-TF action with Amazonian subnational governments, and the initial bottom-up pressure in REDD+ developments in Brazil. Notwithstanding, the Brazilian government attempted to centralize REDD+ processes in the country.

The replication of this theoretical framework for other non-party stakeholders, like private companies, cities, and civil society organizations, can bring different results. It also helps drawing a broader picture of global climate governance and the opportunities and limitations for climate commitment and action beyond the UNFCCC and nation-states, as claimed by Viola and Franchini (2018), Jordan et al. (2018a and 2018b), among others.

Before moving to the next point, I would like to lay one normative implication of the theoretical framework for the reader: should global governance architecture change towards a more polycentric design for subnational governmental actors? What would be the consequences of trust, self-organization, and coordination? For Dorsch and Flachsland (2017: 60), an

“...uncoordinated fragmentation, with counteracting effects of policies and actions poses a fundamental challenge to the environmental and economic performance of a polycentric approach. On the other hand, the realization of the site-specific mitigation options of multiple actors, of enhanced coordination, and especially of additional co-benefits will most likely decrease the net costs of achieving a specific level of ambition”.

Therefore, we face a trade-off. In my perspective, this trade-off is an invitation to a better understanding of global climate governance architecture through the lens of different actors, acknowledging the different analytical and normative implications for policy and institutional design. This development can help overcome the caveat identified in Chapter 5, which recognizes the

downsized role of civil society in the causal mechanism, even if many interviews mentioned their support for actions at the subnational level.

This research has not tried to do experimental control but rather a statistical control (Finlay, 2009:162) based on descriptive inferences and fully aware of implications regarding the choice of variables and weights and their consequences. Combining statistical methods with process-tracing was not incommensurable since the principal component analysis is the reference for descriptive statistical inferences. PCA applies to a specific group of units and variables and is not generalizable, as is the explaining-outcome process-tracing.

The endeavor was to perform well-reported and documented research while acknowledging its theoretical and methodological choices and limits as an effort to report uncertainty properly. There is a higher risk for specification error than inference errors since the Subnational Climate Commitment Index (SCCI) is open to questions about measurement, even if it has theoretical sound ground and its framework was explicitly reported. Nevertheless, as a first effort to quantify climate commitment at the subnational level in Brazil and offer a statistical exploration of the results, it achieved its aim and is open to further development.

Jänicke (2017: 119) presents the creation or improvement of mechanisms to “monitor the impacts of policy within and across policy levels of the multi-level system of global governance” as policy recommendation from his analysis of multi-level global climate governance. The SCCI, as a measure of institutional efficiency in a governance system and its reading through exploratory statistics, can improve the understanding of processes and dynamics at the subnational level – outcomes monitoring, actions visibility, lessons-drawing, networks, and coalitions building and functioning, and the interactions between levels.

The SCCI offered an analysis based on the prevalence of governance processes and emissions characteristics. The results showed that both profiles (policy and emissions) do not have a positive correlation in the case of Brazilian subnational units. Subnational actors had average low to medium climate commitment and a slight decarbonization trend in their emissions profile.

In this point, it is relevant to remember that SCCI is not based on regression analysis or the relationship between the emissions and the policy profiles. Consequently, I did not consider making normalization, independence or error analysis, but, instead, chose the principal component analysis, which offered

satisfactory and convergent results. It demonstrated two types of behavior: between variables of policy and emissions profile and between the 27 subnational units. For that, it can help the development of regression models for further research about climate commitment – quadrants II and IV present cases where the profiles have a similar behavior, and quadrants I and III have cases with profiles with different behaviors.

Also, Chapter’s 4 conclusion addressed some recommendations for SCCI improvement, such as the inclusion of other variables (e.g. vulnerability and emissions reduction targets), the testing of different weights for the policy profile variables and the emissions profile intensity measurements. A broader implementation of the paradiplomacy concept beyond the participation in transnational networks, which also takes into account independent actions and commitments at the subnational level, such as those presented at international conferences or events, is also recommended.

Considering the inclusion of subnational units’ participation in national GHG emissions, quadrants I and II (see Table 35) concentrate the biggest emissions in the country and where there is prevalence of policy processes. Therefore, they can be a focus for policy action. It also helps understand the diversity of subnational units in the country and the challenges of developing climate policies in Brazil. Finally, Pará and Mato Grosso's results and the analysis through the causal mechanism showed how climate federalism is a relevant element in explaining subnational climate commitment.

Table 35 – Subnational units’ position according to the principal component analysis for SCCI

PCA position	Subnational units
Quadrant I: better policy profile, bigger GHG emissions in 2018 in national percentage, and worse emissions profile;	Amazonas, Mato Grosso, and Rio de Janeiro
Quadrant II: better policy profile, bigger GHG emissions in 2018 in national percentage, and better emissions profile;	Pará, São Paulo, Rio Grande do Sul, Tocantins, Minas Gerais, Paraná, Mato Grosso do Sul, Pernambuco, and Bahia
Quadrant III: worse policy profile, smaller GHG emissions in 2018 in national percentage, and better emissions profile;	Amapá, Maranhão, Goiás, Piauí, Roraima, Alagoas, and Rio Grande do Norte
Quadrant IV: worse policy profile, smaller GHG emissions in 2018 in national percentage and worse emissions profile.	Rondônia, Acre, Santa Catarina, Espírito Santo, Paraíba, Ceará, Distrito Federal, and Sergipe.

Source: Author’s elaboration.

Although Amazonian states are dispersed in the PCA graph (Graph 25), this is mostly due to their size and emissions profile difference. There is indeed a specific dynamic for Amazonian subnational governments' climate commitment that does not have an equivalent to other Brazilian subnational units. For example, São Paulo, as indicated by Hochstetler and Keck (2007), is an independent case, and the motivation to act is related to urban issues – water, transportation, and air pollution – and technical capacity of local bureaucracy.

A “most-similar” design justified the choice for the two case studies – they are the two biggest GHG emitters among Brazilian subnational units and have similar GHG emissions sources but different emissions profiles. Pará has scattered climate actions, a recent specific bureaucracy, and a very recent state law combined with a decarbonizing emissions profile, resulting in a better SCCI score. Mato Grosso has a more grounded and structured policy profile, focused on REDD+ projects and political economy drivers, associated with carbonizing emissions profile. The causal mechanism points to different weights for the three elements that help explain these results. While institutional and transnational elements were the main drivers for Mato Grosso in REDD+, Pará had more influence from climate federalism, including national financial resources.

The case of Acre also deserves attention: it is in quadrant IV, with a carbonizing trend (an increase of 6% of GHG emissions between 2010 and 2018) and a medium policy commitment, slightly lower than Mato Grosso and Pará. Many interviews mentioned Acre as a pioneer in payment for environmental services and REDD+ projects. Therefore, we can assume that its position in quadrant IV was influenced by the subnational units' size since its average GHG emissions were 68 times smaller than the national average (Pará's average emissions were eight times smaller and Mato Grosso's 9.5 times smaller).

After summing-up the research findings, I present again the three hypotheses and the results for the Brazilian subnational units and a summary of Chapter's 5 findings with process-tracing in Figure 8.

H1: Subnational actors' commitment is related to the global governance institutional core, represented by the UNFCCC;

Mato Grosso and Pará's laws referred to the UNFCCC principles, objectives, and mechanisms. REDD+ developments had a stronger influence on Mato Grosso, while institutional prescriptions had a weaker influence in Pará. However, REDD+ had a strong bottom-up influence at the global level by multiple actors (subnational governments and civil society), revealing a more polycentric process. Both states' governors participated in COPs and presented subnational actions – the PCI strategy by Mato Grosso in COP 15 and the Amazon Now Program by Pará in 2021.

H2: Subnational actor's commitment is complementary to national positions;

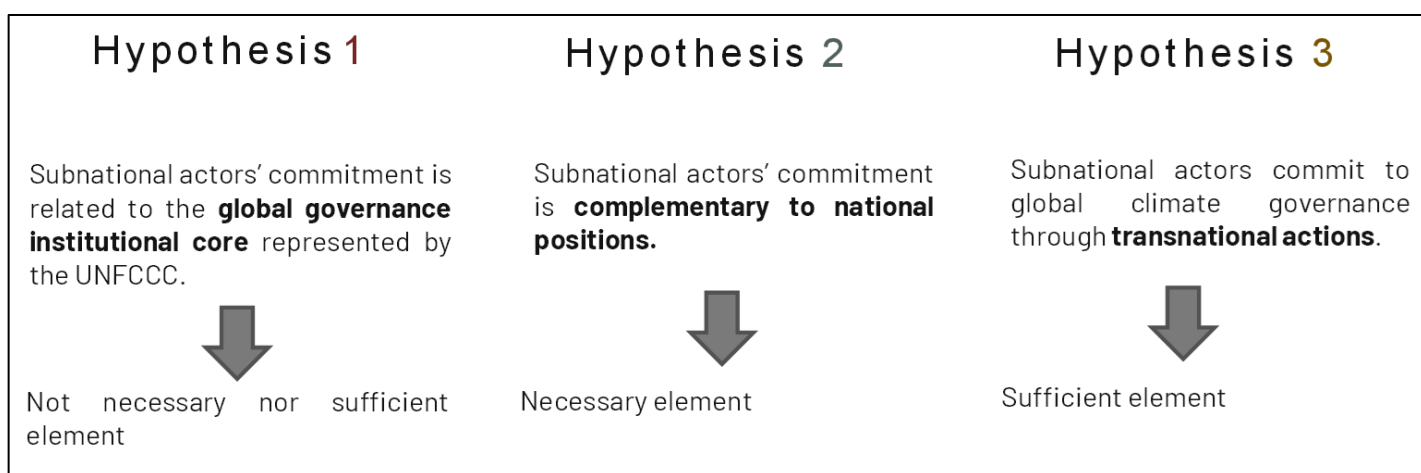
Climate federalism was a relevant element in the causal mechanism. Even in the REDD+ developments, where there was a bottom-up pressure, the federal government tries to centralize the process to avoid the risk of subnational actions' results escaping the national climate commitment. The relationship between subnational actors and the Brazilian federal government was mostly cooperative and enabling (Hochstetler and Keck, 2007), with specific contentious points, like carbon markets in REDD+. Subnational governments are dependent on national resources for climate action and fiscal federalism impacts climate federalism.

Most cooperation mechanisms in Brazilian climate federalism, and the long-lived ones, are related to forest issues. Interestingly, no interviewee from subnational bureaucracy in Mato Grosso mentioned the soy moratorium as a relevant governance process at the subnational level. Climate change and forests are entangled issues in Brazilian climate profile. However, national discourse (Hoff et al., 2015) and subnational practices are sometimes detached, as demonstrated in the contentious point about carbon offsets. The lack of a clear strategy in climate paradiplomacy opens space for polycentric processes, as evidenced by Mato Grosso.

H3: Subnational actors commit to global climate governance through transnational actions

In general, concertation through transnational networks for Brazilian subnational units is concentrated in the Amazon region. Mato Grosso and Pará had different profiles for transnational actions. Their prevalence is more remarkable in Mato Grosso, but they did not necessarily convert to a decarbonizing emissions profile. The GCF-TF was the most relevant transnational network for both cases, and private sector actions were more prevalent in Mato Grosso.

Figure 8 – Process-tracing results



Source: Author's elaboration.

Finally, the research findings – SCCI and the cases of Mato Grosso and Pará - can support policy development in the case of cooperation reestablishment between subnational and national governments in the Brazilian climate agenda. The index's current stage of development and the situation in the country suggest a retake of focus on deforestation, which represents a path, according to Viola and Franchini (2018), away from a deep decarbonization action in Brazil since it is based on the "deforestation buffer". Despite that, the subnational units' map offered by SCCI also presents the position of other subnational units and can support the development of climate policies directed to them.

Interviews indicated that the forest issue had a local to global dynamic, not limited by climate change perception. At the domestic level, Viola and Franchini (2018) indicated a sovereignty paranoia by some groups in Brazil regarding the Amazon biome, and Hoff et al. (2015: 42) reported similar sovereignty concerns

by the Ministry of Foreign Relations regarding carbon offsets in REDD+. Nevertheless, subnational governments pressured the Brazilian government to present and support certain positions at international negotiations, especially for financial mechanisms in REDD+. Even if the Brazilian national government position does not support carbon markets for REDD+, Mato Grosso foresee such a mechanism in its state law.

Many interviewees mentioned that Pará and Mato Grosso should receive compensation for their action in curbing deforestation and, consequently, GHG emissions reduction. One interviewee also mentioned that Brazil's development model has a relevant share of agribusiness and activities that rely on deforestation. Consequently, subnational governments without forests or Cerrado do not act in this regard, and Amazonian subnational units detain the pressure for climate action among Brazilian federated units. However, there is no internal compensation between subnational governments. Also, while there is concertation between Amazonian states, national-wide concertation between subnational governments is very recent, with the markers of the Brazilian Climate Conference in 2019 and the Governor's alliance supported by CBC in 2021.

Therefore, SCCI could be a tool to design a compensation model between subnational governments considering both profiles – policy and emissions, and equity and justice issues. However, initially, it would be based on the deforestation buffer as described by Viola and Franchini (2018), but it could work to foster climate commitment and to make a redistribution of stimulus for action. Climate commitment, as an index, could be a condition and a variable considered to access resources from national and international funds. For that, the improvement recommendations previously mentioned are important.

Considering that climate federalism was a relevant element in the cases of Pará and Mato Grosso, the compensation model should be a national policy, with leadership by the federal government and close negotiation and engagement with subnational governments. However, the development of a compensation mechanism needs thorough research about fiscal federalism in Brazil and alternative sources for financial support. Initiatives like the Green Tax in Pará could work as a model in which resources from a tax are distributed between municipalities that achieve a certain environmental standard. The financial

resources could come from a climate tax based on the climate commitment, and their employment would be bound to the climate agenda at the subnational level.

A national carbon market could be an alternative to a tax. Subnational governments could buy credits from other subnational units to achieve their targets. For example, Azevedo et al. (2013: 22) and Speranza et al. (2013) showed compensation initiatives in the country in Rio de Janeiro and São Paulo – a pilot initiative to create a GHG market in the former and a partnership with Bovespa in the last. This logic, however, implies that all subnational units must have a clear target, and only five of 27 have established targets, with no instrument or process for monitoring or verification at the national level. It also calls for the adhesion of the private sector.

Although there are initiatives like Abema, the Governor's Alliance for Climate Change, or cooperation mechanisms like CONAREDD+ and the NAFC, subnational units have not had a concerted dialogue with the federal government for climate change. The relationship between the two levels has varied through time, bureaucratic entities and subnational units, as described in Chapters 4 and 5, focused mainly on the forest issue. Therefore, while laws and decrees express the desire for internalization according to the Brazilian climate commitment, cooperation mechanisms are fragmented and issue-specific. The NAFC, which had a macro perspective based on the Brazilian national law for climate change, was the most short-lived of them. The cooperation mechanisms related to deforestation received more attention from both levels (national and subnational) – the PPCDAm, the Amazon Fund, and CONAREDD+.

Considering a more multi-level than polycentric architecture lens of analysis in the case of Brazilian subnational units and the two studied cases, a space for concertation or a dynamic for dialogue with a macro-perspective based on climate commitment is an option to foster climate commitment at the subnational level, overcoming the approach based on specific issues and which tend to focus on the “deforestation buffer”. Such a space could also open room for other climate-related issues and foster a true decarbonizing trend in the Brazilian economy. Finally, a macro-perspective is necessary because each climate-related issue works through a different federative dynamic. Addressing this heterogeneity is essential for climate federalism that supports a broad decarbonization process in

the country and the development of a compensation mechanism, which is economically and politically challenging.

This study focused on subnational climate commitment for the period between 2010 and 2018. From 2019 to 2022, when I finish writing this conclusion, the Brazilian national government went through a steeper conservative trend in the climate agenda, with the dismantling of the bureaucratic structure at the Ministry of Environment that addressed the issue, the inclusion of conditionalities in the NDC revision, a paralysis in the Amazon Fund functioning, among other evidence that support the enforcement of a climate negligence in the country.

According to SEEG revised data¹⁴¹, which has information about GHG emissions in 2019, Brazil's emissions for LULUCF had an increase of 5% between 2018 and 2019. Total GHG emissions increased 2.7% in the same period. Data for deforestation from Prodes show a worrisome scenario: a 47% increase of deforestation between 2018 and 2020 measured by deforested area, reaching 11,088 km² in 2020, the highest level since 2009.

This trend puts pressure again on Amazonian states, and specially on Mato Grosso and Pará. This research results, with emphasis on climate federalism as a necessary element for climate commitment at the subnational level in a multi-level architecture, foresees a pessimistic scenario in the near future for Brazilian subnational units' climate commitment. Enforcement from the institutional core and transnational networks will have a relevant role to overcome this scenario.

¹⁴¹ See https://plataforma.seeg.eco.br/total_emission. Access on June 19th, 2022.

APPENDICES

Appendix 1– Brazil national laws, decrees and plans from 1999 to 2020

TITLE	TYPE	DOCUMENT TYPES	DATE_PUBLICATION	DESCRIPTION
Decree establishing the Inter-ministerial Commission on Climate Change (CIMGC)	executive	Decree/Order/Ordinance	07/07/1999	This Decree establishes the Inter-ministerial Commission on Climate Change (CIMGC), composed of nine ministries and headed by the Ministry of Science and Technology, for the purpose of coordinating discussions on climate change and integrating the government's policies in these ministries. The CIMGC provides input on the government's involvement with the UNFCCC and sets criteria and makes decisions on Clean Development Mechanism (CDM) projects Order 533, of 29 August 2000, established the by-laws of the CIMGC.
Laws No. 9.991 and 13.280 on Energy Efficiency in the electricity sector and on National Program for Energy Conservation Funds	legislative	Law	24/07/2000	Law 9.991 provides for the realization of investments in research and development and in energy efficiency by concessionaires, licensees and authorized companies of the electric energy sector, and makes other provisions. Through the Law No. 13,280 (which amends Law 9.991) the National Program for Energy Conservation (Procel) became entitled to 20 per cent of the funds that electricity distributors must invest in energy efficiency actions. It is estimated that the law will help direct to Procel roughly R\$ 100 million per year. It also created the Energy Efficiency Steering Committee (CGEE) and provides to the National Electric Energy Agency (Aneel) the authority to define the schedule of payments and payment of the funds that are to be invested in Procel.

TITLE	TYPE	DOCUMENT TYPES	DATE_PUBLICATION	DESCRIPTION
Law 10.295/2001, establishing the National Conservation and Rational Energy Use Policy and Decree 4.059/2001	legislative	Law	17/10/2001	This Law creates the National Conservation and Rational Energy Use Policy charged with ensuring the efficient allocation of energy resources and protecting the environment. The law determines that one year after the Executive Power publishes the required levels of energy consumption and efficiency, a Targets Programme should be established to monitor the progressive evolution of these levels. Regarding energy demand-side policies, the law charges the Executive Power with establishing maximum levels of energy consumption and minimum levels of energy efficiency for machines and energy consuming apparatus produced or traded in the country. It also obliges the producers and importers of these items to observe these requirements at the risk of being fined. Further charges the Executive Power with developing mechanisms to promote energy efficiency in buildings constructed after the commencement of the law.
Law 10.438/2002, establishing the Programme of Incentives for Alternative Electricity Sources (PROINFA)	legislative	Law	26/04/2002	This Law creates the PROINFA, the largest national plan to promote the use of alternative energy sources, as well as other programmes. Regarding energy supply-side policies PROINFA's implementation is co-ordinated by Eletrobras (a publicly traded company controlled by the government) and divided into two consecutive stages. The first stage sets a target power production value of 3,300MW from renewable energy including wind, biomass and small hydroelectric sources. This target is to be reached by the end of 2007 through a system of subsidies and incentives drawn from an Energy Development Account. This is to be funded by end-use consumers through an increase in energy bills (with the exemption of low-income sectors) as well as by financing programmes available for renewable energy projects from the Brazilian National Development Bank (BNDES). The second stage establishes a target of increasing the electricity generated by these three renewable sources to 10% of annual consumption within 20 years. In addition, Renewable Energy Certificates that are proportional to the amount of clean energy produced by each plant should be issued in this second stage.

TITLE	TYPE	DOCUMENT TYPES	DATE_PUBLICATION	DESCRIPTION
Plan to Control Illegal Deforestation and Recovery of Native Vegetation (PPCDAm)	executive	Plan	25/12/2004	This plan aims to continuously and consistently reduce deforestation and create the conditions to establish a sustainable development model in the Legal Amazon.
Law 11.097/2005 establishing the Mandatory Biodiesel Requirement, Laws 13.033 and 13.263	legislative	Law	03/01/2005	The Law 11.097 (amending Law 9.478 of 1997) introduced biodiesel in transportation energy mix of Brazil. Under the law and subsequent resolutions by the National Council of Energy Policy (Conselho Nacional de Política Energética, CNPE) implementing the requirements of the law, the mandated minimum increased from 2% biodiesel by 2008 and 5% by 2013, 5 to 6% in 2014, and then again from 6 to 7% in November 2015. In March 2016, Brazil's House of Representatives approved law 13.263 that plans an increase of the mandatory minimum of biodiesel in diesel fuel by 1 % annually, to reach 10 % by March 2019. On November 9, 2017, the CNPE decided to accelerate the increase to reach 10% by March 2018.
Law 11.284/2006, establishing the management of Public Forests, Brazilian Forest Service and National Fund for Forest Development	legislative	Law	02/03/2006	This law establishes principles for the management of public forests for sustainable production; institutes, within the structure of the Ministry of Environment, the Brazilian Forest Service (BFS); and creates the National Fund for Forest Development. In order to attest compliance with the forest management principles established by this bill, forest concession-holders should undertake independent forest audits, every 3 years at a maximum, and at their own cost. Additionally, the National Environment System (Sisnama) agencies are responsible for control and environmental inspection. The National Fund for Forest Development has a Consultative Council formed by members from the federal administration and civil society charged with overseeing the disbursement of funds and evaluating performance. Regarding REDD+/land use policies, the bill establishes the following principles for public forest management: Protection of ecosystems, land, water, biodiversity and associated cultural value. Efficient and rational use of forests in line with local, regional and national sustainable development targets. Respect for

TITLE	TYPE	DOCUMENT TYPES	DATE_PUBLICATION	DESCRIPTION
				<p>local communities' right of access to and use of public forests and the benefits associated with conservation. Promotion of local processing, increased value-added of forest products and services, industrial diversification, technological development, and capacity-building of local entrepreneurs and labour-force. Free access to information regarding public forest management. Promotion and dissemination of research on forestry related to conservation, restoration and sustainable use of forests. Promotion of knowledge and awareness of forest conservation, recovery and sustainable use; Creation of stable and secure conditions for the promotion of long-term investment in forest conservation and recovery. The National Fund for Forest Development (NFFD) is instituted with the purpose of promoting sustainable forestry activities as well as technological innovation in the sector. Among other things, the Fund's resources should be channelled to technical assistance, monitoring and verification, recuperation of degraded areas, rational economic use of forests and environmental education. The Fund only finances projects from public institutions or not-for-profit private institutions. The Brazilian Forest Service (BSF) is created with the exclusive mandate of managing public forests; it is equally the managing authority of the NFFD. The BSF is responsible for: training, capacity-building and technical assistance; promoting of sustainable timber and wood and sustainable forest production in general; and market scoping for forest products and services. Research and development: the National Fund for Forest Development finances research and technological development on forest monitoring.</p>

TITLE	TYPE	DOCUMENT TYPES	DATE_PUBLICATION	DESCRIPTION
National Energy Plan 2030 (PNE 2030)	executive	Plan	25/12/2007	<p>The PNE 2030 is the first study of integrated planning of energy resources held within the Brazilian government, and prepared by the Ministry of Mines and Energy of Brazil (MME). It proposes a strategic direction for expansion of energy supply. Its estimate of future electricity needs is based on a forecast percentage growth in demand per annum corresponding to an average GDP growth per annum. The PNE is composed of a series of studies that seek to provide inputs to formulate energy policies according to an integrated view of available resources. As a contribution to meeting that future estimated demand, the MME proposes 164GW as the country's 'Àòexploitable, but as yet unrealised' hydropower 'Àòpotential'. Of that 164GW, the MME says that 90% (about 147GW) is in the Amazon region. If realised, this figure would amount to more than a doubling of the total installed national electricity generation capacity in Brazil - 121GW in 2012 (from all generation sources). The PNE provides for the expansion of the electricity sector by 2030 with the use of energy sources: (1) Renewables - 191.35GW (92GW existed in 2010), (2) Conventional thermoelectric - 21.5GW (16GW existed in 2010), and (3) Nuclear- 8GW (2GW existed in 2010). According to the PNE 2030, energy efficiency policy will be built in aiming at guiding a set of priority projects, to be conducted under the guidance of MME, in co-ordination with the other agents of the Government. The formulation of effective regulatory mechanisms and instruments for inspection will involve the regulatory agencies in the energy sector. The establishment of an operational structure able to manage implementing this policy also involves budgetary resources consistent with the importance of this mission.</p>

TITLE	TYPE	DOCUMENT TYPES	DATE_PUBLICATION	DESCRIPTION
Decree 6.263/2007, establishing the Inter-ministerial Committee on Climate Change (ICCC)	executive	Decree/Order/Ordinance	21/11/2007	This Decree created the Inter-Ministerial Committee on Climate Change (CIM) which was given the function of preparing the National Policy on Climate Change and the National Climate Change Plan. CIM is co-ordinated by the Office of the President of the Republic, and consists of seventeen federal bodies and the FBMC. The federal bodies that belong to it are the Ministries of: Agriculture and Supply, Science and Technology, Defence, Education, Finance, National Integration, Health, Cities, External Relations, Mines and Energy, Agrarian Development, Development, Industry and Foreign Trade, Environment, Planning, the Budget and Planning, Transport, and the Strategic Issues Secretary of the Presidency of the Republic. The responsibility for the preparation, implementation, monitoring and evaluation of the National Plan on Climate Change was assigned to the Executive Group on Climate Change (GEx), under the auspices of CIM, which is co-ordinated by the Ministry of the Environment. Alongside the consultations within the government itself, the Decree created public consultation processes with the aim of guaranteeing transparency in the Plan preparation process and popular participation through the contributions of interested agents.
Law 11.488/2007 creating the Special Incentive Scheme for Infrastructure Development (REIDI)	legislative	Law, Act	15/06/2007	This law creates the Special Incentive Scheme for Infrastructure Development (REIDI). This document stipulates that renewable energy projects (solar, wind, biomass, co-generation) are entitled to specific tax credits.

TITLE	TYPE	DOCUMENT TYPES	DATE_PUBLICATION	DESCRIPTION
National Plan on Climate Change (from Decree no 6.263)	executive	Plan, Decree/Order/Ordinance	01/12/2008	The Plan defines actions and measures aimed at mitigation and adaptation to climate change. One of the key objectives of the Plan is to keep the high share of renewable energy in the electric matrix. With this aim, it establishes a target of having more than 80% of the power base to be derived from renewable sources by 2030. The Plan also aims to: increase the share of electricity derived from wind and sugarcane bagasse plants; add a number of hydroelectric projects to the electricity network; expand the solar photovoltaic industry; promote the use of solar water heaters in the residential sector; as well as establish research on energy production from solid waste. The plan further encourages industrial users to increase their average consumption of ethanol by 11% in the next 10 years; brings forward the 5% biodiesel blending requirement from 2013 to 2010; and supports the creation of an international biofuels market. The Plan determines that a National Energy Efficiency Action Plan should be created to reduce electricity consumption by 10% by 2030 and to establish other measures such as incentives to replace old electric equipment with modern equipment, and create improvements in industry energy efficiency, transportation and buildings. The Plan promotes a sustainable increase in the use of biofuels in the national transportation network and establishes measures on adaptation to climate change. The plan establishes that actions should be taken to eliminate the loss of national forest cover by 2015. The plan sets targets for a consistent cut on deforestation to be accomplished in subsequent four-year periods. The goal is to reduce deforestation by 40% in the 2006-2009 period in relation to the Amazon Fund's 10-year reference period (1996-2005). This is followed by an additional 30% reduction in the 2010-2013 and 2014-2017 periods in relation to the previous 4-year period. These targets are to be accomplished through the provision of new and additional funding from national and international sources, including the Amazon Fund.

TITLE	TYPE	DOCUMENT TYPES	DATE_PUBLICATION	DESCRIPTION
Decree nº 6527/08 providing for the establishment of the Amazon Fund	executive	Decree	01/08/2008	This decree mandates the National Bank for Economic and Social Development (BNDES) to create the Amazon Fund. The Fund must provide for: 1) management of public forests and protected areas; 2) environmental control, monitoring and inspection; 3) sustainable forest management; 4) economic activities developed from the sustainable use of the forest; 5) economic activities developed from the sustainable use of vegetation; (Wording given by Decree nº 8.773, of 2016); 6) Ecological and Economic Zoning, territorial ordering and land tenure regularisation; 7) conservation and sustainable use of biodiversity; and 8) recovery of deforested areas. The decree has been amended multiple times by successive governments to amend or suppress a range of clauses.

TITLE	TYPE	DOCUMENT TYPES	DATE_PUBLICATION	DESCRIPTION
Law 12.187/2009, establishing the National Policy on Climate Change (NPCC), regulated by Decree 7.390/2010	legislative	Law	29/12/2009	This law creates the NPCC with the following key areas of concern: combining climate protection with socio-economic development; reducing anthropogenic GHG emissions from all its sources and strengthening GHG sinks; adaptation; preservation, conservation and recuperation of national biomes; land use and reforestation measures; and the development of a national cap-and-trade mechanism. The NPCC is based on Brazil's international commitment with the UNFCCC and incorporates all previous government instruments related to its key areas (the National Plan on Climate Change, the National Fund on Climate Change and others). The Decree regulates articles of the Law relating to the National Plan on Climate Change, National Fund on Climate Change, and Action Plans on Deforestation Prevention and Control in national biomes; the Sector Plans on climate change mitigation in key economic sectors - the Article set the precedent for inclusion of the Clean Development Mechanism and Nationally Appropriate Mitigation Actions (NAMAs) in these Plans; and the national voluntary emission reduction commitment. Foresees the promotion and development of scientific and technological research concerned with mitigation and strengthening of carbon sinks; reduction of uncertainty in national and regional climate projections; and adaptation measures. The Law recommends the establishment of the Brazilian Emissions Reduction Market (MBRE). It incorporates the National Plans for Prevention and Control of Deforestation in national biomes.
Law 12.144/2009, and Decree 7.343/2010 establishing the National Fund on Climate Change (NFCC)	legislative	Law	09/12/2009	NFCC resources may be directed to REDD+ projects, with priority being given to natural areas under threat as well as relevant biodiversity conservation strategies. Resources may be channelled to society and ecosystem adaption to climate change. The NFCC may fund activities related to the development and diffusion of technologies for the mitigation of GHG emissions. It may also fund research, the creation of project and inventory systems, methodologies that contribute to the reduction of liquid GHG

TITLE	TYPE	DOCUMENT TYPES	DATE_PUBLICATION	DESCRIPTION
National Energy Efficiency Plan	executive	Plan	18/10/2011	emissions, and the reduction of emissions from deforestation and land use change The National Energy Efficiency Plan (PNEf) was published by the Ministry of Mines and Energy. It presents the existing regulatory framework and instruments and actions in a number of economic sectors and areas. It also makes suggestions for improvement and further actions in each area; these include: studies, incentive mechanisms, capacity-building, financing, regulation, improved management, and better co-ordination and integration amongst the different existing programmes. The plan also seeks to clarify responsibilities for the different stakeholder institutions. The areas covered by the PNE are: electricity, industry and micro, small, and medium enterprises, transport, education, buildings, public lighting, sanitation, solar heating, research and development, monitoring and verification, international partnerships, and financing. The national programmes on electricity conservation, rational use of oil and natural gas derivatives, and energy efficiency labeling are also evaluated.
Law No. 12.651 on the protection of Native Forests	legislative	Law	25/05/2012	This Law regulates the protection, and sustainable use and exploitation of native forests and other indigenous plants. The Law aims to promote the economic development of Brazilian selected areas by recognising the existing native forests and other indigenous plants as Brazilian wealth and confirming the preservation of National forests, habitats, biodiversity, soil conservation and water resources for the well-being of the future generations, among other activities. According to the law, the Federal Government shall establish a National Policy for the prevention, management and control of Forest Fires. This policy should provide tools for the analysis of the impacts of forest fires on climate change and changes in land use, ecosystem conservation, public health and fauna, to support strategic plans for the prevention of forest fires. Decision 288/2020 Institutes the National Program for Payments for Environmental Services - Floresta +, within the scope of the Ministry of the Environment. The Program is

TITLE	TYPE	DOCUMENT TYPES	DATE_PUBLICATION	DESCRIPTION
				in charge of payments towards the private sector for environmental services in areas maintained with native vegetation coverage; and the articulation of public policies for the conservation and protection of native vegetation and climate change.
Law 12.805, establishing the National Policy on Farming-Livestock-Forest Integration	legislative	Law	29/10/2013	The law establishes the National Policy on Integration of Farming, Livestock and Forestry to mitigate deforestation caused by these activities, supporting best practices that promote the development of these sectors in a sustainable manner, ultimately contributing to the recovery of degraded areas. The law also foresees the promotion of environmental education, targeting schools and agents involved in the production and/or trade of agricultural and livestock products. In addition, it proposes fostering activities of research, innovation and technological transfer that meet the general objective of the Policy. The programme is part of the Low Carbon Emission Agriculture Programme.
Transport Sector Plan for mitigation and adaptation to Climate Change	executive	Plan	01/06/2013	This plan of the transport and urban mobility sector for climate change mitigation and adaptation aims to contribute to the mitigation of greenhouse gas emissions in the sector, through initiatives that lead to the expansion of the transportation infrastructure and the greater use of more energy efficient transportation. Regarding the urban mobility sector, its objective is to increase the use of efficient systems of public passenger transport, contributing to the fulfilment of the voluntarily commitments made by Brazil. The plan presents by subsector the current profile of emissions, future projections, projections for reduction of emissions and the mitigation actions with strategies for their implementation. The subsectors are: freight transportation (train, roads, water) and urban mobility. The main focus of the plan is mitigation of GHG emissions.

TITLE	TYPE	DOCUMENT TYPES	DATE_PUBLICATION	DESCRIPTION
Industrial Sector Plan for mitigation and Adaptation to Climate Change	executive	Plan	01/06/2013	This industry sector plan for the mitigation and adaptation to climate change, for the period 2012-2020, aims to maintain efficiency in emissions on specific sectors that are in a good international benchmarking position, to create a structure for monitoring, reporting and verification of GHG emissions, the institutionalization of inventories of emissions in all medium and large companies of the sectors covered by the Plan, as well as the implementation of transversal actions of energy efficiency and use of materials to promote emissions reductions with gains of competitiveness throughout the industry. The Plan is organized into five axes of action: carbon management; recycling and co-processing; energy efficiency and cogeneration; voluntary mitigation actions; and sustainable technologies. The main focus of the Plan is mitigation.
Agricultural Sector Plan for mitigation and adaptation to climate change and for the consolidation of a low carbon economy in agriculture (Plan ABC)	executive	Plan	01/06/2013	The Agricultural sector plan for mitigation and adaptation to climate change, called Plan ABC, aims to promote to promote the mitigation of GHG emissions in agriculture by improving the efficiency in the use of natural resources, increasing the resilience of productive systems and rural communities and enabling the adaptation of the agricultural sector to climate change. The plan is organised into 7 programmes: - Recovery of Degraded Pastures; - Agricultural-Livestock-Forest (iLPF) and Systems Integration Agroforestry (SAFs) - Direct Planting System (SPD); - Biological Nitrogen Fixation (BNF); - Planted Forests; - Treatment of animal waste; - Adaptation to climate change.

TITLE	TYPE	DOCUMENT TYPES	DATE_PUBLICATION	DESCRIPTION
Mining Sector Plan for mitigation and adaptation to climate change - Plan for low carbon mining	executive	Plan	01/06/2013	This Mining Sector Plan aims to promote a sectoral analysis, based on a preliminary assessment, taking into account the National Mining Plan 2030 and projections of Brazilian Mining Institute (IBRAM), as well as direct consultations with companies in the sector to reduce GHG emissions in mining, through initiatives of the companies themselves to reduce emissions related mainly to energy efficiency and reduction in the consumption of fuels with high non-renewable carbon content. The plan focuses on three dimensions: value chain, mineral goods and organizational and operational limitations. It doesn't take into account the chemical processing of minerals and external transport, which it states should be considered on the Industry and Transports Plans. It presents the sector's current emissions, its potential for the reduction of emissions, possible obstacles for implementation, adaptation recommendations, financing needs and sources, and monitoring. Its main focus is mitigation.
Law 13.203 on Renegotiation of the hydrological risk of electricity generation and other matters related to electricity generation	legislative	Law	08/12/2015	The Law 13.203 adds some benefits for renewables, and changes a number of measures in the local electricity sector. It seeks to resolve Brazil's hydrological risk and create a new subsidy model to increase the attractiveness of renewable investments. Under the new law, the hydropower generating companies can protect themselves against droughts with the permission to buy and stock renewable energy, in a similar fashion to reserve energy auctions. For generators of solar, wind, biomass and cogeneration power, the government can now also provide rebates of up to 50 per cent in transmission and distribution tariffs. The law also lowers the usage fee for new plants of auto-generation renewable systems and facilitates reorganisation of shareholding of special purpose entities to drive investments in new renewable power plants.

TITLE	TYPE	DOCUMENT TYPES	DATE_PUBLICATION	DESCRIPTION
Law 13.186 on the Policy for Education on Sustainable Consumption	legislative	Law	11/11/2015	The law introduces a Policy for Education on Sustainable Consumption in order to "encourage adoption of consumer practices and production techniques that are ecologically sustainable" (Art 1). The law defines "sustainable consumption" as "use of natural resources in order to provide quality of life for the present generation without compromising the needs of future generations" (Art 1.1) and it includes among its nine key objectives the "promotion of reduction in consumption of water, energy and other renewable and non-renewable natural resources at the household level and from production, commerce and services" (Art 2.II). Other objectives include: promoting re-use of and recycling of packaging and products to reduce solid waste and hazardous waste (Art 2.III-IV); encouraging companies to incorporate social, cultural and environmental dimensions in their production and management processes and better management of the whole life cycle of products (Art 2.V-VI); and ensuring the right to information and promotion of environmental labeling and certification (Art 2.VIII). To achieve these objectives, federal, state and municipal governments are called on to carry out public awareness and media campaigns and train teachers on including sustainable consumption in their curriculum for primary and secondary education (Art 3.I-II).

TITLE	TYPE	DOCUMENT TYPES	DATE_PUBLICATION	DESCRIPTION
National Adaptation Plan to Climate Change Vol I and II	executive	Plan	25/12/2016	The National Adaptation Plan aims to guide initiatives for management and reduction of long-term climate risks. The Plan was drawn up by the Executive Group of the Inter-ministerial Committee on Climate Change 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). It 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. 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. It has two volumes: Volume I General Strategy features and details structural components of the plan: its legal framework, objectives, goals and governance and Volume II Sectoral and Thematic Strategies". The second volume presents adaptation strategies for the following sectors: Agriculture, Biodiversity and Ecosystems, Cities, Disaster Risk Management, Industry and Mining, Infrastructure, Vulnerable populations, water resources, health, food and nutritional security, and strategy for coastal zones. The main objective of the document is to present guidelines for adaptation to climate change for each sector, based on the premise that the inability of a given sector to fully exercise its normal activities because of the impacts of climate change, might directly or indirectly influence the functional stability of other sectors. For each sector it presents a brief analysis of the main vulnerabilities, presents guidelines for adaptation measures and the interdependence of each sector with other sectors.

TITLE	TYPE	DOCUMENT TYPES	DATE_PUBLICATION	DESCRIPTION
Decree no 9.179 on administrative infractions and penalties to the environment	executive	Decree/Order/Ordinance	23/10/2017	The present decree amends Decree No. 6,514, of July 22, 2008, which provides for administrative infractions and penalties to the environment and establishes the federal administrative process for the determination of these infractions, in order to dispose of the conversion of fines. Article 140 (on the preservation, improvement and recovery of the quality of the environment) stipulates that mitigation or adaptation climate change is one of the objectives, considered as actions, activities and works included in projects under the scope of the decree.
Law 13.576 on National Biofuels Policy (RenovaBio) and Decree 9.308	legislative	Law	26/12/2017	The present law establishes the National Biofuel Policy - RenovaBio, and details for its principles, objectives, fundamentals and instruments. RenovaBio provides for 1) Biofuels certification, 2) the goals of reducing GHG emissions in the fuel matrix and 3) issue and trading decarbonisation credits (CBios). Normative Resolution 14/2017 sets the strategy for RenovaBio. Decree 9.308 details the application of the law. Normative Resolution 5/2018 sets annual compulsory goals for the reduction of GHG emissions from fuels.
Decree No. 9.082 establishing the Brazilian Forum on Climate Change, and Decree No. 9759 - dissolving the Forum.	executive	Decree	25/06/2017	This Decree creates the Brazilian Forum on Climate Change. This Forum on Climate Change aims to raise awareness and mobilise society and contribute to the discussion of actions needed to address global climate change, in accordance with the provisions of the National Policy on Climate Change and the United Nations Framework Convention on Climate Change and the agreements international agreements, including the Paris Agreement and Brazil's Nationally Determined Contributions. From June 28, 2019, the Brazilian Forum on Climate Change will be extinct, according to Decree No. 9759 of 11 April 2019.

TITLE	TYPE	DOCUMENT TYPES	DATE_PUBLICATION	DESCRIPTION
Decree No. 8.972 creating the National Policy for the Recovery of Native Vegetation	executive	Decree	23/01/2017	This Decree creates the National Policy for the Recovery of Native Vegetation -Proveg. It establishes its objectives and guidelines, and defines its governance. Proveg has within its main objectives to articulate, integrate and promote policies, programmes and actions that encourage the recovery of forests and other forms of native vegetation; and to promote the environmental regulation of Brazilian rural properties, under the terms of Law 12.651 of 25 May 2011. Its guidelines are: 1) promoting adaptation to climate change and mitigating its effects; 2) prevention of natural disasters; 3) Protection of water resources and soil conservation; 4) encouraging the conservation and restoration of biodiversity and ecosystems services; 5) Provide incentives for the recovery of the Permanent Preservation Areas, Legal Reserve Areas and Areas of Restricted Use; 6) Stimulus of native vegetation.
Decree No. 9308 establishing the annual compulsory targets for greenhouse gas emission reduction related to fuel trade referred to in Law No. 13.576	executive	Decree	15/03/2018	This Decree establishes annual compulsory targets for greenhouse gas emission reduction related to fuel trade, which is dealt with in art. 6 of Law 13.576, for a minimum period of ten years. Targets are defined by the National Energy Policy Council (CNPE), in accordance with the provisions of this Decree. The goals emphasise the improvement of the carbon intensity of the Brazilian fuel and will comply with the international commitments to reduce emissions of greenhouse gases. As of June 2019, the targets were under public consultation.
Decree No. 9.578 consolidating executive regulations on Climate Change	executive	Decree	22/11/2018	This Decree consolidates the normative acts issued by the Federal Executive Power about the National Climate Change Fund regulated by Law No. 12.114 of December 9, 2009, and the National Policy on Climate Change, regulated by the Law No. 12.187 of December 29, 2009, in compliance with the provisions of Complementary Law No. 95 of February 26, 1998, and Decree No. 9.191, of November 1, 2017. The decree was amended on November 28, 2019, by the then government.
Health Sector Plan for Mitigation and	executive	Plan	13/06/2019	

TITLE	TYPE	DOCUMENT TYPES	DATE_PUBLICATION	DESCRIPTION
Adaptation to Climate Change				
Decree no 10.145 providing for the Interministerial Committee on Climate Change.	executive	Decree	28/11/2019	Article 1 of this document states that the Interministerial Committee on Climate Change (CIM), of a permanent nature, has the purpose of establishing guidelines, articulating and coordinating the implementation of the country's public actions and policies related to climate change.
Decree no 10.144 instituting the National Commission for the Reduction of GHG Emissions from Deforestation and Forest Degradation, Conservation of Forest Carbon Stocks, Sustainable Forest Management and Increase of Forest Carbon Stocks - REDD +	executive	Decree	28/11/2019	This decree creates the National Commission for the Reduction of Greenhouse Gas Emissions from Deforestation and Forest Degradation, Conservation of Forest Carbon Stocks, Sustainable Forest Management and Increase of Forest Carbon Stocks - REDD +. It charges the Ministry of the Environment to publish the National Strategy to Reduce Greenhouse Gas Emissions from Deforestation and Forest Degradation, Conservation of Forest Carbon Stocks, Sustainable Forest Management and Increase of Forest Carbon Stocks - ENREDD + and its successive reviews.
Decree no 10.142 instituting the Executive Committee for the Control of Illegal Deforestation and the Recovery of Native Vegetation.	executive		28/11/2019	This document creates the Executive Committee for the Control of Illegal Deforestation and the Recovery of Native Vegetation. The document defines the composition and powers of this Committee, and revokes a number of articles from previous decrees.

TITLE	TYPE	DOCUMENT TYPES	DATE_PUBLICATION	DESCRIPTION
Decree no. 10.387 to provide incentives for financing infrastructure projects with environmental and social benefits.	executive	Decree	05/06/2020	This decree amends Decree 8.874 of 2006 regulating the conditions for approval of investment projects considered as priorities in the area of infrastructure or intensive economic production in research, development and innovation. This document notably aims at easing the financing framework of 1) non-motorised public transport and low-carbon public transport systems (such as bus rapid transit), 2) renewable energy from solar, wind, waste and small-scale hydro, and 3) urban water and waste sectors.

Source: Grantham Research Institute on Climate Change and The Environment and Sabin Center for Climate Change Law, 2021.

Appendix 2- Pluriannual plans with climate change programs from 2000 to 2019

Plurianual Plan	Program	Objective(s)	Estimated budget	% of budget spent
2000-2003 (Law nº 9.989/2000)	475 - Climate Change	Develop scientific information about greenhouse gases emissions to support the definition of policy for action on climate change	R\$ 13.106.794,00	20%
2004-2007 (Law nº 10.933/2004)	1084 - Climate Change and Environment	Promote the control of polluting activities, contributing to improve the quality of the environment and to reduce the effects of these pollutants on the global climate	R\$73.299.714,00	55%
	475 - Global Climate Change	Develop scientific information about greenhouse gases emissions to support the definition of policy for action on climate change		
2008-2011 (Law nº 11.653/2008)	1421 - Meteorology and Climate Change	Understand the mechanisms that determine global climate change and improve the ability of meteorological, climatic, hydrological and environmental forecasting	R\$ 352.160.678,00	43%
	1346 - Environmental quality	Promote the improvement of environmental quality by strengthening management instruments, risk control and responding to emergencies arising from hazardous substances and industrial waste, control of greenhouse gases emissions into the atmosphere and the definition of measures to climate change adaptation		
2012-2015 (Law nº 12.593/2012)	2050 - Climate Change	<p>Create environmental scenarios, with regional specificities, by the construction of the Brazilian Model of the Global Climate System, for the formulation of public policies for mitigation, adaptation and reduction of vulnerabilities</p> <p>Create and disseminate knowledge and technologies for mitigation and adaptation to the effects of climate change through a network formed by public and private research and teaching institutions (CLIMA Network)</p> <p>Develop and implement instruments for mitigation and adaptation to climate change considering sustainable development and regional diversity</p> <p>Reduce environmental, economic and social risks and vulnerabilities resulting from climate change, desertification processes and land</p>	R\$ 1.840.871.174,00	5%

Plurianual Plan	Program	Objective(s)	Estimated budget	% of budget spent
		degradation to minimize material damage, impacts on ecosystems and promote socio-environmental improvement through adaptation measures Assess the impacts of climate change on Brazilian natural systems by monitoring emissions and observing climate manifestations Expand the forecast of weather, air quality and climate on a regional and global scale		
2016-2019 (Law nº 13.249/2016)	2050 - Climate Change	Generate and disseminate information, knowledge and technologies for mitigation and adaptation to the effects of climate change Mitigate climate change and promote adaptation to its effects, through the implementation of the National Policy on Climate Change Develop technologies for remote sensing for deforestation monitoring, land use and occurrence of forest fires and fires and disseminate the information generated	R\$ 1.665.145.347,00	37%
		TOTAL	R\$ 3.944.583.734,00	23%

* Data refers to July 2020.

Source: Integrated Planning and Budgeting System (SIOP), available at <https://www1.siop.planejamento.gov.br/>. Access on July 26, 2020.

The programs listed are the ones directly focused on climate change. Search queries used were: Year: 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020. Program: 0475 - MUDANÇAS CLIMÁTICAS, 0475 - Mudanças Climáticas, 0475 - Mudanças Climáticas Globais, 1058 - Mudança do Clima, 1084 - Mudanças Climáticas e Meio Ambiente, 1346 - Qualidade Ambiental, 1421 - Meteorologia e Mudanças Climáticas, 2050 - Mudança do Clima, 2050 - Mudanças Climáticas.

Appendix 3– Governance processes by federated unit and year

Process	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Bill						AP								MG		
Law			AM	TO	SP GO SC	AC AP PE ES RJ RS	BA PB PI	DF PR	MT	MS	AM	CE SC	MT	RO		PA
Decree			AM		MG	SP	RJ RR		PR						RR	RR
State policy about climate change			AM	TO	SP GO SC	PE ES RJ RS	BA PB PI	DF PR		MS		CE	MT	RO		PA
GHG inventory publication	RS		RJ	MG	PR	BA	SP		ES	AC DF PR	RJ				PE	
Participatory Forum	BA MG SP	MA	AM TO PI ES RJ RS BA MG	CE PR	AM PA PE MT SC	SC SP	RO	PR	AP PR	GO MA		GO		RO	PA	BA RJ
Specific or designated fund				TO	SP SC	AC RJ	BA	PR		MS	AM	PE	MT		PA	

Process	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Plan or Program			RN		AM PA TO	AC AP MG SP	PA MA PE	PR		PI	TO DF MT	AL PE MT RS		AP MS		PA

Source: Conceição (2017), Rio de Janeiro (2017), and author's elaboration.

This table includes the years of establishment and modification of laws, decrees, and participatory fora, and the year of publication of each GHG emissions inventory available

Appendix 4 – Interviews guide and list of interviews

The interview script had nine reference questions related to the interviewee perception about:

a) Which national and international actors are relevant in global climate governance at the subnational level in Brazil from 2010 to 2018;

b) What are the most pressing impacts of global climate change at the subnational level in Brazil;

c) What are time milestones in the global climate change agenda for federated units or a specific federated unit in Brazil;

d) Which are the most relevant movements on the global climate change agenda at the level of federated units or for a specific federated unit in the period from 2010 to 2018;

e) How federated units or a specific federated unit relate to the federal government in the period from 2010 to 2018 on the topic of global climate change;

f) Which elements (policies, plans, programs, financial resources, human resources, etc.) are relevant for federated units or for a specific federated unit to commit to actions to mitigate and adapt to global climate change;

g) Which processes (formalization of partnerships, holding of national or international events on the subject, training of technical staff, participation in national or international forums, organizations or coalitions, etc.) are relevant for federated units or for a specific federated unit to commit to actions to mitigate or adapt to global climate change;

h) Which are the themes directly or indirectly related to the global climate agenda for the federated units or for a specific federated unit in Brazil;

i) What are the motivations to the federated units include climate change in their agenda.

Interview code	Type of association
A1	National government ministry
B1	Civil society forum at the national level
B2	Civil society organization at the national level
B3	Civil society organization at the national level
B4	Civil society organization at the national level
C1	Subnational level – representative association of states' environmental agencies
C2	Subnational government – Pará
C3	Subnational government – Mato Grosso
C4	Subnational government – Pará
C5	Subnational government – Mato Grosso
C6	Subnational government – Pará
C7	Subnational government – Pará
D1	Civil society organization in Mato Grosso
E1	International organization
F1	Foreign organization – cooperation agency
F2	Foreign organization
F3	Foreign organization
G1	Transnational network
G2	Transnational network representation at Mato Grosso
H1	Civil society organization at the international level
H2	Civil society organization at the international level

Source: Author's elaboration

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