

Climate Risks and Neodevelopmental Autopoiesis in the Amazon: Systemic (de)Constructions

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Abstract: The climate risks identified in the South-western Amazon, particularly in the Brazilian state of Rondônia, are the expression and result of a process of autopoietic colonization of a neo-developmental nature, guided by a political rationality that leads to a growing deconstruction of the boundaries between economy, society, and nature. This article discusses climate risks in the Amazon as an expression of this process, from a neosystemic perspective. As a methodological approach, the study is qualitative and exploratory, using as sources of evidence official documents and semi-directed interviews with 17 managers from civil, private, and public organizations, related to environmental and climate policies. The systematized data indicates the exhaustion of the current model, which deepens and spreads at a pace that increases the risk in times of extreme events.

Keywords: Climate risks; neosystemic theory; neodevelopmentalism autopoiesis; Rondônia State.

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Introduction

This article discusses the climate risks in the Amazon as a manifestation of the neodevelopmental autopoeitic process, under the neosystemic view inspired by Niklas Luhmann. The study focuses on one of the most representative regions as regards the occurrence of extreme events, Southwestern Amazon, particularly the Brazilian state of Rondônia. The Amazon has undergone intense hydrological droughts and the main causes for these events are scanty rainfall. The Southwestern Amazon has been an alarming example of what the literature qualifies as critical events (brown *et al.*, 2015). This receives special significance in the context of climate change, in an area with regional and world relevance, such as the Amazon.

In 2023, the droughts in the region proved to be alarming, reducing the flow of the Amazon rivers to little recorded historical series, a phenomenon also repeated in 2005, 2010, and 2015 (INMET, 2023). This situation has resulted in regional catastrophes of significant magnitude; an example was the 2005 occurrence of forest fires in over 470,000 hectares, with damages estimated in direct R\$ 470 million and indirect R\$ 3 billion in environmental services. That was considered the first drought of the century, with only 37% of the rainfall volume considered normal in the region. In 2010, droughts and fires hit 168,000 hectares of forest in Southwestern Amazonia; considered the second drought of the century, it had only 57% of the rainfall considered normal (Brown *et al.*, 2015).

Amidst these disasters, the phenomenon of the risk, at local and regional scales, cannot be attributed to El Niño, as is usually done. In this exact sense, it is necessary to consider the forms of appropriating the elements of nature in that macro region to understand the systemic occurrence of risk situations.

The present reflection is founded on Niklas Luhmann's (1927-1998) neosystemic approach, a theoretical perspective that allows ontologically examining the aforementioned process of constituting risk situations, in a clear effort to understand the complexity of the relationship between society and nature in the Amazon region. This theoretical choice is justified by its systemic and circular character, by refusing conceptual hierarchies, which permits understanding the complexity that constitutes and involves the region in question. From a phenomenological reduction process (Luhmann, 2016), this theoretical perspective allows for diachronically constructing a critical and innovative view on the risks involving Amazonia.

From the abstract constructs proposed by Luhmann, a critical look at the Amazonian reality may sound disruptive, since that author has at times been considered a representative of a structuralist movement that had little concern about the materiality of phenomena (Richter, 2020). Nevertheless, it is possible to balance and to reciprocally approximate the plans of the structural and empirical analysis (Harste, 2021; Minhoto; Amato; Camargo, 2022). This theoretical perspective can contribute to re-signifying the discussion on the extreme climate events in Amazonia, understanding them as a reflection of the development models adopted for the region.

That theoretical lens can shed light on the still obscure aspects that remain in the construction of the social risks involving Amazonia, evidencing that they also result

from a historical process with different intra- and inter-systemic nuances. In fact, it is necessary to understand climate risks and the adaptation of social systems as indissociable aspects. Social systems are therefore understood as an organized set of communicative technical-structural relationships and relying on properties, with survival, self-governing, and autopoiesis abilities (Luhmann, 2013).

The thesis supported here is that there are regional manifestations of climate risks that are directly related to economic and social construction processes, and, in South-western Amazon, these elements are potentialized and furthered by political actions and subjects that expand that autopoietic process, classified by the literature as neodevelopmentalism (Luhmann, 2016; Minhoto; Amato; Camargo, 2022).

The phenomenon has regionally materialized in Amazonia, and has been colonizing different operational mechanisms of the “law” and “politics” functional systems, these systematically taken by the economic rationality (Minhoto; Amato; Camargo, 2022).

Due to this ‘colonization’ in autopoietic operations, the following presupposition is proposed: the neodevelopmental rationality has been disintegrating the possibilities of preventing climate risks, conforming relationships at the regional scale, which can be considered predatory – relationships with a predominance of economic and social interests, duly materialized from a political-institutional viewpoint. As an analysis case, the *modus operandi* of these processes is examined in the state of Rondônia. Beyond the El Niño context, the state in question is an example and brings striking evidences of how post-modernity systemically produces the risk.

Methodological path

From a methodological point of view, this work can be characterized as of a qualitative and exploratory nature, having as a reference empirical studies conducted on the theme (Nobre, 2011; Marengo *et al.*, 2012; Randow *et al.*, 2015; Ribeiro Neto *et al.*, 2017). The main research sources are official documents, particularly the State Plan of the Rondônia Water Resources (Rondônia – Governo, 2018) and the National Plan of Water Security (Brasil – Governo Federal, 2019). Also employed were secondary data from the specialized literature analyzed; field research was also carried out, particularly semi-structured interviews.

The field research consisted of conducting in-depth interviews with the following procedures: (i) preliminary definition of respondents (based on the snowball method); key respondents mapping – those with a direct relationship to the environmental issue and water security in the state of Rondônia. The snowball modality is particularly useful for exploratory means (Alvesson; Skoldberg, 2000). The director of the Managing and Operational Center of the Amazonia Protection System (CENSIPAM) was the first to be interviewed and indicated the main executives who participated in the research.

In total, interviews were scheduled with 17 executives of the following civil, private and public organizations: ECOPORE (not-for-profit organization); Kanindé - Ethnic-environmental Advocacy Association; the State of Rondônia Producers Federation

– FAPERON; Public Prosecutor's Office; Environment Military Police; Secretariat for Environmental Development (SEDAM); Management Operational Center of the Amazonia Protection System (CENSIPAN); Natural Resources Research Company (CPRM) and the Secretariat for the Environment of the Porto Velho Municipality. The interviews were conducted between 2018 and 2022, lasting from 30 minutes to 2 hours.

The following measures were adopted to allow an unimpeded relationship between interviewer and interviewee: (i) the interviewees were informed of the qualitative nature of the research, without specifying or pre-establishing the analysis factors; (ii) the researchers sought to stimulate the interviewees and to make them free to express their opinion and perception on the theme focused, trying not to induce answers, pre-defining or influencing them. We adopted a semi-structured script with guiding questions to capture the opinion of the interviewees at their workplaces.

The questions were deepened according to the interviewees profiles and the organization they worked at. The interviewees were identified with the letter I (from I1 to In) to ensure the anonymity of the opinions. The transcriptions totaled 258 pages and, based on the procedures suggested by Bardin (2016), a pre-analysis of the material produced was performed; the segments and narratives that best related to the constructs of the research were selected. The analysis process was carried out by content analysis and theme classification.

The following autopoietic processes were delineated as the analytical categories adopted for the study: (i) Formation of the political and economic system; developmental sense; (ii) Political system – deforestation as a political and economic operation; government programs; (iii) Legal system – illicit as a generalized operative sense; inefficiency; (iv) Economic system – autopoietic colonization; couplings; local and international economic system. Moreover, the following themes related to climate risks emerged: (i) neodevelopmental colonization; (ii) Expansion of climate risks.

The neosystemic approach has been used to understand climate risk in recent studies, as the one developed by Carvalho, Santos e Brondizio (2021), who examined the civil initiatives directed to preventing extreme events in Amazonia and, more recently, the one conducted by Oliveira (2023), who pointed out the Luhmannian approach as a potent contribution to future international litigations, aiming to protect the Amazon.

As an analysis case, the state of Rondônia is considered a picture of the neodevelopmentalism in the Amazon. It was chosen to be the central object of the research for encompassing characteristics that allow understanding the phenomenon investigated. The state presents a context of dominance of the economic agenda over the environmental one, and is presented as one of the Amazonian sub-regions with more significant occurrences of extreme climate events.

The population of Rondônia went from a little over 111,064 inhabitants in 1970 to nearly 500,000 in 1976 (Silva, 2015; Turchi, 2015). This growth resulted from migratory flows of workers taken by the Brazilian Government to the state of Rondônia – 57.3% of these migrants came from the state of Paraná. In 2010, Rondônia recorded a total of 1,560,501 inhabitants, which represents a 1,305% variation in terms of growth rate in a

40-year period. The disorderly growth process aggravated social exclusion and conflicts regarding land ownership in the state (Silva, 2015; Turchi, 2015). Rondônia accounts for one of the highest homicide rates affecting indigenous people, riverine people and small family farmers in Brazil (CPT, 2018).

This process is related to aspects such as agriculture, livestock production and water supply to urban areas (Vörösmarty, 2018). Rondônia anticipates a near future of scarcity in other Amazonian states in case the generalized deforestation process is not halted. The markedly developmental character, directed to the agribusiness, has been gaining momentum throughout the Amazonian region, even in states with a preservation history, such as Acre (Hoelle, 2018).

Therefore, the territory mentioned is a typical example of the predatory development standard that associates wealth generation and environmental degradation. Rondônia is a case, an emblematic example of how complex the relationship between society and nature can be at the beginning of this century.

A neosystemic reflection on the Amazon

The neosystemic theory was developed as a counterfactual to piecemeal and atomized approaches in a context of great social complexity. Luhmann, one of its major formulators, starting from the necessary decentering of the subject, elaborated his theoretical approach, having communication in the systems and structures as the object (Baralou, Wolf; Meissner, 2012). The society is not represented here by concepts such as individual, group, class, or even by the generic concept of “humanity”, but by self-referring communicative systems. Innumerable concepts try to account for the communication dimension in Luhmann’s theory. Therefore, the necessary reference has to be made to concepts such as autopoiesis, self-reference, reflexivity and couplings among the political, legal and economic systems to understand how the risk can materialize in the analyses of the Amazon, from the formulations of the mentioned author.

For Luhmann (2013, 2016), there is a difference between system and environment. The first gradually moves away from the second after certain communicative operations that use symbolic means, such as having power or not having power (government and opposing parties), legality and illegality (or legal validity or invalidity), owning or not owning (estate). Once codified, those operations become self-referencing.

Systems are self-referencing for referring to themselves at each operative communication. The concept of self-reference allows understanding such systems as concurrently closed and operatively open in their cognitive aspect, conducting inter-systemic interactions without losing their autonomy and preserving their difference with the environment (Minhoto; Amato; Camargo, 2022).

Another important concept is that of autopoiesis. Of Greek origin – auto “self” and poiesis “creation” - it means the ability of the systems to produce themselves. An autopoietic system is operatively closed, having self-reproduction as its major characteristic, faced with the transformations of the environment (Luhmann, 2013). The social systems

of functional nature perform specific functions, represented by self-referring communicative structures, such as law, economy, politics, education, science and media. There is a dynamic system development, with structural changes caused by communication and differentiation, involving variations in the autopoietic systems and stabilization in the structures, in an evolution *continuum* (Luhmann, 2016).

Autopoietic systems are therefore determinant for changes in functional communication structures. The notion of systems is thus based on networks that, in interaction, self-produce elements in an autopoietic process. Autopoiesis is everything that occurs in systems, such as operation, comprehending operative self-organization and self-production in a dynamic production of themselves. Systems create and maintain themselves, having connection capacity as a basic element for their maintenance. The evolution of each system occurs by autopoiesis and the capacity of taking decisions about itself when faced with alterations in the environment (Luhmann, 2013, 2016).

In certain circumstances, the systems “decide” to conduct operative couplings between their structures, without losing their internal operations. The structural coupling mechanism is a lasting way for the system to put its own elements to work by using structures of another system, without causing disorder between the boundaries. This possibility occurs through temporal events. Social systems succeed in building relationships between the elements of their own environment and those of other social systems (Luhmann, 2013, 2016).

The political system’s function is to establish binding collective decisions, operating means for differentiating power mechanisms. However, power is a special type of communication that favors the autopoietic process, structuring politics as a social system. In the State context, this system is built in constant operations between Government and opposing parties, surrounded by political parties, social movements, and groups of interest, legitimizing the State as the only organization to decide in an imposing fashion (Luhmann, 1982, 2016; Minhoto; Amato; Camargo, 2022).

The legal system, in that context, derives from the political system and has an instrumental character. It is characterized by the licit/illicit (legal/illegal) binary code and unfolds as a result of structural innovations intending to adapt society to certain degrees of conduct. This system operates as a generalization of expectations of norms that act conformingly; these expectations are strengthened against non-compliance, when endorsed by sanctions, through regulations and conflict-solving mechanisms. The law in force is the operative process used by means of material and procedural rules, as well as by principles, to constitute its reflexivity and to apply the pertinent regulations (Minhoto; Amato; Camargo, 2022).

As a peculiarity, it happens to be an autopoietic system that is continually constructed by the political system (which elaborates the regulations) and by the second-order observation (of the law operators that interpret the system), aiming to regulate society and its environment. For acting with the generation of stability in the normative expectations, the legal system seeks security in a context of risk, in the decisions of the system, endangering society.

Additionally, founding the study is the concept of *new developmentalism*, which takes us to the social and historical perspective, most often enveloped in unpredictability and uncertainty, which tries to formulate (as from the post-World War II) alternatives of insertion of the countries in the periphery of the global context of capitalist development. The thesis underlying the developmental theory rejects the probability of the economic systems being regulated exclusively by the market and supports the need for regulatory frameworks at national and global scales (Bresser-Pereira, 2016). This theoretical political perspective has been expanded in Brazil more recently, in a context of polarization with political groups from the extreme right wing, of markedly neoliberal nature (Milhorance, 2022).

In this environment, the economic system seeks to ensure the future availability of resources, considering the current distribution. This function is operationalized by resources of financial nature, once the currency operates the binary code of the having/not having system. The organization that best represents the system is the corporation, and its central axis is formed by the banks (Minhoto; Amato; Camargo, 2022). Luhmann (2016) considers that the economic decisions guide the political system and that the structures of the economic system gradually differentiate themselves and develop in co-evolution and co-transformation with the political system, under the inflow of the interests of the former.

Climate risks as an expression of autopoietic operations

Society is a complex system relating to environments filled with complexity, making the system take decisions for self-organization, both internally and regarding the other systems in the environment (Luhmann, 2013). These decision processes bring out risks. Political choices especially matter as regards risks to the very system and to the external environment, of which nature is an integral part. The political system is a decision-making element for shaping the legal system. The risk resides in the decisions taken when faced with certain autopoietic processes, since it determines a hierarchy between contexts and decisions (Luhmann, 1982).

Data – speeches and numbers

The data and speeches of subjects that integrate intersystem networks, based on the communication of risks, indicate the consequences that the *neo-developmentalism* can bring about. Decisions and risks generate autopoietic processes that increase or mitigate damages. Therefore, the selective pressure on certain elements means contingency (decisions), which invariably means risk (Luhmann, 2005). The risks and the damages to the environment (including the natural environment) result from choices adopted by the systems and from self-produced processes directed to these choices.

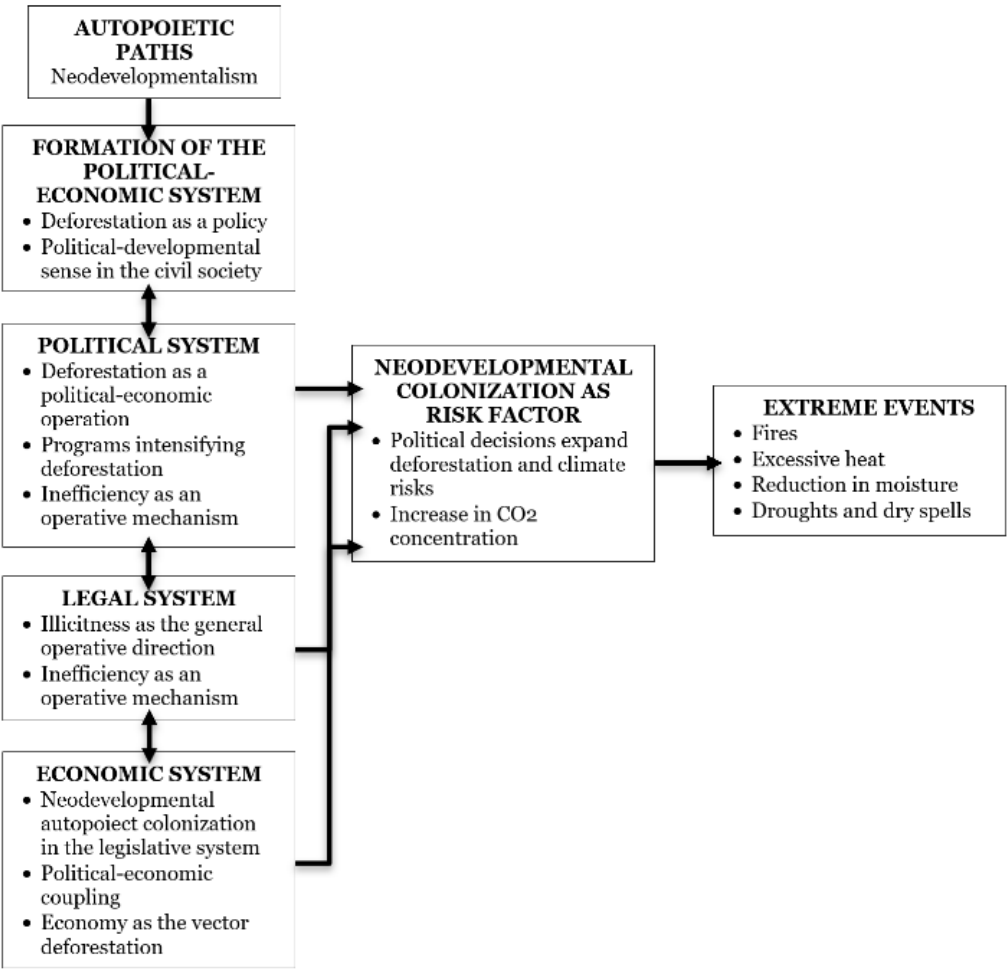
The speeches and numbers presented as follows help to understand the elements of the autopoietic and systemic nature in Rondônia, in their political, economic, and

legal dimensions.

Autopoietic paths and reproductive capacity of the neodevelopmental logic

As an illustration, the speeches of the social subjects interviewed can be synthesized according to Figure 1.

Figure 1 - Autopoietic paths in the social construction of risk in Rondônia



Source: The authors' own, as from Luhmann, 2005.

- **Formation of the political and economic system** – deforestation as a government policy; developmental direction operated by political actors of the civil society.

Migrants were given a piece of land to be deforested in Rondônia. In case you received a piece of land and did not cut the trees down, the government would take it back. The families that came were very poor; most came with the intention to occupy and to make Brazil grow. Thus, development and deforestation were nearly the same for them. This mindset was established and orally transmitted from generation to generation, and is kept among the local citizens. There is a kind of hatred against the environment and everything regarding the Amazonian culture. I2

- **Political system** – deforestation as a political and economic operation; government programs that intensify deforestation; inefficiency as the operative system.

We know that the timber sector is very strong in the state, so it eventually helps elect lumber politicians, because in fact there is a lot of manpower, there are people who earn their living from that. I16

Then comes the government, talks about the dream of the land, cheats the guy, lying with promises of transport, education, health, ways of commercially making his activity viable, decent housing, technical assistance and rural extension. The guy goes and decides to conquer natural areas in the state, as occurred in the 1970s. But the thing doesn't stand, the government doesn't fulfill (the promise) and he invests in cattle-breeding. Twelve years later, most of the pasture here has lost half its capacity to produce biomass. Then comes the soybean and the oxen go to the forest. I10

These management plans near the indigenous lands and close to conservation units just serve to legalize lumber management inside them (indigenous lands, conservation units). I11

We have problems with the inspection organizations, which do not have enough hands. I11

The political interests prevent the structures from functioning. E11'

- **Legal system** – illicit as a generalized operative sense; inefficiency as an operative mechanism.

In the timber sector, in panning, people say like: “I have a family to support and I am working”. Many people here perceive illegal activities as a job, work. I16

We now see indigenous individuals involved in what is illegal. We see loggers, land grabbers and agribusiness people making plots inside indigenous lands. I6

Stunning as it is, the Public Prosecutor’s Office, in some cases of invasion, instead of protecting the indigenous people who were trying to keep the forest standing, started to act on the side of those who were destroying the forest. I6

The finance secretariat, the administrative or planning secretariat of the Rondonian municipalities charges municipal taxes from people who are inside conservation areas, which practically makes it impossible to get them away from the place. The law allows that. I11

- **Economic system** – neodevelopmental autopoietic colonization of the political-legislative system; coupling between the political and economic system; bank system as part of the deforestation operative mechanism; international economic system as a vector of the local political and economic system.

Politicians don’t perceive the importance of the conservation units or of indigenous territories. Some are involved in land grabbing, they appropriate the Union assets. And strongly act in the State Legislature. I4

We’ve been having several legislative victories for the productive sector in recent years. So there were great advances in agribusiness, due to the economic need of the country to be inserted in the world competitive scenario. I17

I should tell you that the banks are the ones who rule here. We here have large agribusiness corporations dictating the development of the state. I10

Agribusiness is a steamroller, it represents the money from large multinational organizations, of Large corporations from countries that have great power, such as China, European Union countries that buy meat and totally dictate what is done in our territory. I10

Climate risks deriving from the decisions

- **Neodevelopmental colonization as a risk factor** – political decisions increase deforestation and climate risks; contribution to climate change due to the increase in CO₂ concentration. I3

Politicians actually work much more to increase extreme events because they are very often involved with economic interests. I3

In an internet search for satellite images, with images from the 1980s, 1990s, 2000s, you will see one of the things that scares the most in visual terms, about Rondônia. I13

There is a close relationship among the alteration in land use, water resources and local microclimate. When you remove the vegetation, there will be an alteration in the nearby water resources; we then see many water springs that are practically being lost; this will alter the flow and the volume of a whole basin. There is an increase in the CO₂ concentration. I12

- **Risks of extreme climate events resulting from political decisions** – fires; increase in temperature; reduction in air moisture; droughts and dry spells.

To maintain the pasture, the general mentality is that the more you burn, the more you improve the land due to the ashes. I15

In the last decades, mainly in the 80s and 90s, the relative humidity of the air greatly decreased, as a reflection of the removal of the forests. I9

The temperature is very exacerbated, impacting the thermal comfort of the population, who were not used to such heat. I14

These droughts have intensified as a function of deforestation. There are municipalities that have 90% of their territory deforested. They have extinguished the *igarapés* (creeks) and the springs; with deforestation, everything goes away. I7

Soybean has a great impact on the water. No wonder soybean comes in a new wave, seeking water, besides land. I13

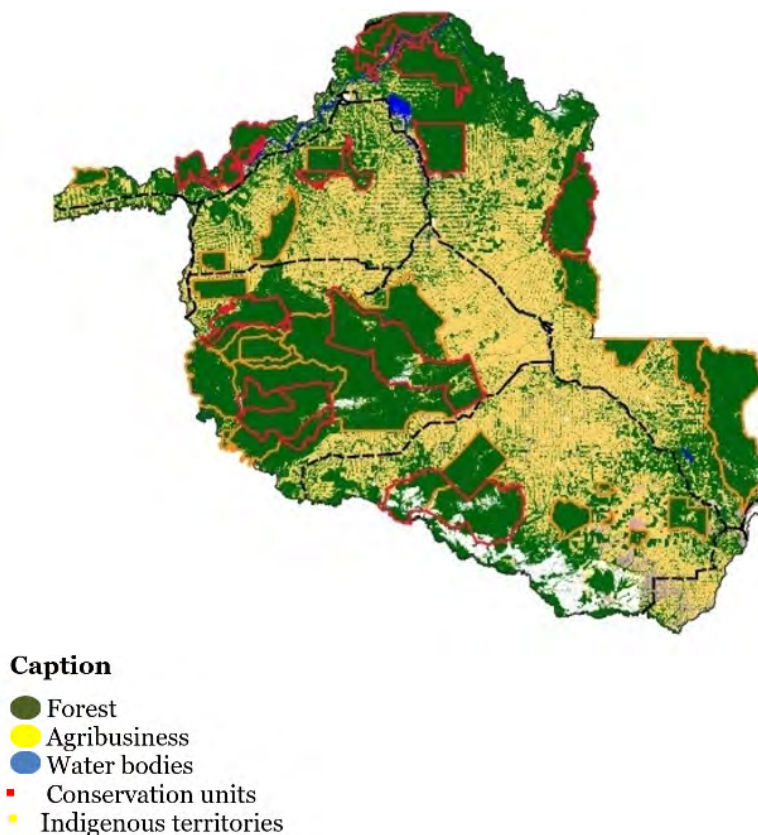
Wau Wau, which is the largest indigenous piece of land in the state, is

about 1,067,000 hectares; inside it, 17 of the main rivers of the state spring up; thus if this land is invaded and the many water springs in there are destroyed, we lose the rivers and agribusiness loses the water. I4

Rondônia in numbers

In the early 1990s, the deforested area in Rondônia covered only 2% of its territory. The migratory waves (aforementioned), the implementation of infrastructure projects by the Government, the timber industry and the expansion of cattle breeding and agriculture increased the deforested area to 28.5% of its territory – the largest deforested area in the whole Amazon (IBGE, 2019). The loss of the ecosystemic services generated by the forest has impacted the economic productivity of the state of Rondônia (Foley *et al*, 2007), once it compromises the economic performance of rural estates in municipalities with a high percentile of deforestation – forest remainders currently represent less than 15% of the original forest cover (OCDE, 2015; Mangabeira, 2018). This situation has led to serious problems of water scarcity during the dry seasons.

Figure 2 - Rondônia – a picture of the deforestation



Source: MAPBiomass (2019)

The forested areas in the state decreased 59,402 km² between 1991-2018, which means an average reduction of 2,120 km² per year. The period with the highest absolute deforestation rates was between 2002-2010, when over 17,500 km² of forest were replaced with alternative land uses, which means a yearly rate of 2,200 km². The yearly deforestation rates in the state, however, were more significant between 1994-1998, when about 3,100 km² of forest areas were lost per year. The deforestation rate has been slowly decreasing in the state over recent years. Between 2010-2018, 9,839 km² of forest were lost, with a yearly rate of 1,230 km² (Mapbiomas, 2019).

Rondônia has been hit by recurrent drought events, as the ones recorded in 1982/1983, 1987, 1997/1998, 2005, 2010, 2020, 2023 (Borma; Nobre, 2013; CPRM, 2021). It is a representative case in the Amazon for being an example of the environmental degradation process that has been jeopardizing the region. Due to federal legislative and executive decisions, the Brazilian protection policies focused on the environment have been reduced and neglected in the state in recent decades (Feng *et al.*, 2021).

In the 1990s, the agribusiness became the economic driving force and its social subjects and representatives, the political protagonists of the state of Rondônia. Note that Rondônia used to play a secondary role in this sector, as compared to the states of Mato Grosso and Pará; however, it progressively became one of the major players in the agribusiness in Brazil over the past few decades. The agricultural production in Rondônia sprawled into forest areas – the abundance of water, wood and land, as well as the possibility of attracting labor from other Brazilian regions, built regional comparative advantages (Feng *et al.*, 2021).

The state currently accounts for the sixth-largest beef cattle herd in Brazil, with 14,091,378 heads. The sector accounts for 66% of the Rondônia GDP, besides recording a fast growth in grain production (yearly increase by 10% in the harvests). Agriculture represents 34% of the GDP of Rondônia, especially from soybean and coffee crops. Regarding the recent international trade, Rondônia has exported beef (42% of the trade balance) and soybean (38% of the exports) (Rondônia-Governo, 2017; Brasil-Ministério da Agricultura, Pecuária e Abastecimento, 2019; Brasil-Ministério do Desenvolvimento, Indústria e Comércio, 2019).

Discussions

The environmental crisis generated about the Brazilian Amazon Region reflects an autopoietic colonization process in its political system (Joy *et al.*, 2014). There is a clear bias in discourses, directives and intervention proposals directed to “water businesses”, enterprises capable of attributing new meanings to water, an element being converted into commodities, to the detriment of traditional or alternative uses, as well as to the relationship the communities in the region develop with the rivers (Batista; Miranda, 2019).

The literature on the theme, the secondary and primary data, demonstrate what the theory of neosystemic inspiration puts forward. Neodevelopmentalism is revealed in the colonization of the functional systems: law and politics are notably operated by a

particular economic rationality that directs its self-reference and reflectivity configurations (Minhoto; Amato; Camargo, 2022).

The data demonstrate that the neodevelopmental model practically predominates all the speeches, also involving the commodification of nature. For this particular autopoietic colonization of the functional systems, when preservation should be discussed, the neodevelopmental rationality presents the paradox of keeping the functional differentiation – each system keeps operating, but in a perverse manner, restricting its foundations: there is a certain degree of systemic disintegration, even though independence is kept among the codes and the economic, political and legal programs.

Neodevelopmental autopoietic operations are perceived in the three systems examined: from the up-down vector of the international economic system in the local economy, delineating the predatory activity as a matrix for the Rondonian development, up to the full coupling between economy and politics, and the trend to lose the legal system in its function of preventing and fighting illicit activities, besides reducing the risks to the ecosystems and vulnerable communities of Southwestern Amazonia.

In a further analysis, there is the historical evolutionary unfolding between political and economic interests, with raids into illegality, which deserves to be discussed. As the main decision and expansion factor of agricultural and timber activities, the scenario of the forest destruction follows the axis of the highways cutting through it (Fearnside, 2022), interlinking Rondônia to the Pacific Ocean and to the Brazilian Southeast. Deforestation has concentrated along the BR-364, BR-429, and BR-421 highways, the former two constructed between the 1960s and 1980s, and the latter opened more recently, connecting the older two. The relationship between the construction of the highways in the Amazon and deforestation has been constantly confirmed by the literature.

The timber activity precedes the conversion of forests into other uses. The ones that exploit timber are also the ones that deforest and sow pasture to grab the land, which lapses into illicit practices. There are signs that the illegal timber activity in Rondônia integrates an economic-productive cycle, in which gains from timber follow gains with agribusiness activity (Fearnside, 2022; Lapola *et al.*, 2023).

Lima, Ferreira and Teixeira (2018) observed that, together with the illegal timber extraction, there are “white-collar crime” practices (involving individuals with a high degree of influence in the state) and money laundering. The decisions favoring the progressive deforestation seem to be related to the terms of each state governor, largely originating from economic activities that imply forest devastation (Agência Brasil, 2020; FGV CPDOC, 2020).

The World Bank has urged the state to meet the conservation and preservation goals the state took on in 1992, through loans taken out in the PLANAFORO (Rondônia Agricultural and Forest Plan). The plan provided actions to stimulate a more sustainable use of the state’s natural resources, complying with the Social-Economic and Ecological Zoning, created by State Decree number 3782/1988. The program is purposed to reduce deforestation, recover deforested areas and more vulnerable ecosystems, pre-delineating an economic, non-predatory, rational occupation model in the state. However, PLA-

NAFORO was not met, having been altered over time by governments representing the agribusiness interests (Keck, 1998).

As a consequence, the state of Rondônia has suffered extended droughts. According to Chambers and Artaxo (2017), the southwest of Rondônia is the most deforested area in the state, due to the predominance of agribusiness, making the area 25% drier, on average. There has been an equivalent increase in the rainfall in the forest remnants in Northwestern Rondônia. Timber extraction activities, formation of pastures and agriculture (soybean and, more recently, coffee) accounted for the deforestation of over 50% of the Rondônia territory in the last three decades and caused dramatic changes in the rainfall mechanism; the state does not benefit from the rains coming from the Atlantic Ocean, conveyed by the forest.

Most of the still-existing rivers in the state have their mouths in conservation units and cross the agricultural production region of the state. The depletion of waters in Rondônia has generated the need for constant interventions by the Public Prosecutor's Office for the recovery of the river basins; the interventions are followed by actions by the State (Betiolo; Andrade, 2020), despite the aforementioned speech about the inefficiency of the Public Prosecutor's Office.

As an example of this, there are six spring revitalization programs, involving 26 out of the 52 municipalities in the state, aiming to recover the Permanent Protection Areas degraded by deforestation: 1. PROBACIAS; 2. Viveiro Cidadão (Citizen Nursery); 3. Recuperar (Recover); 4. Plantar Rondônia (Plant Rondônia); 5. Renascer das Águas (Water Rebirth); 6. COMVIDA (Betiolo; Andrade, 2020).

There are disparities between the legal system's action to recover the Rondonian biomes, and what is stated in the state's main document on water resources. The State Water Resources Plan of Rondônia presents different scenarios and considers that the state does not run the risk of having water scarcity until 2036, although it recognizes the existence of insufficient data to build more reliable time series. In turn, multiple users who participated in compulsory public hearings, conducted to elaborate the document, stressed the generalized water scarcity in a number of municipalities (Rondônia – Governo, 2018).

The pressure of water consumption grows in an inversely proportional manner to the reduction of its availability; currently, 41% of the water taken from the state water courses is directed to livestock production, followed by water for human consumption, with 31%. There is a growing demand for water resources for agricultural ends, which currently account for 10% of the total water catchment. Agribusiness spreads in Rondônia (Rondônia – Governo, 2018). Amidst that, the risks for agribusiness in regions served by small basins are associated with the rise in the average air temperature, as well as the decrease and alterations in rainfall and in the spatiotemporal perspective, which aggravates the extreme events scenario, especially related to fires and to droughts (Escobar, 2019).

Risk situations, manifested as hydric crisis and the occurrence of severe dry periods are spreading in the Amazonian region, not only resulting from El Niño, but from systemic directions that increase and intensify those crises. The bill altering the Law of Waters (Brasil – Câmara Legislativa, 2021) and the National Plan for Water Security (Brasil –

Governo Federal, 2019) express and materialize the radicalization in the implementation of models and the intensive productive processes in the use of environmental resources, which are socially harmful.

Therefore, the neodevelopmentalism in vogue in Amazonia and the strategic choice of agribusiness as the major component of the economic agenda (translated into what is qualified as re-primarization of the economy) are harmful from the environmental point of view – agribusiness is avid for water and for land. This development standard definitely increases deforestation, water consumption, and alters the water cycle in the region (Batista; Miranda, 2019).

Conclusions

The climate risks identified in the Amazon are the expression and the result of a neodevelopmental autopoietic process. The current model of development is supported on a political rationality of autopoietic operations by which the directions guiding the corporations, founded on their peculiar competition, are dilated to different scales of social life, which leads to a growing deconstruction of the boundaries between economy and society (Lemke, 2012), and to new ways of constructing subjectivities (Dardot; Laval, 2016). The former neodevelopmental colonization has directly reflected on the directions and on the new autopoietic processes of functional systems identified in Rondônia.

As demonstrated in the documents analyzed, the speeches of the interviewees, plus the data and indicators presented, the current model deepens and spreads at a pace that increases the risks of extreme climate events. The expansion of the economic rationality discussed has the potential to endanger the self-reference in the systems, helping to disintegrate them in their functions and reducing their differentiation (Minhoto; Amato; Camargo, 2022). The results help to understand how couplings between the economic and political systems also involve the legal system, which cannot always prevent environmental unlawfulness, but acts to mitigate the fatal climate effects of deforestation.

This research helps to operationalize Luhmannian concepts considered abstract (at times criticized for that), demonstrating that the neosystemic theory has methodological applicability and may very richly be associated with other approaches, notably those of critical origin. The limitations presented herein derive from the fact that this is a case study of a qualitative nature.

Views of a wider scale on the Amazon region are likely to provide answers that allow for inferences. Anyway, this article contributes to evidencing that the new paths adopted by the neodevelopmentalism are not restricted to the already established models of commodification, monetization and private appropriation of nature. There traditionally veiled aspects this article sheds light on by qualitatively signaling the *modus operandi* and the risks of colonizing the very functioning forms that the Rondonian political system is immersed in when maintaining such close coupling with the economic systems.

These reflections point out the need for conducting further research aiming to investigate how autopoietic colonization trends can affect other internal mechanisms in the

systems, not discussed in the present work, and how this compromises the reproduction of the social systems. Analyses on the difficulties related to “second-order observations” of systems such as the scientific one are appropriate. Why can science not materialize couplings with politics and the economy, strengthening the communication of the risks? Lastly, it would be relevant to investigate how the entrenchments in the economic criteria, in the self-reference process, erode the operational closing and the cognitive opening of other social systems.

Understanding that climate risks, in times of El Niño, are exacerbated by the colonization of a predatory economic model in different systemic structures may help us make wiser decisions, while there are still natural areas in Rondônia and in the Amazon. Otherwise, we will be the spectators of an unprecedented tragedy, with the mournful end of what, one day, will have been “the largest rainforest on the planet”.

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Riscos Climáticos e Autopoiese Neodesenvolvimentista na Amazônia: (des)Construções Sistêmicas

Kleverton Melo de Carvalho
Maria Elisabete Pereira dos Santos

Resumo: Os riscos climáticos identificados na Amazônia Sul-ocidental, particularmente no estado brasileiro de Rondônia, são expressão e resultado de um processo de colonização autopoietica de caráter neodesenvolvimentista, pautado por uma racionalidade política que leva a uma desconstrução crescente dos limites entre economia, sociedade e natureza. Este artigo discute riscos climáticos na Amazônia como expressão desse processo, sob a ótica neossistêmica. Como percurso metodológico, o estudo apresenta natureza qualitativa e exploratória, utilizando como fontes de evidências documentos oficiais e entrevistas semidirigidas a 17 gestores de organizações civis, privadas e públicas, relacionadas a políticas ambientais e climáticas. Os dados sistematizados indicam o esgotamento do modelo em curso, que se aprofunda e se espalha em um ritmo que amplia o risco, em tempos de eventos extremos.

Palavras-chave: Riscos climáticos; teoria neossistêmica; autopoiese; neodesenvolvimentismo; Rondônia.

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Riesgos climáticos y autopoiesis neodesarrollista en la Amazonia: (de)construcciones sistémicas

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Resumen: Los riesgos climáticos identificados en el sudoeste amazónico, particularmente en el estado brasileño de Rondônia, son expresión y resultado de un proceso de colonización autopoietica de carácter neodesarrollista, guiado por una racionalidad política que conduce a una creciente deconstrucción de las fronteras entre economía, sociedad y naturaleza. Este artículo analiza los riesgos climáticos en la Amazonía como expresión de este proceso, desde una perspectiva neosistémica. Como enfoque metodológico, el estudio es de carácter cualitativo y exploratorio, utilizando como fuentes de evidencia documentos oficiales y entrevistas semidirigidas a 17 directivos de organizaciones civiles, privadas y públicas, relacionados con políticas ambientales y climáticas. Los datos sistematizados indican el agotamiento del modelo actual, que se profundiza y se propaga a un ritmo que aumenta el riesgo, en tiempos de eventos extremos.

Palabras-clave: Riesgos climáticos; teoría neosistémica; autopoiesis; neodesarrollismo; Rondônia.

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