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Pyrocene and Economic Rationality: Fire as Tool, Practice and Culture in the Doce River Valley

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Abstract

This paper investigates the relationship between hegemonic economic rationality and the environmental crisis, with fire as the common thread. Based on Warren Dean's work, "A ferro e fogo" (*With broadax and firebrand*), we delimited the Doce River Basin (DRB), in the Southeast Region of Brazil, as a unit of analysis to understand the circumstances that led us to the current situation and, from there, to reflect on future possibilities for changing the *status quo*. In a dialog between the works of Espindola (2009; 2011; 2015; 2022) and Pyne (2016), we point out the possibility of going against the degradation tide that leads us to the Pyrocene.

Keywords: Economic rationality; environmental rationality; sustainable development; Doce River Basin; Pyrocene.

Piroceno y Racionalidad Económica: El fuego como Herramienta, Práctica y Cultura en el Valle del Río Doce

Resumen

Este artículo investiga la relación entre la racionalidad económica hegemónica y la crisis ambiental, con el fuego como hilo conductor. A partir de la obra de Warren Dean, "With broadax and firebrand" (El hierro y el fuego), recortamos la Cuenca del Río Doce (CRD), en la Región Sudeste de Brasil, como unidad de análisis para comprender las circunstancias que nos llevaron a la situación actual y, a partir de ahí, reflexionar sobre las posibilidades futuras de cambiar el *status quo*. En un diálogo entre los trabajos de Espíndola (2009; 2011; 2015; 2022) y Pyne (2016), señalamos la posibilidad de remar contra la corriente de degradación que nos conduce al Piroceno.

Palabras clave: Racionalidad económica; racionalidad ambiental; desarollo sostenible; Cuenca hidrográfica del Río Doce; Piroceno.

Introduction

The environmental crisis stands out among the several planetary challenges that humanity faces at the beginning of the 21st century. In the course of European expansion, from the end of the 15th century, an explorationist[1] economic rationality was configured, which became hegemonic

[1] Translator's Note: We use "explorationist" as a translation of "exploracionista" from the Portuguese version of Claude Raffestin's most influential book *Pour une géographie du pouvoir* (For a geography of power).

in the 19th century and globalized in the 20th century. The explorationists, in the terms proposed by Raffestin (1993, p. 234-235), "practically only resort to one category of information, which can be qualified as functional. Functional information is that which is of interest to all techniques of valorization at all levels".

In this logic, according to Raffestin (1993, p. 234-235), what matters is the "present good at the expense of a future good", so the impact on the "physical and human environment is not taken into account, since the immediate gains have as a corollary, in most cases, the costs in long or even medium term". As the author recognizes, the colonial period was strongly determined by "explorationist behavior". Exploitation is based on "very dissymmetrical power relations, both with things and with men". In this sense, historically, local or international conflicts over the control of resources (raw materials) are embedded "perfectly in the explorationist perspective".

In the first decades of the twentieth century, the explorationist conception was settled in the context of economic rationality, by linking the notion of development to that of economic growth and paving the way for the great acceleration[2], from 1950 onwards. What we call here the environmental crisis is equivalent to the climate crisis, as shown by Marques (2022), a term used by the United Nations (UN)[3]. The climate crisis can be understood as an imbalance in the energy balance of the Earth's System due to the concentration of greenhouse gases (GHG), which, by increasing, raise the levels of heat retention in the Earth System (ES) and cause the global warming. Thus, GHGs are usually pointed out as the biggest villains in climate crisis/emergency narratives and, therefore, any and all agricultural practices involving fire and burning are immediately condemned by modern science, which relates them to primitive practices.

This Promethean narrative, in the terms of Stephen Pyne (2016), transformed fire, which was initially related to the notion of power and the representation of deities in various cultures, into something bad. The fire that fertilized the soil for the crops of the first human societies became one of the biggest obstacles to the survival of the species. But the issue is more complex than just excessive burning. Pyne (2019, p. 175) states that "we have too much bad fire, too little good fire and too much combustion in general". The author draws attention to the need to understand fire not as an exogenous force, but as a natural process, as fundamental to ecosystems as rain and sun (Pyne, 2016, p. 7). Without anthropogenic interference fires occur in several ecosystems, within their respective ecological limits and in specific seasons, however, after the human species used fire as a management tool/technique for its territorialization, the rhythm of the ES was changed. What characterizes the great acceleration is the magnitude of incessant combustion, mainly due to the burning of fossil fuels for energy generation or the widespread extension of fires that consume forests.

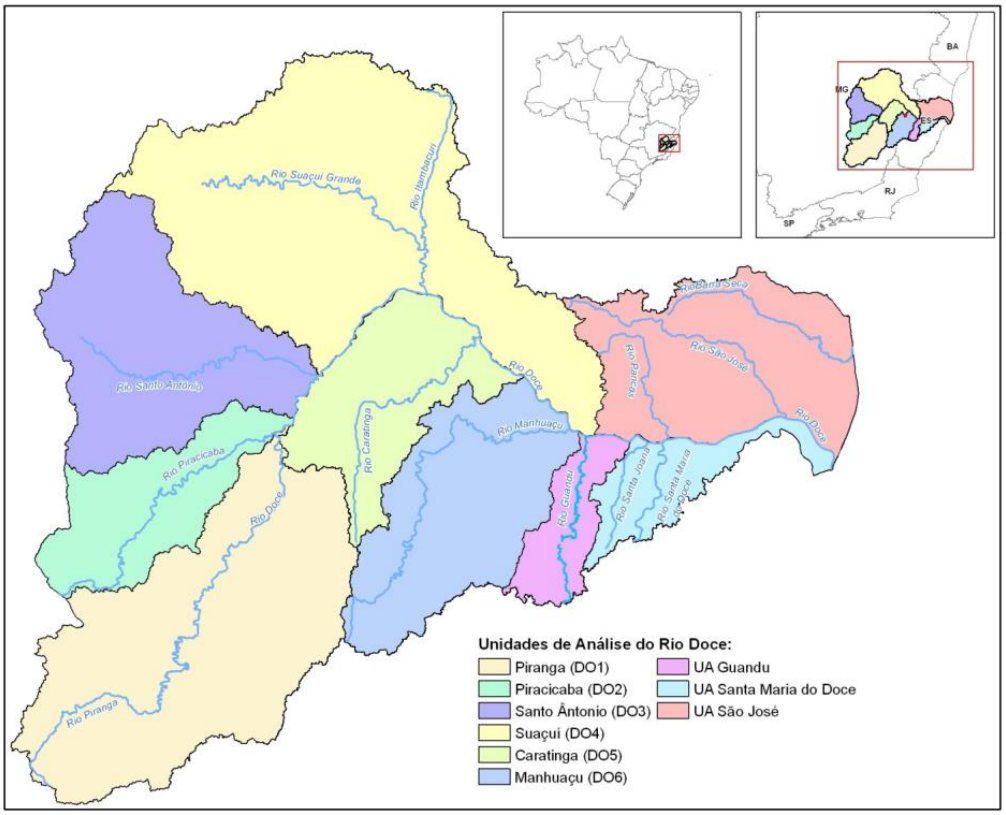
[2] The term is used to refer to the significant rise in the energy consumption curve from 1950 onwards, made possible by the increasing availability of oil, the diffusion of the capitalist economy of mass consumption on a planetary scale, the innovations of breakthrough technologies and the spatial and social generalization of large-scale consumption. For more details, see Luiz Marques (2022).

[3] United Nations Brazil. Communication on Climate Change. Found at: https://brasil.un.org/pt-br/199476-comunica%C3%A7%C3%A3o-na-mudan%C3%A7a-clim%C3%A1tica. Accessed in 7/7/23.

Faced with this context, we adopted a critical stance in terms of Foucauldian genealogy, and conducted a "historical research through the events that led us to constitute and recognize ourselves as subjects of what we do, think, say" (Foucault, 2000, p. 247). Foucault proposal is to turn criticism into something positive, in the following way: at first, analyze the historical conditions in which certain discourses and specific strategies that have consolidated into consensus have emerged, and at a second moment, reflect on the limits imposed and the possibilities of navigating beyond such borders.

To accomplish this task, we leave the macro scale and reach the micro scale (Santos, 1988; Souza, 2021). Although the environmental crisis is planetary, within Brazil we identified the Doce River Basin (DRB) as one of its locus of significant expression of the totality. Thus, we cut out the DRB as an unit of this analysis to exemplify the relationship between economic rationality and the environmental crisis, based on Warren Dean's classic book, "With broadax and firebrand", one of the most influential works on the Atlantic Forest in Brazilian environmental History. In this article we describe the construction of economic rationality; the evolution of the concept of development; we apply the lenses of Espindola (1998, 2009; 2011; 2015; 2022) and Pyne (2016; 2019) to contextualize the situation of the DRB; and finally, we discuss the possibilities of thinking alternatives to the great challenges that the environmental crisis imposes on us.

Figure 1. Location of the DRB Units of Analysis.



Source: ECOPLAN-LUME, IGAM (2010). Delimitation of the DRB units of analysis.

Economic rationality and the concept of development

This section deals with economic rationality as an explorationist Eurocentric construct that gradually became hegemonic after the 15th century, rooted in European colonialism (Dussel, 1993). Enrique Leff (2014) states that the sciences "were born in the ontological order and historical time of modernity", from a Cartesian understanding of knowledge. Boaventura de Sousa Santos (2006) follows in the same direction, claiming that modern science created the scientific paradigm that subjected nature to mathematical laws that would be able to predetermine its behaviors, creating a division between the "natural sciences" and other cultural and social studies. In other words, the sciences as we know them are ideologically rooted in the view of the world as something that can be understood and controlled.

This way of perceiving reality has roots that go back to the great navigations and the European commercial and colonial expansion between the 15th and 17th centuries, a period in which Europe ceased to be the hitherto peripheral and secondary portion in the "Euro-Afro-Asian" far west (Dussel, 2005). The process of socio-economic and technical change is seconded by a fundamental change of mentality, which is generally called the Renaissance. In this context, as Espindola (1998, p. 31-32) indicates, the human being became the "measure of all things", that is, a new mentality was established that "separates man from nature". Nature as a reality external to human beings becomes the object of scientific research and, at the same time, becomes a thing, a good that can be appropriated, exploited, transformed and negotiated, in order to integrate economically and be a source of enrichment and a resource of power.

In the process of economic and colonial expansionism, as Wallerstein (2007, p. 35) states, European thought began to see Europe as the center of the world and morally impelled to spread its values and its model of society across the planet, in a "civilizing mission" to end the barbarians and their practices violating universal Christian values. The European man perceived himself as fully capable of subjugating the "uncivilized Other" and nature, converting everything and everyone into resources, or means, to enhance the accumulation of capital, his ultimate goal. The European model of society should be followed, as the most advanced civilization and, consequently, the natural destiny of all those who manage to evolve (Magalhães, 2012, p. 26).

The sciences and the forms of organization of the States have developed as parts of this Eurocentric world-system (Wallerstein, 2002), also acting as pillars of support for this complex network of human relations that seeks constant expansion. "In the twentieth century, the state and large multinational corporations transformed science into a scientific enterprise, which moves billions of dollars, financed and dependent on capitalism and the governments of developed countries" (Espindola, 1998, p. 16). The economic sciences are a case in point, such is their relevance to the structuring of the Eurocentric world-system. Raworth (2019) points out that the initial approach of political economy aimed at the materialization of specific objectives (namely the subsistence of the population and/or the regular functioning of the State) broke down after the work of John Stuart Mill (1844), who redirected the field to "the discovery of its

apparent laws[4]". Mill's work led to the expansion of methodological individualism in economic analysis, and the search for the explanation of social phenomena based on individual behavior (Avila, 2014, p. 319).

In the 18th century, intellectuals wanted to make their disciplines "science", moving away from metaphysics and closer to Newtonian physics. In parallel to the other social sciences, economics was shaped by modernity's understanding of the world, which sought to bring scientific rationalism to human behavior, to create a "social physics" capable of interpreting behavior through the principle of causality, orienting knowledge towards the control of social order to foster "progress" (LEFF, 2014, p. 20-21). Léon Walras (1883, p. 5) was one of the main thinkers of this "purification" of the economy, stating that "the characteristic of a science proper is the complete indifference to any advantageous or undesirable consequence, of its link with the search for pure truth". Such a search for "pure truth" would be obtained through mathematical calculations, according to Jevons (1871, p. 48.): "Economics, if it is to be a science at all, must be a mathematical science".

The idea was worked out by Lionel Robbins (1932), who delimited human behavior and its relations with scarce means[5] as the object of economic study; and it evolved until it reached the current definition found in the introductory books of undergraduate economics courses: Economics is the study of how society manages its scarce resources and "economists, therefore, study how people make decisions and interact with each other" (Mankiw, 2013, p. 4). Economic science has become a science of human behavior and, in order to define the "laws" governing such behaviors - in an analogy to Newton's laws of mechanics - they have adopted a "standard organism", called "*Homo economicus*", always rational, seeking the maximization of profits and utility[6], always choosing the best possible course of action (Mankiw, 2013, p. 471).

Thus, economics became a "positive science", stripped of values and concerned only with describing its "behavioral rules" (Raworth, 2019; Boaventura 2006). "Some influential economists, led by Milton Friedman and the Chicago School, claimed that this was an important step forward" (Raworth, 2019: 44), but this intended ethical/moral distancing in reality only moved economics away from its initial goals and values, leaving in its place a blank slate - a moral void (Sandel, 2018: 19) - that was quickly filled by the idea of "utility".

Working from *Homo economicus*, questions about moral values beyond self-interest were extirpated (Avila, 2014, p. 320), leaving implicit the obvious conclusion that man, always rational, seeks the continuous growth of his income and production, to consume increasingly "useful" goods, making consumption, then, a necessary condition for his happiness. This was the

[4] "The science which traces the laws of such of the phenomena of society as arise from the combined operations of mankind for the production of wealth, in so far as those phenomena are not modified by the pursuit of any other object" (Mill, 1844, p. 68)

[5] "Economics is the science which studies human behavior as a relationship between ends and scarce means which have alternative uses" (Robbins, 1932, p. 15).

[6] "Utility is an abstract measure of the satisfaction or happiness that a consumer receives from a bundle of goods" (Mankiw, 2013, p. 444). In Jevons's words (1996, p. 78) "the variation of the function expressing the final degree of utility is the main point of economic problems".

theoretical construct that the anthropocentric and Eurocentric world-system found, through the economic sciences, to equalize money with happiness and scientifically justify its incessant accumulation of capital as a "natural" search for happiness and human well-being, through the maximization of utility. The generalized search for development in underdeveloped countries, which is configured in the context of the great acceleration, should continuously raise this maximization.

As Esteva (2000, p. 59-60) explains, in the post-World War II period, the world was divided into "developed countries" and "underdeveloped countries", the core of which was to affirm development as a goal to be achieved by the second group of countries. This change expressed the new hegemonic position assumed by the USA, as can be seen from the words of Harry Truman, when he stated that the "old imperialism" would have no place in his plans (inauguration speech for the second term, January 20, 1949). Instead, he makes US "scientific advances" and "industrial progress" "available for the growth and advancement of underdeveloped areas". Truman re-signified development and, at the same time, established a program, expressed in economic rationality, which makes it his duty to "escape from the undignified condition called underdevelopment".

In the USA, since the crisis of 1929, the goal of economic growth has been combined with the term development and established as a hegemonic rationality in a world system, through the diffusion of the Gross National Product (GNP) calculation. The US government initially used the GNP calculation to measure whether its ailing economy was improving, but it became a metric that gained diffusion for its "simplicity" and multiplicity of uses, by allowing national economies to be compared in numbers. This widespread use, however, did not take into account the recommendations of the GNP creator himself, who warned that it did not measure the well-being of a nation and, moreover, was being used to "impress foreigners and our fellow citizens" without concern for ethical principles (Kuznets, 1934; 1946; 1962). The criticism was ignored and the calculation was adapted so that Gross Domestic Product (GDP) became "the sum of market prices", in other words, all types of consumption, regardless of their value as "utility", measuring "any final consumption to national income" (Mazzucato, 2020).

The belief in an infinite nature[7] led economic rationality to ignore the negative effects of productive processes, classifying them as "negative externalities" that were neglected. Based on the theory proposed by Simon Kuznets (1955), the inequalities arising from the GDP growth process were understood and propagandized as inevitable on the path towards economic success, a kind of "economic law of motion" used by the World Bank in projecting the estimated time for the fall in poverty levels in peripheral countries (Raworth, 2019, p. 182).

According to Esteva (2000, p. 63), "development has become an obligatory program to be followed by all States or, more precisely, a necessary and inevitable destiny". "Developed" economies become the horizon to be sought, "the final stage of a unilinear path for social evolution", understood as "the natural culmination of already existing potentials". The idea of

[7] "There will be no shortage of Earth's resources, claimed the laissez-faire economist Julian Simon in the 1980s, if markets are permitted to do their job. A shortage of, say, copper or oil will raise the its price, spurring people to use it more sparingly, search for new sources and discover substitutes" (Raworth, 2019, p. 80).

development, generalized and vulgarized in political speeches, journalistic articles in print and broadcast media, but especially on the radio, reaching every home on the planet, is the metaphor that has given "hegemony to a genealogy of purely Western history".

Although consolidated as an instrument of hegemonic reason and fit like a glove to those seeking to justify infinite growth, the resilience of the GDP growth metric to assess development did not withstand the ravages of the 2008 financial crisis[8]. It is interesting to observe a growing and constant change in the narrative about development, which, while always present, has come to be followed by adjectives such as green, inclusive or sustainable. The idea of "growth for growth's sake" has gradually become less acceptable, given the escalation of real-life problems, which have called on economic science to take a closer look at its definition of development.

If the concept of development has moved away from pure economic growth, where is it heading? How do we define development? Which development are we talking about? From the economic perspective, according to Celso Furtado (2000, p. 21-22), the concept of development was commonly used in two main senses until the 20th century: 1) increasing the effectiveness of a social system of production; 2) in reference to the degree of satisfaction of human needs. The author also raises the importance of considering "the objectives pursued by dominant groups in a society", because, according to him, the concept of development is intrinsic to the social structure of a given society and therefore directly influenced by the dominant ideology.

The notion of development was tied to liberal economic growth until the 1950s and 1960s, when theories of economic development emerged proposing complex alternatives to the neoclassical proposal (Cardoso, 2019). But it was during the 1970s that the debate on the physical limitations imposed by the planet on economic growth intensified, especially after the book “The Limits to Growth” (1972), commissioned by the Club of Rome[9] to a group of researchers from the Massachusetts Institute of Technology (MIT), which broadened the discussion of the environmental issue by arguing that the Earth Systems could not support the maintenance of economic and population growth at the levels of the time.

Heated debates took place in the following years, with the economy as an antagonist to ecology, until at the end of the 1980s, when the UN World Commission on Environment and Development produced the report "Our Common Future" (1987), also known as the Brundtland report, presenting for the first time an idea of intergenerational responsibility (da Silva Azevedo; Clark, 2019, p. 80), essential for the establishment of the concept of sustainable development (one that meets the needs of the present without compromising the ability of future generations to meet their own needs) as a goal for all nations.

Due to its conciliatory approach, despite the "strong political and ideological inclination, and a certain conceptual vagueness" (da Silva Azevedo; Clark, 2019), this concept of sustainable

[8] "The financial crisis gripping the world is severe. Nothing has been comparable since 1929. It is a deep crisis of confidence resulting from a chain of loans originally based on insolvent debtors that, by leading economic agents to prefer liquidity and thus liquidate their credits, is leading banks and other financial companies to bankruptcy even if they themselves are solvent." Cf. Bresser-Pereira *et. al.* (2009, p. 133).

[9] Group of academic, political, business and religious leaders seeking solutions to the complex problems facing the planet. Found at: https://www.clubofrome.org

development was incorporated into the legal system of several countries, such as the Constitution of the Federative Republic of Brazil, in its article 225. During the United Nations Conference on Environment and Development, known as Eco-92 or Rio-92, a consensus was cemented for the institutionalization and legitimization of sustainable development on a global scale (Oliveira, 2011; Leff, 2022), establishing an adequate commitment to hegemonic rationality among the countries present, and unifying the various concepts related to development under the umbrella of the sustainable development idea. The debate was closed - momentarily - as of 2015, with the definition of the Sustainable Development Goals (SDGs), which materialized a compass for the "sustainable future" that hegemonic rationality managed to agree through the paths of diplomacy.

The concept of sustainable development has been carefully built over time to please a wide audience, but it continues to receive strong criticism, both in the sense of being an obstacle to the economic growth of the signatory countries, and in the sense of the impossibility of sustainable growth within a capitalist logic (Coelho, 2022). On the other hand, a positive view of the SDGs would be aligned with their use as a guide for planning, an "indispensable tool for designing and promoting sustainable development strategies" (Sachs, 2000, p. 56). In any case, the "geopolitics of sustainable development" ends up reaffirming the free market as a mechanism capable of readjusting ecological imbalances and social inequalities arising from capital accumulation (Leff, 2022, p. 197).

Fire as a tool, practice and culture in the formation of Brazilian territory

Brazilian society and economy were constituted and, continuously, the frontier advanced by incorporating new lands to supply commodities (sugar, wood, tobacco, gold and coffee) to the European market, without paying attention to any other demands beyond commercial interest. In this process, the Atlantic Forest biome was devastated to accomplish the sense of colonization referred to by Caio Prado Jr. (2011). In this process, the forest is seen pragmatically, as a source of energy, raw material for various purposes or obstacle to be overcome. The rainforest was deforested to provide firewood, charcoal and wood for building furniture, railroad tie, railway sleeper, boats, among other purposes. Fire was used not only to produce charcoal, but to burn the forest after felling in order to clear the land and fertilize it with the ashes, which provided calcium, phosphorus, magnesium, nitrogen, etc. to the soil.

The guidebook for excursion no. 2 (Strauch, 1958), realized on the occasion of the XVIII International Congress of Geography, held in Rio de Janeiro, instructed participants to observe as a dominant feature of the landscape the forests devastated by fire; the extensive pastures of capim-colonião (*Panicum maximum*), burned regularly as a method of management; and the erosions that take over the slopes, previously covered by forest. The relief and climate characteristic of the forest biome of the Brazilian Atlantic coast favored the spread of fire, with forest fires assuming large proportions and duration.

> The fire ... is terrible, but it attracts us, because we feel the necessity of observing it close at hand.... Really, how beautiful is the fire of a great burn.... What a strange sensation.... It is distressing for some, in truth; for others it is a grandiose spectacle that awakens the feelings and sharpens the eye in the same way that we are taken when we see and hear the mass of an army that moves to the sound of a triumphal march.[10] (Dean, 1996, p. 199).

The highlighted excerpt reflects the perception of fire as a technology for the production of power, as recalled by Pyne (2019). Fire is compared to an army moving towards triumph, a clear relationship of territorialization. Fire in these terms is the technology used by man to overpower his opponent in the "war" against nature. Pyne (2019, p. 173) states that through fire humanity reached the top of the food chain by "cooking landscapes", and then became a geological force when they started to "cook the planet". Through the direct or indirect use of fire, the human species has shaped the planet at will, always guided by economic rationality. Pyne (2016) defines fire as the "distinctive power" of the Anthropocene, and suggests another name for the so-called Age of Humans: Pyrocene, to better define what would actually be the Age of Fire.

In this sense, among the entire extension of the Atlantic Forest - the most devastated Brazilian biome - one of the portions where devastation occurred in a more accelerated and expressive way was in the east of the state of Minas Gerais, particularly the DRB, between the decades of 1940 and 1970 (Dean, 1996; Brito et al., 1997). This peculiar condition negatively highlights the DRB, but is not different from the occupation pattern of the rest of the biome, as well as from the socioeconomic formation and how the "natural resources" of the current state of Minas Gerais have been perceived, since the colonial period (Brito et al., 1997). During the eighteenth century, gold from Minas Gerais went to Portugal and flowed to England through the Methuen Treaty, playing a central role in the English Industrial Revolution (de Sousa, 1976; Falcon, 2005). In this gold period, the production of iron and tools for mining and agriculture was concentrated in the western portion of the DRB, in the so-called "mato dentro" zone, which extended south-north from Mariana, through Santa Bárbara, Antônio Dias, Itabira do Mato Dentro, Conceição do Mato Dentro, etc. to Vila do Príncipe (Serro).

In the second half of the 18th century, the Rio Doce region began to receive more attention as a possible alternative to the decline of mining, largely due to the cornucopian myths dating back to the 16th century, about "fabulous riches" in gold and a supposed "Emerald Mountain", which would be able to place Minas Gerais in a new auriferous peak (Espindola, 2009). Expectations did not materialize after the first expeditions that entered the DRB, but eyes turned to other identified natural resources, mainly iron ore, dense forests and "fertile soils" for agriculture.

In the 19th century, metallurgical production advanced eastward, particularly in the Piranga and Piracicaba river basins, as well as the upper Santo Antônio river (see Figure 1: DO1,

[10] Herman von Burmeiseter, Viagem ao Brasil através das Províncias do Rio de Janeiro e Minas Gerais (São Paulo, 1952 [1853]), p. 130.

DO2 and DO3), taking advantage of iron ore and forest resources. However, the portion of the watershed that corresponds to the medium and lower Doce River was still covered by the Atlantic Forest and occupied by native peoples (Marinho Jr.; Espindola, 2021). It was in the 20th century that the occupation of the forest lands of the Atlantic Forest biome advanced in eastern Minas Gerais, corresponding to the current intermediate geographical regions of Juiz de Fora, Governador Valadares, Ipatinga and Teófilo Otoni. According to Brito et al. (1997), three distinct phases can be defined, how it is in the table X:

Table 1. Dynamic Phases of the Territory of Eastern Minas Gerais

1st phase – 1900/1940	**2nd phase – 1940/1970**	**3rd phase – 1970/1990**
Predominance of the coffee economy; construction of railroads and beginning of steel projects: emergence of three major regional poles in the South - North direction: Juiz de Fora, Teófilo Otoni and Caratinga.	Large steel projects become a priority; the timber industry and livestock farming expand; Governador Valadares becomes a regional hub.	Beginning of large reforestation projects; emergence of the cellulose industry; hegemony of the Vale do Aço Urban Cluster (AUVA): Ipatinga, Timóteo and Coronel Fabriciano.

Source: Created by the authors.

Despite the relevance of the coffee economy in the early 20th century, its effects were not central to the DRB, which in 1925 still had most of the forest reserves in the eastern region of Minas Gerais (Alvim, 1929). In the first phase, large foreign capital, linked to the English, North American, German and French steel industries, intensified its operations in the state to control iron ore reserves (Espindola, 2015, p. 191) and, in this context, the Vitória-Minas Railroad (EFVM) dictated the pace of occupation in the Rio Doce Valley. After the start of the railroad works in 1903, intense political disputes between the elites of Minas Gerais and external forces occurred in the following decades, until, in 1942 (Washington Agreements with England and the USA), the Brazilian government took over the EFVM and the iron mines, creating Companhia Vale do Rio Doce (Vale S.A) to exercise the state monopoly of extraction and transportation of iron ore from Itabira to the port of Vitória (Brito et al., 1997; Espindola, 2015).

In the 20th century, the elites of Minas Gerais saw the DRB as strategic for industrial progress through the steel industry, as it offered the perfect combination of forests, iron ore and rivers, a view that, according to Espindola (2015, p. 192), dominated until the inauguration, in 1962, of the coal-fired steel industry, Usinas Siderúrgicas de Minas Gerais S.A. (USIMINAS). To better understand the scale of the steel complex that depended on the transformation of the

forest into charcoal, consisting of dozens of pig iron factories and several steel mills installed in the DRB, it should be noted that in 1937 the Companhia Siderúrgica Belgo-Mineira (now ArcelorMittal Aços Longos) inaugurated the largest charcoal plant in the world (Espindola; Morais; Aquino, 2011).

Railroads were crucial to the new economic dynamic, both for the advancement of mining and steelmaking, as well as for agriculture and the timber industry. Not only did the steel industry demand charcoal, but the railroads needed wood for sleepers, charcoal and firewood. The advance of human occupation by agriculture and urbanization also demanded firewood and charcoal. According to Espindola, Morais and Aquino (2011) the combination of different fronts of exploitation of natural resources, involving mining, steel industry, agriculture, livestock, timber industry and urbanization operated as a key factor accelerating the destruction of the Atlantic Forest in the DRB. According to the authors, forests as a resource were exploited in three distinct phases: initially hardwood was extracted, later medium-sized timber, and finally the lower quality timber; but in the DRB in Minas Gerais, between 1930 and 1960, the forest was all extracted/burned simultaneously, due to the combination of the various economic factors mentioned above. (Espindola; Morais; Aquino, 2011)

The squatters who initially started in the "Rio Doce forests" (portion of the hydrographic basin that corresponds to the medium Rio Doce), opened clearings for agriculture, commonly using fires for cleaning and fertilizing the soil (coivara). As there was no concern with fire management and firebreaks, forest fires spread over huge extensions and days. According to Dean (1996), the forest was perceived as an obstacle to the farmer and the burning beyond what was foreseen was even seen with good eyes. With the advance of livestock and the use of fire to manage capim-colonião pastures, fires became even more frequent, adding to those caused by the sparks of steam locomotives, hunters, charcoal burners, among others.

The concern with fires, understood as a waste of resources, was a change that came with the railroad and steel mills, although it did not prevent them from occurring frequently. The demand of the steel mills and the presence of the railroads, enabling the entry of the timber industry, convert the forest into a valuable resource, changing the perception of the local population that, guided by economic rationality, starts to make a quick profit from the sale of hardwood and wood for charcoal and firewood, exponentially accelerating devastation. (Espindola; Morais; Aquino, 2011)

A second phase began in the context of World War II, with the hegemonic presence of the USA, enabling the implementation of the mineral extraction industry by Companhia Vale do Rio Doce (iron ore), in addition to the extraction of mica by hundreds of miners and its processing by industrial units concentrated in the city of Governador Valadares. To ensure the success of large capital investments, through the Washington Accords, made to ensure the Brazil-US-UK alliance, the sanitation of the DRB and the eradication of malaria were made possible through projects carried out by the federal agency Special Public Health Service (SESP) supervised by the American Agency for Inter-American Affairs (IIAA) (Espindola, 2015, p. 193). During this period, the DRB was strongly influenced by international capital and the federal and state governments, which promoted the large projects that rooted neoextractivism (Svampa, 2019) and, in the

background, led to the construction of a road network linking the extraction points to the processing points.

In the 1940s/1950s, upstream of the city of Governador Valadares was the zone of influence of the steel mills, which continued to Coronel Fabriciano, marked by strong land concentration, mainly in the hands of the two large charcoal steel mills, Belgo-Mineira (ArcelorMittal) and Acesita (now Aperam South America), which acquired vast areas of forest to use them in the production of charcoal, consolidating a pattern of large estates (latifundia) and devastation, where little human presence was dedicated to activities also linked to the steel industry (Strauch, 1955, Brito et al. 1997, Espindola, 2015).

The concentration of charcoal steel mills in the DRB represented a victory for the elites of Minas Gerais in the clash against foreign interests, but it should be noted that the options were always tied to extractivism that met the hegemonic rationality. Perhaps this was a better path than simply extracting raw iron ore for export. However, the cost of the implementation of the steel park was added to the process of suppression of forest cover. (Strauch, 1955; Brito et al., 1997; Espindola, 2015). Therefore, the abundance of natural resources (forest, ore and water) and the available human labor force guided the option for short-track economic growth that swallowed the abundance of the Atlantic Forest in eastern Minas Gerais and regurgitated environmental degradation, land concentration and social inequalities.

Economic dynamism based on extractivism gave eastern Minas Gerais high economic and demographic growth rates between 1950 and 1960. This dynamism is marked by the acceleration of the process of extraction of natural materials and environmental conditions, which came from the first phase, by combining with the routine practices of farmers and forms of exploitation for short-term gains, by local dominant groups of farmers, miners, loggers, charcoal burners and speculators in general, the industrializing intentions of the state and federal governments, in addition to the interest of international capital in mining.

The third phase, between 1970 and 1990, is marked by the reversal of this dynamic and the rapid reduction of economic and demographic indicators in the eastern region of Minas Gerais, particularly in the part corresponding to the DRB. This reversal started in the 1960s, as Espindola (2015) points out, expresses a structural crisis, without direct correspondence with the movements of expansion and retraction of the national and state economy. The author cites as an example the 1970s, in the context of the so-called economic miracle of the military dictatorship period (1964-1985), in which the economy of Minas Gerais presented its highest growth rates of state GDP[11], the situation of eastern Minas Gerais presented not only an economic stagnation, but a tendency of demographic reduction:

[11] "In the period 1970-77, industry in Minas Gerais achieved an average annual growth rate of around 16.4%. This vigorous expansion included the most varied manufacturing sectors, such as: textiles (26%), clothing and footwear (16.3%), hides and skins (14.4%), paper and cardboard (13.5%), mechanics (26%), transport equipment (32%)." Cf. II Seminário sobre a Economia Mineira, p. 12-13. DSpace ALMG. Found at: https://dspace.almg.gov.br/bitstream/11037/2606/3/2606.pdf. Accessed in 12/7/2023.

> Population growth rates are also the lowest in the state. While Minas Gerais maintained, between 1960 and 1991, annual growth rates of around 1.5%, the region presented, in the first decade, an average annual rate of 0.03%; in the 1970s, a negative rate of -1.03% (with an absolute loss of population, therefore); and, between 1980 and 1991, it grew 0.14% p.a.. (ALMG, 1993, p. 15)

This reversal in the third phase from growth to economic-demographic decline is directly related to the depletion of the region's natural resources, which were consumed very quickly by urban expansion and economic activities in the previous phase (1940-1070). The regional "development" in the logic of the economic rationality prevailing in the state, national and international context has swallowed nature in a very accelerated way in the DRB. According to Dean (1996, p. 269), "no industry had a greater impact on firewood reserves than the steel industry"; with twelve large integrated steel mills in the 1950s, "they produced 4.2 million tons of pig iron" with coal purchased from itinerant contractors and from their own reserves. However, in this third phase, as Dean (1996, p. 316) points out, charcoal consumption by the steel industry was still on the rise, having doubled in the 1970s and reaching a wood demand of 11 million cubic meters in the 1980s, whose own planting provided no more than a quarter of this demand. Thus, the steel mills continued to rely on contractors, who practiced land grabbing, in addition to harvesting forest on leased land.

The economy of Minas Gerais followed the national pattern and developed outward-looking, exporting positive externalities and internalizing negative ones (Brito et al., 1997, p. 86), with the DRB as one of the axes of this extractive and commodity-producing dynamic. The DRB, particularly the lands north of the Doce River, which extend to the São Mateus River basin (intermediate regions of Ipatinga and Governador Valadares), stands out in this context, as it is the last occupied frontier of Minas Gerais and yet presents the worst situation in relation to the environment, with the most drastic suppression of forest cover in the Atlantic Forest biome (CVRD, 1969). The forest was reduced to charcoal for steel mills and railroads, to firewood for domestic and industrial fuel, to ashes to fertilize the land for agriculture, or burned to open pasture, this after extracting the hardwood of commercial value in the domestic and foreign markets. This use of fire as a tool, practice and culture in the historical formation of the territory in eastern Minas Gerais allows us to use the notion of Pyrocene proposed by Pyne (2016).

It is possible to go against the tide

We argue that economic rationality, by consolidating itself as explorationist, led to the environmental crisis, having in the DRB one of its loci of significant expression of the totality. Fire played a central role in this journey, for it was through its use as technology that our species reshaped entire biomes, smelted minerals and produced the tools demanded by incessant productive expansionism. We recoded the "ecological pulse" and extended the dominion of fire, "we took it to places it could never burn on its own, we exhumed fuels from deep time and released their effluents into the future, [...] we left the planet in flames" (Pyne, 2019, p. 173).

These were the “contingencies that made us what we are” (Foucault, 2000) as inhabitants of the Doce River Basin. The experiences of the "development" of the mentioned regions, which are parts of the DRB, can be divided into two predominant visions, a cornucopian perspective that prevailed until the mid-twentieth century, painting the Rio Doce Valley as a land of endless natural resources and tropical exuberance, and a more realistic one, which sees all the devastation caused during the territorialization process (Espindola, 2015). Power disputes between national elites and international capital have directed the DRB towards an ever-deeper dive into the hegemonic rationality of modern capitalism in its neoliberal and neoextractivist phase, opening a field of opportunities for many human lives to be tragically affected in the process of territorialization of the Atlantic Forest, along the Rio Doce and its tributaries.

The crises, disasters and environmental devastations experienced in the DRB usually dominate the tragic plots that populate the imagination and daily life of the local population; and are present in several scientific productions (Egler, 1951, Strauch, 1955; Dean, 1996; Hora, 2012; Espindola, 2015; Poemas, 2015; Milanez, 2018), having as its most expressive exponent the work of Warren Dean (1996). Despite this, Espindola et. al. (2022), in their recent work, raised the importance of channeling attention to cases of conservationism and environmental restoration, valuing and disseminating the “movements against the tide”, or, in the words of Enrique Leff (2014), initiatives that “wager on life”.

Pyne (2016; 2019) points out two central narratives for fire, the Promethean one, which deals with fire as technological power, something extracted from its place of origin and redirected according to human intentionality; and a second hypothesis, which addresses fire as a companion in our journey - as a human species - as guardians of the planet. For the author, our future depends on which of these narratives we follow. The first narrative is the dominant one, which fosters feelings against "bad fire", linking it to the notion of disaster when it is too destructive. The author does not go into the merit of questioning economic rationality, however, the history of fire is closely related to that of the rationality that has become hegemonic, given that fire (in its various forms) has been used as a key technology throughout the process of historical formation of different territories, among which we can include several regions of Brazil, particularly in the DRB, in Minas Gerais and Espírito Santo (Dean, 1996).

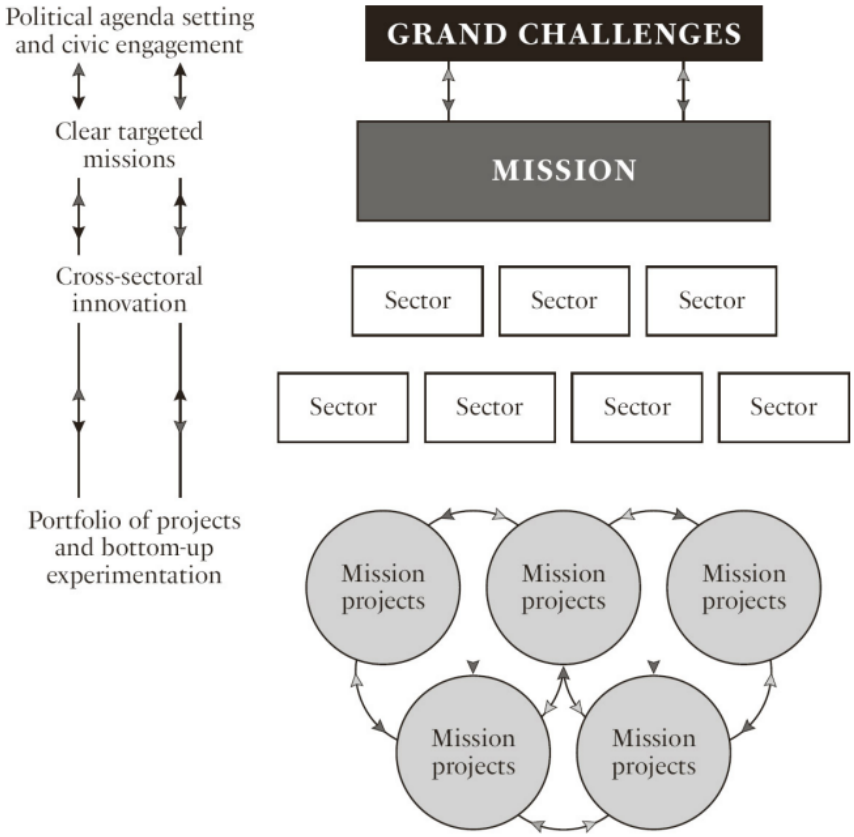
To question economic rationality and its narrative that there are no alternatives to the neoliberal capitalist model is also to question the culture of fire as a tool used to dominate nature. Raworth (2019, p. 170) states that we must overcome the capitalist economy that is now divisive and degenerative by definition and build an economy that is distributive and regenerative by design. The economist argues that we need to abandon efforts that seek to predict and control the behavior of the economy, say goodbye to the idea that constant and ever-seeking growth will solve all problems through the laws of the market (Kuznets, 1955) and, metaphorically, stop seeing the economy as a machine and embrace it as an organism. For the author, just as gardeners do with plants, economists should create the conditions for the economy to thrive, not just calculate theories, isolated in ivory towers and disconnected from reality, but rather engage, nurture, select, transplant, graft, prune and weed as the "economic organism" develops and matures (Raworth, p. 171).

Our reflection is directed towards breaking with modern anthropocentric, Eurocentric and Cartesian thinking and, from a decolonial perspective, questioning the limitations considered "necessary" by hegemonic reason, seeking possible ways of overcoming (Foucault, 2000, p. 347). The crises and climate chaos push us towards an alternative to exploitative development, and in various parts of the planet theoretical references emerge that can subsidize decision-makers brave and disruptive enough to take their first "paddles against the tide", whether at the local, regional, national or global level. There are several alternatives, such as, for example, the Environmental Rationality proposed by Enrique Leff (2022), which would take the place of economic rationality having as principles the values of cultural diversity, the potentials of nature, equity and democracy, in tune with the ecological conditions of the biosphere, the purposes of sustainability and the existential meanings of life. Another theory that emerged in parallel was the Donut Economy (Raworth, 2019), which proposes working as a social construct that must respect planetary boundaries (Rockström et al. 2009), including in its model the social foundations necessary to avoid critical human deprivations such as hunger and illiteracy.

The “mission maps” proposed by Mazzucato (2020) can be a way of aligning the various possibilities and projects that keep emerging. The economist advocates the construction of mission-oriented public policies, using government intervention as a catalyst for the creation and structuring of markets through dynamic partnerships and investments by public and private actors to solve major challenges, such as the climate crisis, with the public sector playing an essential role in the early stages, where the risk is heavier and the private sector tends to avoid (Mazzucato, M.; Penna, 2016).

The missions have to be ambitious and inspiring goals, capable of connecting multiple economic sectors and actors in the quest to improve the lives of the citizens in a given territory. Not just big projects from a particular political force, but bold social goals that will be achieved through large-scale collaboration between public and private entities, "nested on top of resilient systems and social and physical infrastructure" (Mazzucato, 2021, p. 103).

Figure 2. A mission map.



Source: Mazzucato, 2021, p. 109.

This pattern of building public policies has the capacity to put various ideas into dialogue, even at the regional (like in the DRB, for example) or municipal level. Different ideas and positions can be classified as "mission projects" in the "Portfolio of projects and bottom-up experimentation". This structure is capable of aligning various public policies, including existing ones, towards a greater goal, such as the restoration of the Doce River Basin. The final part of this article is not intended to delve into this subject, but merely to contribute by point out an existing theoretical construct that could help changing the course of the ship on which the human species is sailing, while there is still time to remedy the most severe effects of the Pyrocene.

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