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GEOGRAPHICAL TRAJECTORY OF FORESTRY IN MINAS GERAIS, BRAZIL

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Abstract

From the Historical Geography perspective, we aimed at understanding how the expansion of forestry in Minas Gerais occurred, by pursuing a synchronic and diachronic investigation of the used territory. We verified that public policies, the partnership between university-industry and the advances in silvicultural techniques as well drove the trajectory of forestry in the state, particularly of eucalyptus. In addition, the evolution of the reforestation took place from the south of the state to regions of flat relief and low land cost, consolidating in the North and in the Jequitinhonha Valley.

Keywords: Reforestation; Eucalyptus; Historical Geography; Used Territory.

Resumo / Resumen

TRAJETÓRIA GEOGRÁFICA DA SILVICULTURA EM MINAS GERAIS

O objetivo desse artigo foi compreender como ocorreu a expansão da silvicultura em Minas Gerais pelo prisma da Geografia Histórica, por meio de investigação sincrônica e diacrônica do território usado. Verificou-se que a trajetória da silvicultura, particularmente do eucalipto, foi impulsionada por políticas públicas, pela parceria entre universidade-indústria e pelo avanço das técnicas florestais e se deu do sul do estado para regiões de relevo plano e de baixo custo da terra, se consolidando no Norte e no Vale do Jequitinhonha.

Palavras-chave: Reflorestamento; Eucalipto; Geografia Histórica; Território Usado.

TRAYECTORIA GEOGRÁFICA DE LA SILVICULTURA EN MINAS GERAIS, BRASIL

El objetivo de este artículo era comprender cómo se produjo la expansión de la silvicultura en Minas Gerais a través del prisma de la Geografía Histórica, mediante la investigación sincrónica y diacrónica del territorio utilizado. Se constató que la trayectoria de la silvicultura, em particular del eucalipto, fue impulsada por políticas públicas, la asociación entre universidad e industria y el avance de las técnicas de silvicultura y se produjeron desde el sur del estado hasta las regiones de relieve llano y de bajo costo de la tierra, consolidándose en el Norte y el Valle de Jequitinhonha.

Palabras-clave: Reforestación; Eucalipto; Geografía Histórica; Territorio Utilizado.

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INTRODUCTION

For over a century implanted in Brazil, silviculture has maintained its importance in the national economic scenario due to significant advances in productivity, constantly driven by a growing consumer market for timber and non-timber products. This triumph lies in Navarro de Andrade's (1881 - 1941) scientific work on reforestation, public policies, university-industry partnerships and the progress of silvicultural techniques.

When embracing Brazilian silviculture, we need to bear in mind that since the colonial period, deforestation and forest degradation has become a recurrent practice, deepened by the expansion of the agricultural frontier, the demographic growth and the urbanization and industrialization processes. As a result, often industries that consume raw wood were likely to face an impending deficit of wood, and therefore reforestation was a plausible and promising solution to address this issue.

As in the forestry literature, there are different meanings of reforestation we adopted the term regarding the planting of forests for commercial exploitation. Non-native tree species such as pines and eucalypts are the most common essences used in reforestation in Brazil, most notably the genus Eucalyptus because of its short rotation cycle, its high profitability and its easy adaptation to the country's edaphoclimatic conditions.

Today, 91 per cent of the wood for industrial uses come from planted forests, which are destined to the steel and pulp and paper sectors, wood panel and laminate floors, solid wood, pharmaceuticals, among others (IBÁ, 2019). In 2018, the Brazilian area covered by forest plantations accounted for almost 9.9 million ha. The state of Minas Gerais (MG), in the Southeast of the country, is the leader in terms of reforestation, which mainly supplies the charcoal-based pig iron and steel industry. In the same period, its planted forest area reached 2,014,676 ha, of which 1,966,626 ha under eucalypt plantations, 48,050 ha under pine and 6,840 ha under other species (IBGE, 2019).

Considering the above context, from the Historical Geography perspective, this paper aimed at investigating how the expansion of silviculture in Minas Gerais occurred. As the category of analysis, we took into account the used territory, in which human manifestations materialize (SANTOS; SILVEIRA, 2003), as an effort to understand its formation processes, the dynamics between society and nature and the intentions of its use in different historical contexts through a synchronous and diachronic examination.

In so doing, we established a period from the 1940s with the beginning of reforestation on a large scale in the state to the contemporary moment. Additionally, we based the reconstruction of this trajectory on a bibliographic survey, census data and fieldwork, by analysing the political, socioeconomic, technological and environmental framework.

HISTORICAL GEOGRAPHY: THE RECONSTRUCTION OF PAST GEOGRAPHIES

In an attempt to distinguish itself from History in the field of the social sciences, and "in view of the need to build its own theoretical and methodological tools" (CARNEIRO, 2018, p. 26), Geography adopted the present as the primary focus of analysis while History investigated the past. According to Abreu (2000), it was a limiting aspect for the interpretation of the past as for geographic studies.

Opposing this heritage of the Classical Geography, especially the French, some geographers devoted themselves to seeking explanation to earlier times; however, many attached themselves to merely historical analyses, to purely diachronic research, and usually focused on morphological features, neglecting the processes and the actions that occur in the construction and production of space (DARBY, 1953; ABREU, 2000).

When reflecting on the past and the present as space, Santos (2006) observes that Historical Geography rebuilds the past based on the present, because it is exactly at this moment that the writing starts. The author puts forth the idea that past moments consolidated into current geographical objects constitute the current space and concludes that space is the unequal accumulation of time (SANTOS, 2012).

Darby (1953) explains that in Historical Geography, the data are historical, but the method is geographic, which allows reconstructing past geographies to understand the present. Nevertheless, through methodological adjustments, it is possible to interpret the past itself, what Abreu (2000, p. 18) refers as the "the present of then". Thus, the geographer needs to master the method to determine the categories of analysis that enable the appropriate reading of the space.

Although the categories of analysis have a universal character, the factors that operate them do not, and, therefore, they must be adapted to the interpretation of the past. Santos (2006) emphasizes the need to work space and time together, which is possible when applying the empirical time, that is, to make it material, so it is feasible to connect it to the concreteness of space.

The association between space and time is given by the techniques and through them one can demonstrate "how, where, by whom, why and for what" the territory is used (SANTOS; SILVEIRA, 2006, p. 11). The techniques are intrinsic to history; hence, they provide information about the space, which permits the adoption of a periodization, seeing that the used territory has different uses at different historical moments (SANTOS; SILVEIRA, 2006).

By the periodization "we seek to identify homogeneous segments of the historical time, in which the variables remain in relative balance with the same combination of economic, social, political and moral elements, constituting a system" (SILVA, 2019, p.6). Moreover, it also allows a synchronic-diachronic analysis, since one can comprehend the special shapes and territorial configurations by the axis of coexistences and by the axis of successions of a space-time frame.

THE PRELUDE TO REFORESTATION IN THE TERRITORY OF MINAS GERAIS

THE LEGACY OF NAVARRO DE ANDRADE

One cannot refer to the success of Brazilian silviculture without recalling the valuable work of the agronomist Edmundo Navarro de Andrade. Given the devastation of native forests and the increase in the price of wood charcoal in the early twentieth century, the Companhia Paulista de Estradas de Ferro (CPEF) (Paulista Raildroad Company) hired Navarro de Andrade as the director of its Forest Service in order to find an economically viable species, capable of supplying firewood and railway sleepers.

In 1909, after five years comparing native and exotic essences, Navarro de Andrade opted for the eucalypt for large-scale reforestation at the arboretum of Rio Claro because of its rapid growth and the durability of its wood. Around 1922, the company had evaluated and acclimated 115 species of the genus to the state of São Paulo, distributed in its arboreta. Although CPEF prioritized the eucalypt forests, it also developed research on conifers, specifically the genus Pinus, native to North America (ANDRADE, 1922; ANTONANGELO; BACHA, 1998).

The remarkable results obtained by CPEF geographically exceeded the limits of São Paulo and soon eucalypt plantations spread to several regions of the Brazilian territory, namely Bahia, Ceará, Rio de Janeiro, Santa Catarina, Rio Grande do Sul and Minas Gerais. However, in the light of the different edaphoclimatic and topographic conditions in the country, it was necessary much criteria for the choice of species for each state of the federation (ANDRADE, 1922).

Navarro de Andrade envisioned multiple uses of silviculture for several types of industries. It could provide charcoal for the steel industry and pulp to produce paper, which was able to take place in the country from 1930 onward with the Brazilian industrialization process, when in the midst of an international economic crisis, the Vargas regime adopted policies of import-substitution industrialization to strengthen the domestic market.

In this sense, the steel sector became fundamental to the national economy and Minas Gerais stood out owing to its abundance of iron ore deposits, profuse forests and water resources, favoring the creation of a charcoal steel plant in the central region of the state for the production of pig iron, the main input of steel.

Furthermore, the industrial sector started to develop reforestation programs for its self-supply with

the imposition of forest restoration by large consumers of forest products implemented by the Forest Code of 1934 (Decree no. 23.793), impelling forestry in the territory of Minas Gerais (BACHA, 1991).

THE PIONEERING ROLE OF THE FOREST-BASED INDUSTRY IN REFORESTATION

The company Melhoramentos de São Paulo, based in Caieiras, a city near the capital of São Paulo, was the precursor to reforestation in Minas Gerais, allocating its first plantations to Araucaria angustifolia for the manufacture of pulp and paper. This native species occurs naturally in the south of Minas Gerais, in the Mantiqueira Mountains, where in Camanducaia, the company started to plant on its own land in 1942. However, due to the lower productivity of the araucaria compared to exotic tree species, pine and eucalypt forests replaced it (GOLFARI, 1975).

Nonetheless, the steel industry was the one that propelled silviculture in the state. The company Belgo Mineira played an important role in establishing eucalypt forests, mainly after the inauguration of its second plant named Barbason in 1937, in Monlevade, in the metropolitan region of Belo Horizonte, the capital of Minas Gerais. It was around this plant, between Nova Lima and Coronel Fabriciano, in the Rio Doce Valley, where the first eucalypt trees were planted for self-consumption with the assistance of the CPEF Forest Service in 1948 (OSSE, 1982).

In 1949 the firm Aços Especiais Itabira (Acesita), today Aperam SouthAmerica, started its reforestation program in the vicinity of Coronel Fabriciano to supply its blast furnace, considered at that time the largest in the world, whose production of 200 t of pig iron spent about 800 to 1,000 m3/day of charcoal (OSSE, 1982).

In the 1950s, the intensification of the import-substitution strategy plus the federal policy of national integration conceived by the Plano de Metas allied to the improvement of transport infrastructure connected Minas Gerais to more developed states, promoting a vigorous development in its heavy industry.

Thus, in 1953 Belgo Mineira announced its reforestation project for the Barbason plant and established its own forest service under the auspices of the company Agrícola Florestal Santa Bárbara (CAF Santa Bárbara) in 1957. Two years earlier, Klabin Irmãos & Cia, a pulp and paper industry set up its reforestation with araucaria in Sapucaí-Mirim in the Mantiqueira Mountains (OSSE, 1982; GOLFARI, 1975).

Regarding the planting of pine, the Florestas Rio Doce SA, a subsidiary of the company Vale do Rio Doce (CVRD), began planting in Itabira, in the Rio Doce Valley in 1967. The company also had an area of 15.000 ha of planted eucalypts in the municipalities of Santa Bárbara, Barão de Cocais, Nova Era, Conceição do Mato Dentro and Açucena, in the metropolitan mesoregion of Belo Horizonte (GOLFARI, 1975).

It was in Triângulo Mineiro, however, where there was the largest pine plantation, owned by the company Resa. Between 1970 and 1973, Resa held the amount of 18.000 ha of pine reforestation. As well, other companies contributed to pine plantations such as Caxuana SA and Reflorestadora Perdizes, located between the municipalities of Uberlândia and Araxá, the latter located in Alto Paranaíba (GOLFARI, 1975).

Still in the 1970s, due to the scarcity of forests in the Aço Valley, Belgo-Mineira expanded its eucalypt forests within an area of approximately 120.000 ha. The largest portion was in the Rio Doce water basin and the smallest fraction in the upper course of the São Francisco water basin, in Bom Despacho and in the Rio das Velhas Valley, in Várzea da Palma, in the northern mesoregion of the state (OSSE, 1982).

Undoubtedly, eucalypt plantations was the most expressive in Minas Gerais and between the 1940s and the mid-1970s its expansion occurred from the extreme south of the state, a mountainous region characterized by escarpment and highly dissected relief to others with flat or slightly dissected relief, suitable for mechanized practices (Figure 1).

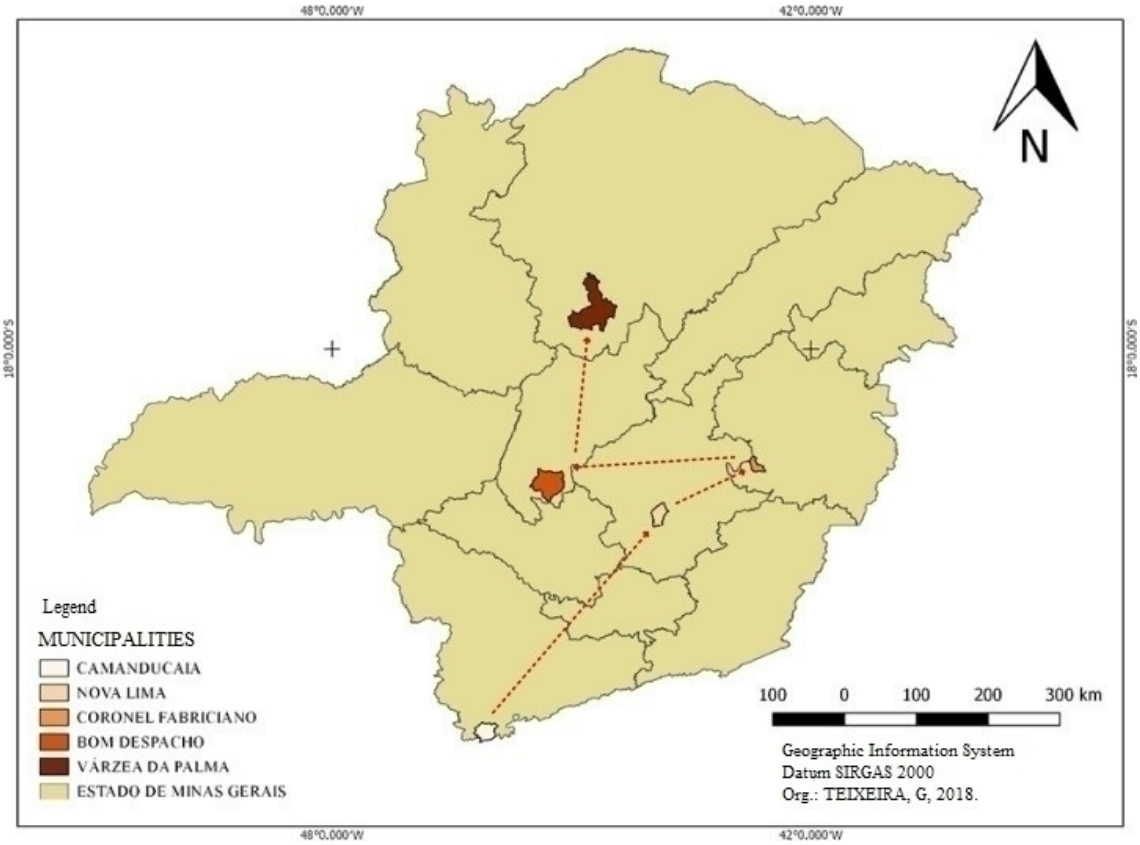

Figure 1 - Expansion of eucalypt plantations in MG between 1940 and the mid-1970s.

In addition to the relief, the value of the land was a significant factor in the choice of areas for forestry. In 1976, lands in regions provided with better energy and transportation infrastructure were more expensive. For instance, in Triângulo Mineiro, the hectare was worth Cr$ 550.00, in the Centro-Oeste it was Cr$ 220.00, while the vacant lands of the São Francisco and the Jequitinhonha Valleys were traded at Cr$ 20.00 (IBDF, 1976).

Reforestation skyrocketed in the territory of Minas Gerais from 1966 with the adoption of fiscal incentives granted by the military regime, which focused on economic growth by the industrial development, chiefly the steel and pulp and paper segments.

THE CONSOLIDATION OF SILVICULTURE IN THE TERRITORY OF MINAS GERAIS

THE CONFLUENCE OF THE TRIAD: FORESTRY SCIENCE, PUBLIC POLICIES AND TECHNOLOGICAL PROGRESS

Before the 1960s, the agronomy and engineering courses were in charge of teaching forestry science, but silviculture that had been developing widely throughout the country started to demand broader knowledge and more advanced technologies. Consequently, in 1961 it was founded the Escola Nacional de Florestas (National School of Forestry) in the city of Viçosa in Minas Gerais. Two years later, it was transferred and incorporated to the Federal University of Paraná in Curitiba. However, the initial group of Viçosa remained and created the Escola de Engenharia Florestal (School of Forestry Engineering) at the Federal University of Viçosa in 1964. In 1968 the University of São Paulo formed the Instituto de Pesquisas e Estudos Florestais (IPEF) (Institute for Forest Research) of the Escola Superior de Agricultura Luiz de Queiroz (Esalq) (LADEIRA, 2001).

The search for increased productivity led to the partnership between academia and forestry

industries, unifying science and funding for research in the field of forestry. Because of this combination, the first technological developments came about, involving particularly the techniques of planting, fertilization and nutrition and improvement of seeds (LADEIRA, 2001).

Besides the university-industry cohesion, public policies adopted in the mid-1960s conduced significantly to the boom in reforestation in the country. Firstly, the Forest Code (Law 4.771/1965) instituted tax incentives and determined mandatory restoration by all consumers of wood raw material, whereas the Forest Code of 1934 required that only large consumers of forest products had to act in compliance with the law.

Secondly, the Federal Law (5.106/1966) regulated the tax incentives granted to forestry enterprises, whereby individuals and corporations could rebate on income taxes the amounts used in reforestation. One year after the enactment of this law, the federal government established the Brazilian Institute of Forest Development (IBDF), now the Brazilian Institute of Environment and Natural Resources (IBAMA), as an organizational tool for the sector, responsible for analysing and authorizing projects subsidized by the tax benefits.

In 1974, the federal government launched the II National Development Program (II PND), whose major goal was to provide self-sufficiency in the domestic market by substituting imports and increasing exports to be in the basic input sectors. To that end, some programs emerged such as the National Program of Pulp and Paper, the Charcoal Steel Plan and the Energy Replacement Program, which increased the demand for charcoal and wood logs (BACHA, 1991).

This set of measures presented guidelines on the use of wood charcoal from planted forests for industrial use, on university-industry integration and on support for forestry research, boosting forestry in the country. In the same year, the fiscal incentive scheme underwent restructuring and the Federal government implemented the Fundo de Investimento Setorial (FISET) (Sectorial Investment Fund) (Decree-Law 1.376/1974), through which deductions were allowed for investments in tourism, fishing, and reforestation (ANTONANGELO; BACHA, 1998; HORA, 2015).

At the beginning of the fiscal incentives scheme, reforestation scattered throughout the state of Minas Gerais and the socio-environmental aspects of the regions with reforested area received little attention. There was no concern about costs as the benefits covered expenses up to the first four years of planting. Moreover, the techniques were rudimentary, the forestry research was incipient and the planted forest stands presented low yields about 15 m3/ha/year (INDI, 1975).

In view of these failures, the federal government dedicated itself to the ecological zoning for silviculture based on climatic, vegetative and species tolerance conditions, constituting five Forestry Districts (DF) in Minas Gerais: the Triângulo, the Centro-Oeste, the São Francisco, the Rio Doce and the Jequitinhonha Valleys.

In 1979, FISET began to be destined only for the coverage area of the Superintedência de Desenvolvimento do Nordeste (SUDENE) (Northeast Development Superintendence), favouring the state of Minas Gerais, which had part of the DF of Jequitinhonha in this region. In this way, the lands considered idle and of low cost, the flat relief that allowed mechanization and the proximity to the consuming centres of wood, firewood and coal turned the Jequitinhonha Valley into the locus of great reforestation projects (BACHA, 1991) .

The considerable growth of reforestation in Minas Gerais occurred with the link between the public policy of the II PND and forestry between 1975 and 1979. From the 1980s, the fiscal incentives had a progressive reduction due to the economic recession that had hit the country and ended in 1987. From 1970 to 1988, the area of the silviculture in the state reached 2.157.904 ha (Table 1).

Large consumers belonging to the private sector were ultimately responsible for carrying out the largest percentage of these forest plantations. Although attempts were made to include local farmers in reforestation by the state and federal government via forest outgrower schemes provided by the Instituto Estadual de Florestas (IEF) (State Forestry Institute) from 1976 to 1985, this initiative had a poor result in terms of reforested area, representing 2,4% (Table 2) (BACHA, 1991).

Year	Eucalipt	Pine
1970 - 1974	313.694	35.638
1975 - 1979	844.707	134.530
1981 - 1987	782.217	47.118
Total	1.940,618	217.286

Table 1 - Reforested area in MG between 1970 and 1987. Source: Ibama apud Anuário Estatístico de MG (1989). Org.: Authors (2020).

Program	Start	Seedling (n)	Reforested Area (ha)	Beneficiary (n)
Prodemata	1976	46.699	24.482,07	13.975
Repemir	1978	28.666	14.350,35	7.604
MG-II	1980	9.121	4.556,79	4.198
Planoroeste II	1981	3.198	1.601,50	1.111
CVRD	1981	9.954	4.957,93	1.579
CAF	1985	1.466	586,00	-
CENIBRA	1985	2.096	1.259,00	-
TOTAL	_	101.202	51.793,64	28.467

Table 2 - Reforestation by outgrower schemes in MG between 1976 and 1985. Source: IEF apud Assis, Silva and Araújo (1986). Org: Authors (2020).

The end of federal stimulus led the Brazilian silviculture to adapt to a new reality. It was necessary to improve research and technologies in order to increase competitiveness and decentralize the activity by strengthening the partnership with small and medium farmers to reduce production costs (BACHA, 1998).

THE RESTRUCTURING OF FORESTRY AND THE SEARCH FOR SUSTAINABILITY

In the post-incentive period, the Brazilian political and economic situation was challenging with high inflation rates, a new Federal Constitution enacted and an ongoing presidential impeachment process. The forest-based sector focused on clonal intensive silviculture to optimize productivity in a shorter time and on forest outgrower schemes and investment funds (HORA, 2015; FERREIRA, 2015).

In relation to the steel industry, the economic opening and the fall in the import price of mineral coal resulted in the retraction of the reforested area by this segment. On the other hand, the pulp and paper sector that consumed only wood from silviculture expanded the area of eucalypt forests through the restoration of the incentive stands, when inflation was controlled and the national currency started to show a certain economic balance with the insertion of the Plano Real in 1994 (HORA, 2015; FERREIRA, 2015).

Under the new Federal Constitution of 1988, the Union, the States and the Federal District had the autonomy to draft their own forest laws in agreement with the strengths and weaknesses of each region. Minas Gerais, by the law no. 10.561/1991, was the first state to draw up its legal framework, provided for the exclusive use of reforestation wood by the steel industry after 1998 to mitigate the pressure on native forests.

In 1995, part of the wood used in the state came from the subsidized reforestation stock of the 1970s and 1980s, when the annual rate of planting was 120.000 ha/year. The reforested area in the territory of Minas Gerais totalled 1.2 million ha, approximately 900,000 ha less than in the previous two decades. The average planting was 40,000 ha/year and remained so until 1999 (Table 3) (MACHADO, 1995).

Year	Outgrower Program (ha)	Landowning Area (ha)	Total
1997	11.778	23.686	35.464
1998	10.612	23.295	33.907
1999	14.381	21.408	35.789

Table 3 - Evolution of annual eucalypt plantations in MG between 1997 and 1999. Source: AMS, 2009. Org.: Authors (2000).

According to the IEF (1997), the state had to establish reforestation programs in order not to suffer from scarcity of wood for industrial use in the short term, otherwise it could make it impossible to expand and start new companies. In 1997, the estimated deforested area in Minas Gerais was 400.000 ha/year, so it was urgent to introduce new outgrower programs aimed at the economic and socio-environmental spheres, in which rural producers could participate in the production chain and at prioritizing the multiple use of wood. In this way, IEF began to promote different types of funding that involved partnerships among government institutions, entrepreneurs and producers, by using grants of seedlings and technical assistance to small and medium-sized properties.

The 1990s reflected the importance of forests for the balance of environmental systems discussed at the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro in 1992, "there was a radical shift from a utilitarian perception of forest resources to a preservationist vision" (KENGEN, 2001, p. 30). From this context, pursuing the goal of sustainable forest management, the Forest Stewardship Council (FSC) originated, a non-governmental organization (NGO) that lays down principles and criteria for forest certification taking into account economic viability as ecological responsibility and social justice (HORA, 2015).

To Kengen (2001), despite the development of many environmental and forestry programs in this decade, no policy was implemented to replace the fiscal incentives law for reforestation, which only happened in the early 2000s. Briefly, forests were treated only as an environmental heritage and not as a productive resource during this period. Even so, the private forestry sector continued to grow, mainly due to the multiple uses of wood of planted forests that emerged at this stage.

FROM THE 2000S TO CONTEMPORARY SILVICULTURE IN MINAS GERAIS

The 2000s started with the creation of the National Forest Program (PNF) (Decree 3.420/2000) aiming at the exploitation of the Brazilian forests sustainably, promoting outgrower programs and expanding the domestic and foreign markets for forest products and by-products.

In 2002, the federal government launched two rural credit programs to foster reforestation: the Programa Nacional de Fortalecimento da Agricultura Familiar (PRONAF-Florestal) for small farms and the Programa de Plantio Comercial de Florestas (PROPFLORA) for medium and large farms. Both initiatives did not achieve the expected results because of financing guarantees and the entry of new private investors in the forestry sector, the Timber Investment Management Organizations (TIMOs), which are management companies that operate in mediation between investors and commercial plantation consumers.

Also in 2002, the Brazilian Forest Certification Program (Cerflor) was implemented. Cerflor together with FSC are the main worldwide certification systems. In 2010, in Minas Gerais the total certified area was 497,020, 60 ha and in 2012 it corresponded to 597.854,70 ha (FSC, 2010; ZERBINI, 2014).

In short, in the 2000s, silviculture evolved throughout the territory of Minas Gerais (Figure 2), resulting both from the increased demand for forest products, including from companies located in other states such as Bahia, Espírito Santo and São Paulo, and the restriction of the use of native forest determined by environmental agencies. Between 2004 and 2008, the pig iron producers, the integrated steelmakers, the pulp and paper sector, the ferro-alloys segment and the independent operators were responsible for the largest plantations respectively. The independent operators also comprise participants in outgrower schemes who are small and medium-sized producers. In 2005-2006, reforestation through

outgrower programs rose 55%. In 2006, it corresponded to 28.8%, the equivalent of 42.8 thousand ha (REZENDE; SANTOS, 2010).

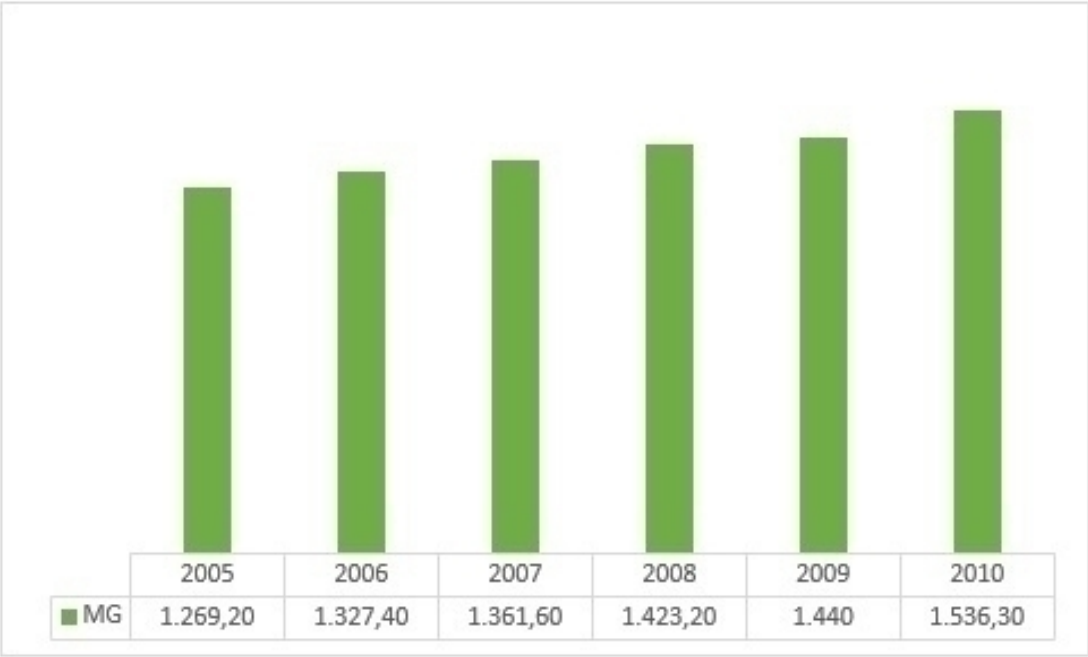

Figure 2 - Forestry area in MG from 2005 to 2010 (ha). Source: AMS, 2012. Org.: Authors (2020).

When it comes to silvicultural techniques, they have been saturated with extreme specialization, reflections of the technical-scientific informational milieu, in which there is a close interaction between science and technique, characterized as the "high coefficient of intentionality with which they serve the different modalities and the various stages of the production" (SANTOS, 2006, p. 157). They are techniques that support decision-making and employ geotechnologies and software that assist in forest management from planting to harvest, focusing on maximizing productivity and reducing costs.

The progress of techniques throughout the history of forestry has placed Brazil in a highly competitive position in the global market. From the 1960s to 2018, the Average Annual Increment (AAI) for eucalypt jumped from 15 m3/ha/year to 36.0 m³/ha/year and for pine from 18 m3/ha / year to 30.1 m3 ha/year (IBÁ, 2019).

Brazilian planted forests accounted for 9,895,560 ha. Of this total, eucalypt forests occupied 7,543,542 ha, the area of pine totalled 1,984,333 ha and other species 367,685 ha in 2018 (Figure 3). The geographic location of eucalypt plantations concentrated in the states of Minas Gerais, Mato Grosso do Sul, São Paulo and Paraná and the pine plantations in Paraná, Santa Catarina, Rio Grande do Sul and São Paulo (IBGE, 2019).

The total value of production reached R$ 16.3 billion, 11.1% over 2017. Timber production for the pulp and paper industry contributed to the highest value, equivalent to R$ 5.1 billion. Cellulose pulp production led the country to become the world's largest producer, making it second only to the USA, and the largest exporter of this input. The main reason for it was the increase in exports. The main destinations were China (30%) and Europe (25%). However, charcoal production was the driver of this growth, representing 50.5%, 18.9% higher than the previous year, corresponding to R $ 4.1 billion (IBÁ, 2019; IBGE, 2019).

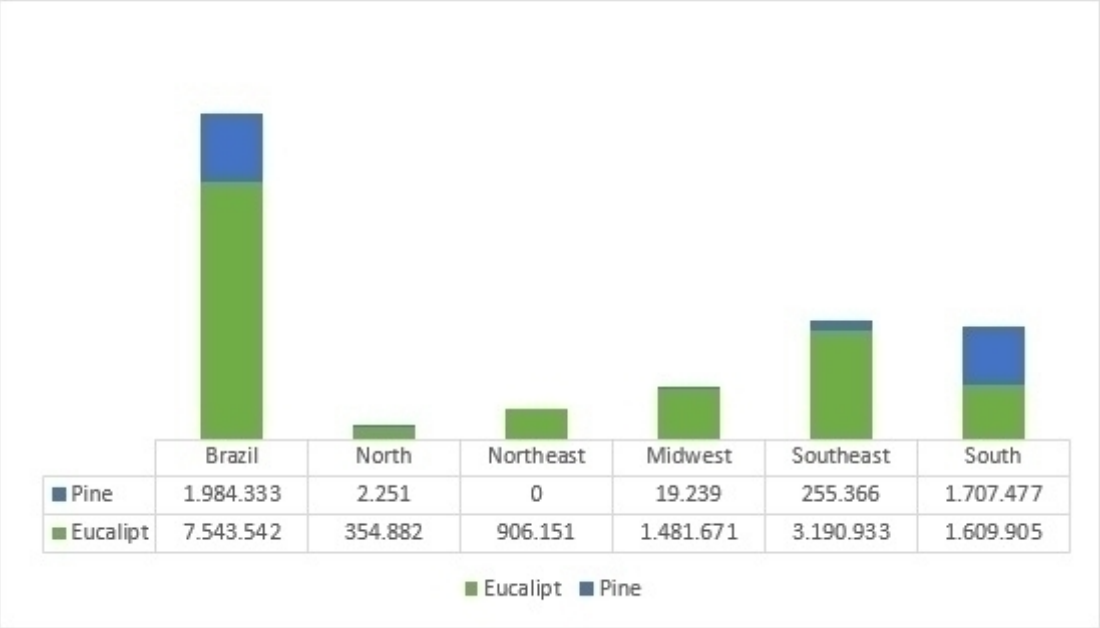

Figure 3 - Area of Brazilian forestry by species in 2018 (ha). Source: IBGE (2019). Org.: Authors (2000).

Minas Gerais registered the highest production value totalling R$ 4.6 billion, growth of 45.7% over 2017. Because of its steel industry, the state is the leading producer and consumer of wood charcoal worldwide. In 2018, the Brazilian steel sector displayed signs of recovery after the contraction of the national steel industry strongly affected by the international crisis in the commodities market as of the mid-2014. In regards to pig iron production, Brazil produced 6,562,740 tons, of which 5,347,510 tons were in Minas Gerais and exports totalled 1,912,302.92 tons and 1,228,900.61 tons respectively. Importers of pig iron produced in the state were Europe (29.8%), Asia (25.5%), the USA (24.5%), Latin America (20.2%) and others (0.04 %) (SINDIFER, 2019).

During 2018, Minas Gerais produced a total of 5,094,242 tons of charcoal, 84% of the national volume (IBGE, 2019). Maugeri (2017, p. 40) clarifies that “over 70% of all production is in the hands of small and medium-sized producers who, on the one hand, are the owners of the smallest areas of planted forests". In this scenario, production takes place in circular ovens with manual loading and unloading and a harvesting system using chainsaws. Furthermore, they operate plants with a maximum production capacity of 1 thousand tons of charcoal/year and the control of gas emissions is low. In contrast, large forestry holds cutting-edge technologies, mechanized charcoal production and blast furnaces, which have a production capacity of 10 to 140 thousand tons of charcoal /year (MAUGERI, 2016).

Silvicultural techniques are constantly evolving in the search for the efficiency of the productive processes. As a result, “the pre-existing objects are aged by the appearance of the most technically advanced objects, endowed with superior operational quality” (SANTOS, 2006, p. 147), used by hegemonic actors, unfolding the mode and social relations of production and work.

Although the steel industry plays a central role in Minas Gerais economy, silviculture in the state also provides wood for the pulp and paper sector, the panel, laminate, sawn wood, treated wood and other industries that use wood in its industrial process, such as food, cement and ceramics. Planted forests have spread across the territory of Minas Gerais and data from 2018 indicated the intermediate geographical region of Montes Claros as the owner of the largest reforested area with 499.868 ha, followed by Teófilo Otoni with 309.029 ha.

Given the recent economic crisis, the area of silviculture in Minas Gerais has suffered a stagnation in the last five years due to the producers' abandonment in keeping their plantations. However, Maugeri (2019) explains that the forestry sector needs to focus on improving productivity instead of increasing its cultivated area. Still, she stresses the necessity of reducing progressively its dependence on charcoal, because in times of recession in this sector, there is an impact on the entire chain of planted forests, and

therefore it is crucial to raise the possibilities of multiple use of wood to those who are interested in reforestation.

CONCLUSION

Silviculture in Minas Gerais built his trajectory based on the Brazilian industrialization process, woven by political, socioeconomic, technological and environmental aspects. From the Historical Geography perspective, under a synchronic and diachronic analysis of the used territory and through the adoption of periodization, we could apprehend the intentions of the used territory of Minas Gerais towards reforestation and the dynamics between society and nature.

Firstly, the early-planted forests were a mechanism for the preservation and conservation of native forests that had become scarce near industrial plants and its major goal was to maintain the supply of wood for the forestry sector, mainly for the production of pig iron for export.

From the 1960s onwards, silviculture associated with the expansionist ideals of the federal government, particularly founded on the Fiscal Incentive Law enacted in 1966, on the relationship between science and industry and on the silvicultural technique advancement, notably regarding eucalypt forests. Thus, from the reforestations in the south of the state in the 1940s, the activity intensified and expanded to regions with low cost land, as well as where the relief was suitable for mechanization, consolidating in the North and in the Jequitinhonha Valley in the mid-1970s. At the same time, it caused new territorial arrangements, changes in environmental systems and in the mode of production and social relations.

With the end of the fiscal benefit scheme in the late 1980s, silviculture had to restructure, intensifying research and promoting advanced techniques in order to achieve greater productivity and reduce the operating costs at a time when sustainability had become an integral factor of the forest-based sector. Since then, Minas Gerais has been investing in outgrower programs in an attempt to integrate small and medium-sized producers into the production chain to attend several segments that consume wood. Forestry plays a key role in the state's economy and reforestation has been flourishing throughout the territory of Minas Gerais, with the largest planting areas in the intermediate geographical regions of Montes Claros and Teófilo Otoni.

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