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## EDITED BY

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Chrispine Mtocha,  
The World Bank, United States

## \*CORRESPONDENCE

Andre Marengo  
✉ amarencoufrgs@gmail.com

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# Policymaking in multilevel governance: how local governments adopt sustainable development policies in Brazil

Andre Marengo\* and Drisa Kern

Federal University of Rio Grande do Sul, Gov.Munic-Applied Research Laboratory, Porto Alegre, Brazil

Brazil has a multilevel governance institutional arrangement, where environmental policies have been designed by the federal government but depend on the cooperation of the 5,570 municipalities, which have administrative autonomy for their implementation. The study goal was to investigate factors that drove municipalities to adopt legislation and regulation agencies regarding environmental management. The research (1) mapped government capacity for environmental management in municipalities; (2) verified the presence of local legislation for environmental regulation; and (3) identified determining factors for the adoption of that legislation. Four sets of factors were considered in that approach: (a) municipal state capacities, represented by environmental departments, councils, and budget; (b) policy diffusion; (c) political factors; and (d) demography. We used data from MUNIC 2020 [Survey of Basic Municipal Information], carried out by the Brazilian Institute of Geography and Statistics [IBGE], and electoral data from the Supreme Electoral Court [TSE]. Descriptive and inferential statistics—in this case, logistic regression—were used to analyze the data. Results suggested that municipalities with environmental councils are five times more likely to adopt environmental legislation, while the presence of specific secretariats increased the likelihood of legislation adoption by 29%. State capacities matter: Councils, secretariats and local civil service with higher education are the main factors that empower municipal governments to adopt environmental policies.

## KEYWORDS

multilevel governance, environmental management, environmental legislation, municipal government, state capacities

## 1 Introduction

Brazil has 5,570 municipalities spread over a diverse and heterogeneous territory in social, economic, and environmental terms. The institutional arrangement of “cooperative federalism” differs from other cases of decentralization, such as Mexico and India, by combining federal policy design with the responsibilities of subnational governments—states and municipalities—in their implementation (Grin and Hernández, 2017; Demerutis, 2021; Dardanelli, 2023; Abrucio, 2024; Chattopadhyay, 2024; Olmeda, 2024; Schnabel, 2024).

Studies on multilevel governance have shown the relevance of local governments for policy implementation (Järvelä, 2023; Tomàs and Pyka, 2023; Varga, 2025). Systematic review of international literature on peer-reviewed publications shows hurdles such as inadequate participation, insufficient national and local policy frameworks and slow legal and administrative processes as problems for environmental preservation policies (Muthee et al., 2022). The Study of Craig (2022) shows that much climate adaptation work

occurs within local governments, regardless of who sits in the Oval Office. Findings by [Zhang et al. \(2022\)](#) reveal that the urban environmental legislation increased the number of local green patents.

Extensive literature has presented evidence of the effect of state capacities on the implementation of public policies ([Soifer, 2008](#); [Fukuyama, 2013](#); [Cingolani, 2013](#); [D'Arcy and Nistotskaya, 2021](#)). The environmental management of municipalities varies according to the existence of environmental secretariats, budget resources for environmental protection, environmental councils, legislation, programs, training of civil servants, and agreements for preserving natural resources [[Instituto Brasileiro de Geografia e Estatística \(IBGE\), 2020](#)]. From this perspective, the question that guided this research was: What drives municipal governments to adopt environmental legislation, mechanisms, and regulatory bodies?

This study aims to assess municipal environmental governance by mapping the institutional capacities of local governments, examining the prevalence of environmental legislation, and analyzing the underlying factors influencing policy adoption.

## 1.1 Context: the environmental agenda in Brazil

When the ecologically balanced environment was considered a fundamental right in the 1988 Brazilian Constitution, the National Environmental Policy [PNMA] (Lei n° 6.938, 1981) had already advanced, empowering state entities on environmental matters. However, at that time it focused on solid waste management and granting tax incentives.

It was the constitutional framework, combined with specific legislation, that defined competencies for all federative entities on environment preservation, fighting pollution, preserving forests, fauna, and flora, and fostering programs and the improvement of basic sanitation. In addition to cooperation between the units and supplementing the legislation of other municipalities, they can legislate and implement policies on local issues, to ensure adapting to the reality of environmental problems, as well as encouraging social participation in decision-making processes ([De Carlo, 2006](#)). On the other hand, local interest does not refer to the exclusivity of municipal interest on the matter, at the expense of the state and the union, but rather to the prevalence of action over others ([Meirelles, 2016](#)).

The different duties of this decentralized governance require the articulation of legal, institutional, and technical aspects in order to achieve PNMA goals ([Rodrigues et al., 2012](#)). To this end, the bodies of the National Environment System [SISNAMA], State Secretariats and Councils, exercise environmental guardianship through processes of command and control. Municipal bodies carry out environmental licensing and inspection, as long as environmental councils exist and legally qualified professionals are available. Environmental councils are higher deliberative bodies that require public participation, and environmental secretariats execute local command and control—inspection and licensing.

However, the existence of these agencies, set up in a systemic way, is not a standard among Brazilian municipalities, as our results show. Even with a multilevel environmental governance, the

implementation of local environmental policies is fragile, especially in small and medium-sized municipalities. Therefore, it is relevant to identify factors that drive the development of their own policies, whether through the design and enactment of laws, articulation of mechanisms, or even the establishment of environmental bodies.

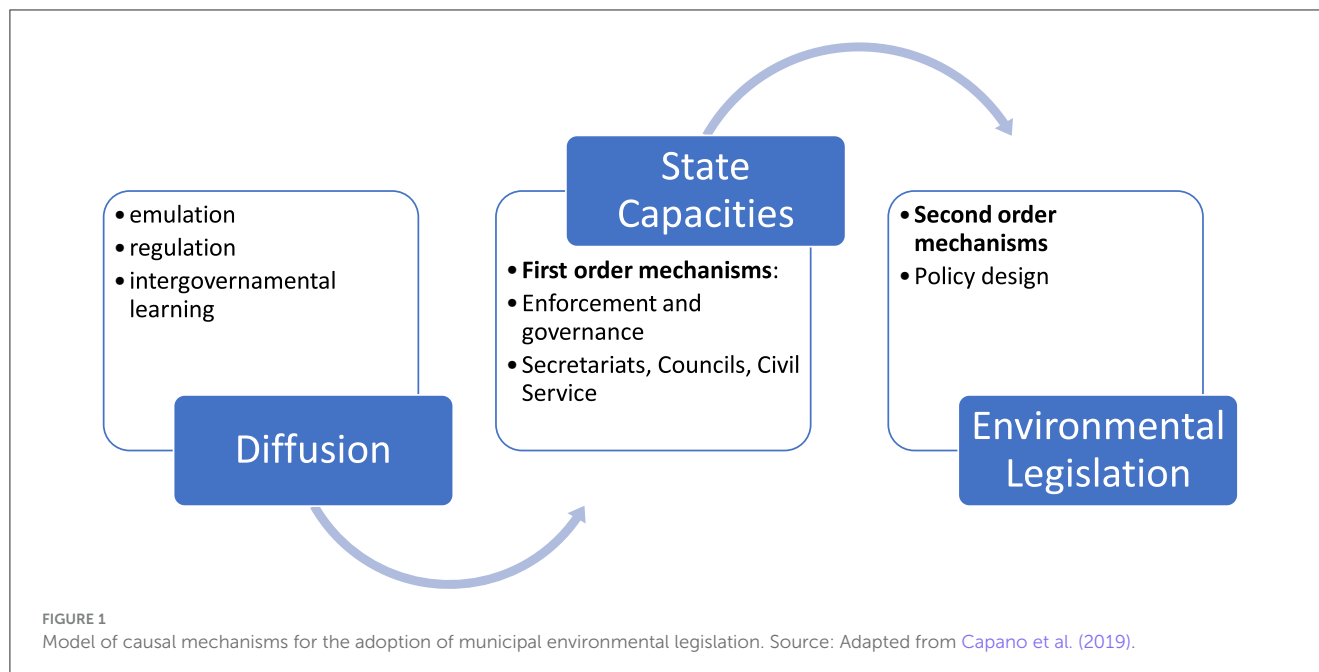
## 1.2 Experiences of environmental policies in Brazilian local governments

The first policies related to environmental management addressed topics on waste, sanitation, water resources, and territorial organization. This was largely due to the pioneering National Sanitation Plan [PLANASA] of 1970, the National Water Resources Plan [SNIRH] of 1997, as well as the National Solid Waste Policy [PNRS] of 2010, and the City Statute of 2001. The preservation of natural resources was designed for promoting social welfare in the urban environment, and relating to other matters of common interest, such as health and housing.

In a literature review using the SCIELO database ([scielo.org](#)), we found a clear predominance of studies on waste management ([Belli et al., 2024](#); [Chaves et al., 2020](#); [Galavote et al., 2023](#); [Kim and Barros, 2023](#); [Leal and Sampaio, 2021](#); [Mannarino et al., 2016](#); [Melo et al., 2009](#); [Silva and Santos, 2023](#); [Túlio and Schmitz, 2023](#); [Viana et al., 2024](#)), basic sanitation ([Faria et al., 2022](#); [Heller et al., 2006](#); [Lima et al., 2019](#); [Lisboa et al., 2013](#); [Ogera and Philippi, 2005](#); [Rossoni et al., 2020](#)), and land management ([Almeida et al., 2023](#); [Ayres et al., 2023](#); [Bernardi et al., 2020](#); [Costa et al., 2020](#); [Paixão et al., 2012](#)). There are also analyses that address the preservation of water resources and water supply ([Castro and Alvim, 2022](#); [Nicollier et al., 2023](#); [Peres and Silva, 2013](#); [Schussel and Nascimento, 2015](#); [Trentini and Buriti, 2021](#)). In climate change scope, few studies address adaptation ([Nusdeo et al., 2023](#); [Queiroz et al., 2022](#)), prevention of catastrophes and disasters ([Silva et al., 2020](#)) and urban resilience ([Oliveira and Rehbein, 2022](#); [Sotto and Philippi Jr., 2024](#)). Despite the importance of deforestation and forest conservation in Brazil's environmental agenda, as well as gender or traditional communities, these topics appear underrepresented in the municipal-level policy literature ([Tupiassu et al., 2019](#)), signaling a potential research gap.

The literature also shows that the experiences of Brazilian municipal governments have found limits in designing an environmental policy. These include: (a) the lack of technical capacity to draw up and implement local policies and plans ([Chaves et al., 2020](#)); (b) the lack of municipal data and information on the environment ([Condurú and Pereira, 2017](#); [Faria et al., 2022](#); [Klein et al., 2018](#)); (c) difficulties in creating a culture of popular participation; and (d) resource allocation, financial or budget availability ([Chaves et al., 2020](#); [Rodrigues et al., 2022](#)). [Frey et al. \(2022\)](#) observed an unequal distribution of administrative capacities and the effect of party changes in municipal governments on discontinuing environmental policies, in seven municipalities within the same region.

At the municipal level, [Reichert and Mendes \(2014\)](#) observed that the participation of the technical sector of autarchies and active institutions have the potential for suggesting policy alternatives and building more sustainable scenarios, such as sectoral plans. In



addition, the availability of qualified professionals is also essential for implementing local plans, especially in small municipalities (Lisboa et al., 2013).

In addition, financial capacity to invest in environmental management varies between municipalities and is not related to economic wealth (GDP), municipal area, or population (Pereira et al., 2020). However, there is a regional concentration of spending, with higher allocation in Brazilian center-south states. These same regions have more environmental management instruments, like Environmental Councils or Funds (Carvalho et al., 2005).

Analyzing environmental expenditures in municipalities with over 100,000 inhabitants, Pereira et al. (2020) found that spending on environmental management more than doubled (117% growth) between 2005 and 2015, overcoming the growth of federal and state governments (between 12% and 33%). For Lisboa et al. (2013), solving the lack of financial resources can fix, although partially, the limitation of professional and technical qualification, by means of training and hiring professionals.

Regarding information issues, there was poor use of the specific databases available to municipal managers, which are currently being used and updated in the National System of Information on Sanitation [SINIS] (Leal and Sampaio, 2021) and the Solid Waste Management System [SINIR] (Klein et al., 2018; Ramos et al., 2017).

To stimulate access to information and participation in local environmental issues, environmental councils are one of the instruments that can link environmental management with community participation, through meetings, public consultations, debates, forums, and socio-environmental projects. However, Giarretta et al. (2012, p. 531) observed that “less than half (47.6%) of Brazilian municipalities keep a Municipal Environmental Council, of which 11.6% have an equal composition (government and civil society), with an advisory and supervisory nature”.

The literature review also identified the allocation of different resources for promoting local environmental policy, such as:

life cycle assessment (Reichert and Mendes, 2014), fostering the multipurpose land registry (Paixão et al., 2012), geoprocessing with the identification of morphometric parameters (Costa et al., 2020), scenario simulation (Melo et al., 2009), structuring the information cycle (Condurú and Pereira, 2017), and suggestion of sustainability indicators (Polaz and Teixeira, 2009).

### 1.3 Analytical tools for explaining the adoption of environmental legislation

The challenge of understanding the establishment of environmental management and legislation by local governments requires incorporating two mechanisms into this process: (a) the influence of spreading environmental policies from national arenas to sub-national governments, and from large municipalities to small and medium-sized ones; and (b) the “state capacities” available at each municipal administration for implementing innovations in the form of local environmental legislation.

To do that, we adapted Capano et al.’s (2019) model of causal mechanisms (Figure 1):

According to the causal mechanisms framework proposed by Capano et al. (2019); Capano and Howlett (2023), policy tools act as triggers (here represented by policy diffusion processes) causing effects on first-order mechanisms (local state capacities). In turn, these increase the chances for second-order mechanisms (environmental legislation), which influence the behavior of agents.

The diffusion of public policies is a non-incremental government innovation (Berry and Berry, 1990), and can be useful for tracking the transfer of ideas, problems, and alternatives (Coelho, 2016). Diffusion studies analyze organizational innovation based on four factors: emulation, learning, competition, and norms and coercion (Walker, 1969; Rogers, 1983; Berry and Berry, 1990,

2007). On the other hand, the blind spot lies in the heterogeneous nature of public policies and in the fact that they depend on contextual configurations of decision-making processes.

An additional view can be seen through the contributions of “state capacities” as an analytical tool for studies on the choice and implementation of public policies (Cingolani, 2013; Cingolani et al., 2015; Grin, 2012; Aguiar and Lima, 2019; Souza and Fontanelli, 2020). The concept has been used in a polysemic way, corresponding to administrative (Evans and Rauch, 1999; Centeno, 2002; Centeno et al., 2017), informational (D’Arcy and Nistotskaya, 2017), fiscal (Besley and Persson, 2010, 2011), legal (Fukuyama, 2004), political and relational (Olsen et al., 1993) dimensions.

The meaning used in this work considers state capacities as the potential to implement policy decisions in the face of opposition (D’Arcy and Nistotskaya, 2021). It follows that “capacities” must be related to the type of policies. According to Lowi (2009), policy arenas can be classified as distributive, redistributive, regulatory, or constituent, according to the likelihood of coercion in their application (immediate or remote) and their recipients (individual vs. environmental/collective). This implies that in conflictive arenas (zero-sum configuration), resources should be available for the necessary enforcement, in order to change the previous resource distribution, in the face of real or potential opposition, transferring and reallocating them, regulating economic agents, and imposing sanctions (Acemoglu et al., 2015; Akhtari et al., 2015; Cingolani, 2020). This can be translated into (1) infrastructural capacities, such as (a) bureaucratic professionalism, and (b) administrative structures for specialized environmental management, with incentives and resources for proposing an agenda and regulatory policies in this area. On the other hand, the “capacity” needed to implement policy agendas achieves features of (2) “strategic state capacity” (Meckling and Nahm, 2022), when (c) institutional arrangements activate abilities to mobilize interests groups, enhance cooperation and minimize conflicts.

Finally, an investigation into the adoption of environmental legislation in Brazilian municipal governments should consider the “politician’s dilemma” (Geddes, 1994). That is, the political costs faced by incumbents in adopting policies to provide common goods with long-term returns, while having to face short-term electoral cycles.

## 2 Materials and methods

The paper’s goals consisted of (1) surveying the environmental regularization policies adopted by Brazilian municipal governments, and (2) identifying factors that could explain the adoption of these policies. To get information for descriptive statistics on the structure of municipal environmental management (secretariat, commissions, available resources), and environmental legislation, we collected data from the MUNIC 2020 database of the Brazilian Institute of Geography and Statistics [IBGE]. This is the latest time series available with information on municipal environmental legislation, although it doesn’t consider gender and traditional communities or other social minorities data, which could enhance future analysis on social equity and climate justice [Instituto Brasileiro de Geografia e Estatística (IBGE), 2020].

According to the causal mechanisms framework of Capano and Howlett (2023) to identify the factors associated with the adoption of environmental legislation (*dummy* dependent variable), we employed logistic regression models grouped into four categories: explanatory variables as diffusion and municipal capacities, control variables such as demographic indicators and political variables:

- (i) diffusion as institutional innovation, considering the (a) timeline for the adoption of environmental policies such as Capano and Howlett’s *policy tools*, when legislation is adopted before the existence of indicators of municipal state capacities; (b) when the adoption of municipal environmental legislation is adopted following a temporal pattern, from large municipalities to medium-sized ones and from these to small ones.
- (ii) municipal state capacities: secretariat, own revenue, training for civil servants, Municipal Environmental Council, year of creation, assignments, as a state capacities indicators;
- (iii) demography indicators: population size, Human Development Index (HDI), urbanization; illiteracy (proxy for information costs), and
- (iv) electoral competition: to operationalize the “politician’s dilemma” (Geddes, 1994) representing the costs for governments in adopting policies with long-term returns, and incentives for common good policies, the degree of local electoral competition was considered, identifying the (a) proportion of votes for the mayor winner in the first round; and, (b) the vote for Jair Bolsonaro in the first round of the presidential elections, inferring the presence of voters who are resistant to environmental preservation policies. Here, in addition to information from the MUNIC database, we used electoral data from the Supreme Electoral Court (TSE).

Logistic regression informs the effect of explanatory variables on the probability of occurrence of the dependent variable, in the case of whether or not the municipality has environmental legislation.

## 3 Results

### 3.1 State capacities for environmental management

The following step was to assess the installed “state capacities” for environmental management in each municipality. To this end, we got information from the MUNIC/IBGE database on the existence of own environmental secretariats, availability of specific budget, educational background of the secretariat’s incumbent, and the environmental training for civil servants in partnership with the federal government. These data allowed us to identify the presence of an administrative structure responsible for environmental management. At the same time, we also gathered information on the existence of Municipal Environmental Council, prerogatives, availability of infrastructure, and regularity of meetings. This information, broken down by population size, is shown in Table 1.

By observing the data, we checked that both variables on administrative infrastructure and environmental governance are

TABLE 1 Existence of administrative structure responsible for environmental management, by municipal population size.

Variables and	Up to 5 K	5 to 10 K	10 to 20 K	20 to 50 K	50 to 100 K	100 to 500 K	Over 500 K	Average
Exclusive secretariat	19.7	21.8	27.7	34.6	43.0	52.0	61.2	28.5
Incumbent with higher education	38.4	44.6	50.1	63.2	80.0	87.7	98.0	53.1
Revenue	36.3	36.0	42.1	55.3	70.4	81.6	89.8	46.3
Training	30.3	33.4	33.5	40.3	40.5	45.5	61.2	35.4
Municipal environmental council	72.5	72.1	76.3	84.4	93.2	98.9	98.0	78.5
Advisory board	53.0	54.7	58.5	69.2	76.4	81.9	73.5	61.0
Deliberative council	57.1	58.0	60.6	69.3	80.9	87.0	89.8	63.8
Normative council	24.4	25.5	28.3	32.8	37.9	41.5	51.0	29.2
Supervisory board	24.5	28.7	29.2	30.5	34.2	33.2	36.7	28.9
Average number of meetings in 12 months	2.8	3.1	3.5	4.3	5.6	7.1	8.3	3.9
Council infrastructure	46.6	4.5	53.8	63.3	73.5	87.0	91.8	55.3
Council creation year	2008	2008	2008	2007	2005	2003	1999	2007

Source: Instituto Brasileiro de Geografia e Estatística (IBGE) (2020), processing by authors.

related to municipal population size. While just one in four cities with up to 5,000 inhabitants have an environmental secretariat, this proportion is tripled in large metropolitan areas with over 500,000 inhabitants, where six out of ten have their own administrative structure for environmental policy. Many previous studies have demonstrated the lack of correspondence between party preferences and identities in the federal and local arenas (Batista et al., 2022; Cate, 2023; Vasquez et al., 2024; Gelape et al., 2024; Peixoto et al., 2024; Zolnerkevic, 2025). This paper assumes that the existence or not of an environmental department reflects the preferences and alignments of the mayor, regardless of his or her party affiliation.

Mayors with a university degree, the environmental training for civil servants, and budget revenue follow the same pattern, with an increase in municipalities with more than 20,000 inhabitants.

Municipal Environmental Councils seem to indicate an appropriate local environmental governance, as they are institutional arrangements with the potential to manage conflicts and coordinate environmental actions. Although there are also variations according to population size, the differences are less pronounced, since the floor is significantly higher. No less than 72.5% of small municipalities with up to 5,000 inhabitants have an environmental council. On the other hand, we should consider significant differences in the effectiveness of these councils, especially regarding deliberative and normative prerogatives, average number of meetings, and availability of infrastructure for the councils.

The year of creation of the Municipal Environmental Council is a relevant indicator for time longevity and, later in this study, for comparing it with the adoption of environmental legislation. Half of the municipalities set up their councils before 2009. At the same time, the correspondence with population size is very striking, allowing to identify a pattern of diffusion in the formation of environmental councils, from large to small municipalities. We highlight the gap between the creation of exclusive secretariats and environmental councils: while only 28.5% of the municipalities

have specific environmental secretariats, more than three out of four cities have environmental councils. Among municipalities with secretariats, 83.7% also have councils; among those with councils, only 30.3% have secretariats.

The 2020 MUNIC/IBGE database provides relevant information on municipalities that registered any event with environmental impact, in the 24 months before 2020. Environmental impacts were considered to be: extreme weather conditions, pollution, deforestation, burning, soil and biodiversity degradation, houses at risk, and lack of sanitation. Just over half of small municipalities with up to 5,000 inhabitants recorded environmental impacts in that period of time. This frequency shows an almost linear increase according to population size, reaching 91.8% of metropolitan areas. Comparing the group of municipalities that recorded any environmental impact in the previous 2 years (65%) with the presence of environmental councils (78.5%), only 14.9% of the records occurred in municipalities without councils, while 85.1% happened in municipalities with environmental councils.

Next, we compared municipalities with records of environmental impacts in that period with variables chosen for their explanatory potential. To do that, we ran a logistic regression, considering environmental impacts in relation to: (a) having a Municipal Environmental Council; (b) having an exclusive environmental secretariat; (c) having an environmental legislation. In parallel, we included variables to capture social vulnerability and information costs, such as (d) HDI and (e) illiteracy rate (for both, a negative relationship was expected); and (f) urbanization (positive effect on impacts). For the dependent variable “record of environmental impacts”, we assigned dummy values of 1 for “yes” and 0 for “no”. The results are shown in Table 2.

The variables related to environmental management capacity showed a strong association with the recording of environmental impacts in municipalities: municipal administrations with an Environmental Council had an odds ratio more than twice as high as those without this forum; the availability of exclusive



TABLE 2 Logistic regression, municipalities with records of environmental impacts in relation to the chosen variables.

Independent variables	B	SE	Wald	df	Sig	Exp(B)
Municipal environmental council	0.805	0.77	109.185	1	0.000	2.237
Exclusive secretariat	0.403	0.068	34.818	1	0.000	1.496
Environmental legislation	0.780	0.076	104.030	1	0.000	2.180
Human development index (HDI)	−2.011	0.985	4.171	1	0.041	0.134
Urbanization	0.002	0.002	1.918	1	0.166	1.002
Illiteracy	−0.005	0.007	0.467	1	0.495	0.995
Constant	0.536	0.710	0.570	1	0.450	1.709

Source: Instituto Brasileiro de Geografia e Estatística (IBGE) (2020), processing by authors.

environmental secretariats increases the odds ratio for recording impacts by around 50%; and having some environmental legislation doubles the odds of being associated with environmental impacts.

Notably, there is no causal logic between the municipality having a secretariat, council, or legislation and causing environmental impacts. Here, the association is inverse: installed capacity, legal instruments for regulation, governance, and the “fire alarms” built by the councils allow identifying environmental impacts that, in another context and without this structure, would probably be underreported or omitted. This is not simply something bureaucratic, of administrative record, but this institutional arrangement (installed capacity/governance/regulation) is relevant for inserting the environmental question as an issue in the municipal agenda.

Among the sociodemographic variables, HDI showed a negative association with municipalities with higher human development indices, reducing the chances of impacts by 86.6%. This can be understood as an association between cities with better public services and quality of life, lower social vulnerability and lower frequency of environmental impacts. On the other hand, the illiteracy rate—here a proxy for the cost of information for citizens—showed no significant relationship (odds ratio of 0.5%), just as the proportion of urbanization increases impacts by only 0.2%.

## 3.2 Environmental legislation

Municipal governments and legislative bodies have the prerogative to establish legislation on the use of urban and rural space in order to ensure the protection of natural resources, reduce environmental degradation, and mitigate climate change, in line with the population’s basic needs. Regulations of this type imply enforcement on private agents, constraining their activities or limiting the generation of negative “externalities”, such as soil degradation, the release of gases into the atmosphere, and dumping waste into water resources. They are pieces of legislation with high potential for conflict and high political costs—since they generate direct losers, who must bear the economic or social burden of their activities—with diffuse beneficiaries and long-term returns (Lowi, 2009). Using information provided by the MUNIC/IBGE database for 2020, we sought to identify the existence of the following environmental laws in each of the 5,570 Brazilian municipalities:

- Environmental Protection Zones, through public regulation of economic activities in private properties;
- Basic sanitation, universalization of sanitation services, such as drinking water supply, sewage disposal, drainage and stormwater management, urban cleaning, and solid waste management;
- Solid waste, defining instruments and guidelines for the public sector and companies to handle the proper disposal of waste;
- Mineral extraction, through a special regime for the exploration and exploitation of mineral substances within the municipality;
- Biodiversity Protection Act, seeking to explore, in a sustainable way, land use, natural resources, genetic heritage, and traditional knowledge;
- Municipal legislation on climate change, by articulating sectoral policies of planning and social, economic, urban, and environmental development, public transportation, reduction of greenhouse gas emissions, and effective pollution prevention and control.

The adoption of environmental regularization legislation seems to be, once again, related to population size, as the presence of legislation for regulating the use of natural resources increases with the size of the city. Since these policies have a high political cost, their establishment seems more difficult in small municipalities, where not only physical proximity, but also greater economic dependence on a few companies or properties increase the political and economic risk of their adoption (Table 3).

The descriptive statistics used so far enabled us to identify a potential association between the existence of councils and the recording of natural impacts and adoption of environmental regularization legislation. Next, we used inferential tests to measure this association more precisely.

We sought factors to explain the adoption of environmental legislation in municipalities. To do that, we ran a new logistic regression, using the dependent variable “municipality has any environmental legislation”, assigning dummy values of 1 for “yes” and 0 for “no”. Two variables were used for “state capacities”: exclusive secretariat and Municipal Environmental Council; urbanization (*Urb*) and illiteracy rate (*Illit*) were employed as proxies for pluralistic social order (Dahl, 1997). Finally, two “political” variables were introduced: competition (*Comp*), and

TABLE 3 Environmental legislation in Brazilian municipalities, average proportions according to population size.

Legislation	Up to 5 K	5 to 10 K	10 to 20 K	20 to 50 K	50 to 100 K	100 to 500 K	Over 500 K	Average
Basic sanitation	63.5	59.2	62.7	71.2	78.3	86.3	85.7	66.2
Solid waste	52.7	48.4	52.8	62.4	71.5	81.2	81.6	56.6
Environmental protection zone	24.8	27.5	37.6	54.3	71.8	87.4	93.9	41.0
Biodiversity protection	15.6	17.6	26.8	37.3	46.7	62.8	71.4	27.8
Mineral extraction	12.7	16.4	24.1	33.6	44.2	51.6	53.1	24.6
Climate change	3.7	4.3	6.7	9.5	9.2	15.9	36.7	7.0
No legislation	22.9	25.2	21.2	13.3	7.4	2.2	0.0	18.9

Source: Instituto Brasileiro de Geografia e Estatística (IBGE) (2020), processing by authors.

the share of votes for Bolsonaro in the first-round of 2018 election (*Bolso1t18*).

To measure electoral competition, we extracted the average votes of the winning candidate for the municipal government, in the 2008, 2012, and 2016 elections. The higher the share of votes for the winner, the lower the electoral competition. This observation can be linked to [Geddes's \(1994\)](#) politician's dilemma: the greater the competition, the greater the uncertainty and the lower the incentives for indivisible policies. On the other hand, the vote for ultra-right-wing candidate Jair Bolsonaro ([Couto, 2023](#); [Lotta et al., 2023](#); [Silva and Santos, 2023](#)) in the first round of the 2018 presidential elections allowed us to isolate the presence of voters who are more resilient to the environmental agenda, and therefore more likely to maximize the political and electoral costs caused by proposing regulatory legislation in this area. During his term as President of the Republic, Jair Bolsonaro implemented policies to dismantle environmental preservation structures built in previous decades ([Irving et al., 2023](#); [Fonseca et al., 2023](#)).

The results can be seen in [Table 4](#).

The variables of state capacity for environmental management showed a strong association with the adoption of regulatory legislation: the existence of an Municipal Environmental Council increases the odds ratio for the presence of at least one piece of environmental legislation by almost five times; the proportion of career civil servants in municipal administration with higher education, increases increases the probability in 2.74 times; an exclusive secretariat increases odds ratio by 29%.

What is the logical relationship for this association? The existence and effectiveness of Municipal Environmental Councils constitutes an strategic state capacity ([Meckling and Nahm, 2022](#)) or agenda-setting agent, driving environmental issues in local government priorities; career civil servants with higher education represent the Weberian dimensions ([Evans and Rauch, 1999](#)) of autonomy in relation to political cycles, such as technical capacity; an exclusive environmental secretariat constitutes a specialized and continuous staff on the topic.

By contrast, sociodemographic and political variables showed low explanatory potential for environmental legislation: urbanization has a counterintuitive negative and non-significant

relationship, reducing by 0.1% the probability of legislation; illiteracy has a relationship in the expected direction, statistically significant but very modest (3.4%). Electoral competition increased the odds ratio by 0.5% for passing legislation. The relationship between Bolsonaro voters in the first round of the 2018 presidential elections and a counterintuitive and surprisingly moderate relationship with environmental legislation was significant and positive. Data and tests were reviewed to identify any inconsistencies, always confirming these results.

A hypothesis to be tested in future studies would be whether the adoption of regulatory legislation on the use of natural resources is not a trigger for activating anti-environmental voters. Disaggregating the dependent variable into each of the six pieces of legislation under examination, there were no significant variations in the coefficients related to Bolsonaro electors.

On the other hand, the odds ratios for municipalities with environmental councils vary from five times higher than those without them, in the case of older municipal legislation, such as for biodiversity and climate change, slightly more than half, in most recently enacted laws, regarding solid waste and basic sanitation.

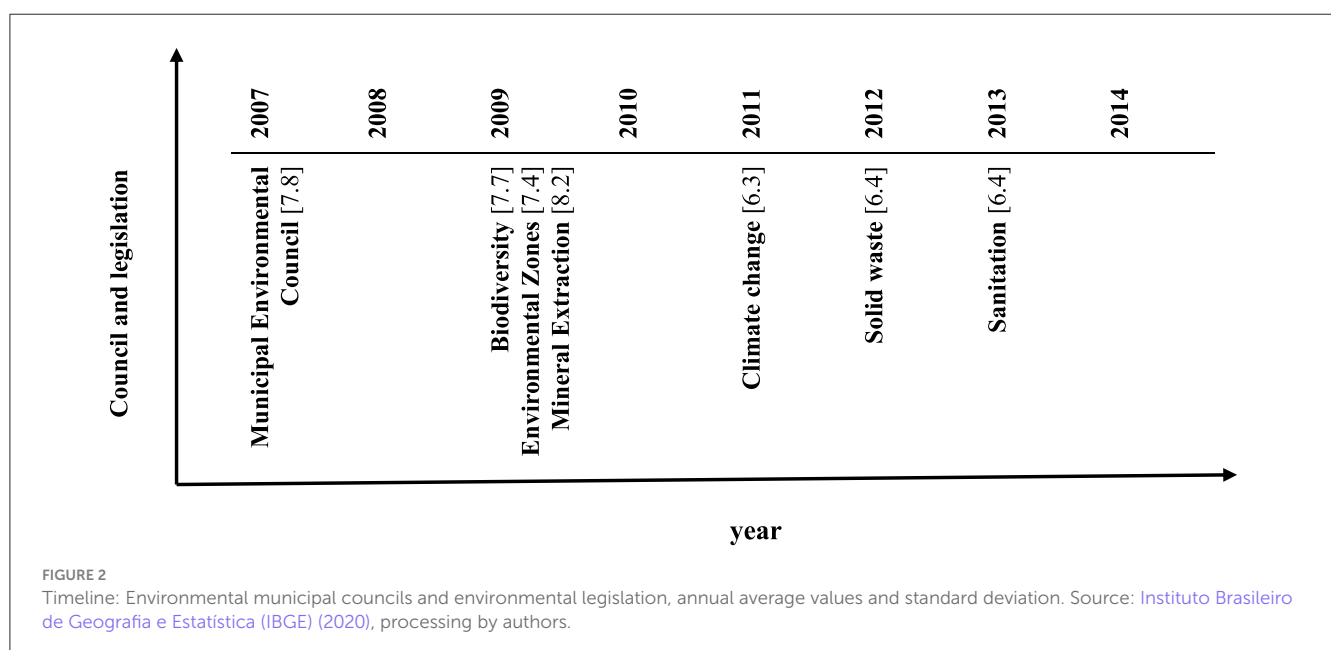
So far, the strongest finding was the relationship between state capacities for environmental management (secretariat and councils) and the existence of municipal environmental legislation. However, once again, it is necessary to distinguish between the direction and the association. Would institutional arenas be responsible for increasing the chances of legislation adoption or, conversely, would *policies* shape *politics*—as [Lowi \(2009\)](#) suggests? In other words, would the adoption of environmental legislation lead to the creation of bodies responsible for environmental management?

A revealing angle is to consider the interactions between a municipal institution for environmental management and the legislation for regulating the use of natural resources. To this end, a first step was to identify the corresponding years, in order to isolate sequential patterns. Unfortunately, IBGE data do not provide the years when exclusive secretariats were created. In exchange, information is available on the year of councils' creation and legislations' enactment. Considering that the number of secretariats is low (28.5%) compared to councils (78.5%), it seemed appropriate to use this information for comparing

TABLE 4 Logistic regression, municipality has some environmental legislation, according to chosen variables.

Variables	B	SE	Wald	df	Sig	Exp(B)
Municipal environmental council		0.085	355.01	1	0.000	4.946
Exclusive secretariat	0.255	0.091	7.761	1	0.005	1.290
Proportion of career civil servants with higher education	1.005	0.149	46.120	1	0.000	2,743
Urbanization	−0.001	0.002	0.174	1	0.677	0.999
Illiteracy	−0.035	0.007	25.862	1	0.000	0.966
Electoral competition	0.005	0.005	0.922	1	0.337	1.005
Bolsonaro votes 1st round 2018	0.015	0.004	14.309	1	0.000	1.015
Constant	0.114	0.392	0.084	1	0.772	1.120

Source: Instituto Brasileiro de Geografia e Estatística (IBGE) (2020); TSE (2020), processing by authors.



legislative decisions. This information is presented as a timeline, in Figure 2.

Figure 2 illustrates a clear temporal sequence in which the creation of Municipal Environmental Councils precedes the adoption of environmental legislation across population categories. Notably, councils were typically created by 2007, while laws on biodiversity, environmental zoning, and mineral extraction were later and addressing issues such as climate change and waste management were enacted from 2010 onwards, suggesting a governance-led pathway in most municipalities. This timeline shows a sequential pattern: councils before legislation, as well as the different length of distinct environmental regulation laws. Information between brackets shows the corresponding standard deviations, enabling to see temporal variations in all records. At this point, the question that arose was whether municipal population size would affect this temporal pattern, both in terms of councils' precedence and the order of arrival of environmental legislation (Table 5).

The choice of a descending presentation in relation to population size enables a clearer view of a sequential pattern, highlighting the time lag of environmental management bodies and

legislation between large > medium > small municipalities. This time lag is greater regarding the creation of councils and legislation on biodiversity and mineral extraction, and smaller in the (later) creation of laws on solid waste and climate change. Municipal Environmental Councils precede environmental legislation in all population groups, except for the overlap with biodiversity and mineral extraction laws, in municipalities between 5,000 to 10,000 inhabitants.

Here, it was possible to identify two patterns of environmental legislation introduction: in about 2/3 of municipal administrations, the installed state capacities for environmental management preceded the legislation, being both fire alarms for recording environmental impacts and an inducing element for changing the local environmental *status quo*. Municipal Environmental Councils are “strategic state capacities” (Meckling and Nahm, 2022) institutional arrangements for governance as well as for enforcement, when they are assigned deliberative prerogatives.

At the same time, in nearly 1/3 of the municipalities, environmental legislation preceded the creation of secretariats or councils, providing a more characteristic pattern of diffusion, when innovation is produced top-down, through emulation, without the



TABLE 5 Councils' creation year and approval of environmental legislation, according to population size.

Councils and environmental legislation	Over 500 K	100 to 500 K	50 to 100 K	20 to 50 K	10 to 20 K	5 to 10 K	Up to 5 K
Environmental municipal council	1999 [9.8]	2003 [9.9]	2005 [9.1]	2007 [7.9]	2008 [7.7]	2008 [6.7]	2008 [6.5]
Biodiversity	2005 [10.3]	2008 [7.1]	2008 [7.4]	2009 [7.0]	2010 [7.3]	2008 [8.7]	2009 [8.3]
Mineral extraction	2005 [9.9]	2007 [7.7]	2008 [7.8]	2009 [7.2]	2010 [8.1]	2008 [10.1]	2009 [7.4]
Environmental zoning	2009 [9.0]	2008 [7.8]	2009 [6.8]	2009 [6.8]	2010 [7.8]	2009 [7.8]	2010 [7.2]
Basic sanitation	2010 [10.5]	2012 [7.2]	2012 [7.1]	2013 [6.1]	2013 [6.6]	2012 [6.4]	2013 [5.7]
Solid waste	2010 [7.1]	2011 [6.9]	2011 [6.8]	2012 [6.1]	2012 [6.8]	2013 [5.7]	2012 [6.7]
Climate change	2011 [8.5]	2010 [7.1]	2010 [11.5]	2011 [6.6]	2012 [6.2]	2011 [6.0]	2012 [5.0]

Source: Instituto Brasileiro de Geografia e Estatística (IBGE) (2020), processing by authors.

TABLE 6 Logistic regression, environmental legislation prior to councils, according to chosen variables.

	Environmental zoning	Solid waste	Basic sanitation	Mineral extraction	Biodiversity	Climate change
<i>HDI</i>	0.059***	1.587	0.673	0.059***	0.027***	0.024***
<i>Gini</i>	3.143**	1.010	1.141	1.750	4.745***	0.663
<i>urb</i>	1.002	0.999	0.998	1.000	1.000	1.000
<i>illit</i>	1.030***	1.053***	1.046***	1.044***	1.034***	1.060***
<i>pop</i>	0.984	1.468***	1.552***	1.127*	1.077	1.767***
<i>Const</i>	1.353	0.164	0.302	1.123	1.477	1.108

Source: Instituto Brasileiro de Geografia e Estatística (IBGE) (2020). HDI, human development index; Gini, Gini index of inequality; urb, proportion of urbanization city; illit, illiteracy rate; pop, total population municipality. Statistical significance: \*\*\*(.001), \*\*(.005), \*(.10). Gray shade: more robust and statistical significant coefficients.

presence (or fragility) of a local institutional agent to cause a change in the *status quo*.

In order to understand the profile of municipalities that show this diffusion pattern, we ran a new logistic regression, with a dummy variable for municipalities where the adoption of the respective legislation preceded the councils. We chose demographic variables like HDI, Gini, urbanization (urb), illiteracy (illit), and municipalities with up to 20 thousand inhabitants (pop). The literature on “retrospective voting” (Downs, 1957) usually highlights factors such as income and education as elements that can increase the costs of informing voters and make it difficult to punish their representatives. On the other hand, Table 6 sought to identify demographic characteristics in municipalities in which dissemination precedes state capacities, hence the use of variables such as HDI, Gini, urbanization, population size. The results are shown in Table 6.

The odds ratios for a municipality to adopt environmental legislation before having environmental councils are approximately three times higher in cities with high social inequality, measured by the Gini index, reaching almost five times regarding the diffusion of biodiversity laws. Municipalities with less than 20,000 inhabitants have an odds ratio of 46.8% for adopting legal rules on solid waste, 55.2% on basic sanitation laws, and 76.7% on climate change legislation, before having their own environmental management bodies, compared to municipal administrations in cities above this level.

The Human Development Index showed strong and statistically significant Exp(B) coefficients, but negative regarding the chances of explaining the temporal antecedece of legislation

on environmental zoning, mineral extraction, and climate change. This means that the greater the human development, the lower the chances of the legislation preceding local environmental management structures. Similarly, illiteracy rates were statistically significant, but with very low odds ratios. Local inequality, measured by the Gini index, revealed high, positive, and statistically significant odds ratios for environmental zoning and biodiversity legislation to emerge before the councils, that is, in cities with greater social inequality. In cities with less than 20,000 inhabitants, the odds ratio for the advance of legislation before councils was very strong, positive and statistically significant regarding solid waste, basic sanitation, and climate change.

## 4 Discussion

We started this paper with three goals: to map (1) the installed state capacities for municipal environmental management; (2) the existence of municipal environmental legislation; and (3) factors capable of explaining the adoption of these legislations.

It doesn't seem difficult to identify patterns of diffusion in the formation of the government's environmental agenda. International conferences and forums set up a dynamic of innovation emulation in environmental topics and proposals, in addition to the Brazilian organization that encourages cooperative and multilevel governance. Learning or coercion contribute to national governments incorporating the issue into institutional arenas *parallel* or *serial* (Baungartner et al., 2023). Over time, sub-national governments take on this agenda by creating

environmental management bodies and regulatory legislation. A blind spot in public policy diffusion models is assuming that the expansion of institutional innovation occurs isomorphically. The analytical effort adopted in this study consisted of associating the inductive effects of the diffusion of the environmental agenda, by considering that the “state capacities” installed for environmental management in each municipal government are important for the assimilation of the environmental agenda by local governments.

Although the proportion of municipalities with an exclusive environmental secretariat is low (28.5%), almost half of them allocate a specific revenue to environmental policies, and slightly more than three out of four municipalities (or 78.5%) have environmental councils. The relevance of these “capacities” is the perception that 85% of the municipalities that recorded environmental impacts between 2018 and 2020 had environmental councils; therefore, the presence of this environmental management body seems to be the difference between reporting or underreporting environmental impacts.

What drives municipalities to adopt an environmental regulatory legislation? These are policies that cause enforcement on specific economic and social agents, projecting potential conflict between easily mobilizable losers and diffuse beneficiaries, with high coordination costs. Municipalities that have environmental councils have odds ratios almost five times higher than those that do not have them. Environmental secretariats increase the odds ratio for environmental legislation by 29%. Demographic and electoral competition variables, on the other hand, showed low explanatory potential.

The association between councils and legislation raises a challenge as to the direction of causality, which can conceal different patterns of decision-making:

- (a) Councils as inducers of legislation, strengthening the relevance of “state capacities” and of politics > policies sequences;
- (b) Legislation preceding councils’ creation, disclosing a more typical pattern of diffusion or processes where policies shape politics.

By identifying the averages for the years of creation of municipal environmental councils and legislations, it was possible to see the prevalence of two patterns: (a) of “municipal government capacities”, with environmental legislation spreading from large to medium-sized municipalities, and from these to small ones; more remarkable, the precedence of environmental councils over legislation, present in 2/3 of Brazilian municipal administrations. On the other hand, (b) in 1/3 of local governments, environmental legislation was introduced without the presence of environmental councils, strengthening the importance of institutional diffusion. These are small municipalities, with less than 20,000 inhabitants and high inequality, measured by the Gini index and lower HDI values. The implication is in small municipalities with limited capacity, the induction by diffusion top-down of policy tools (Capano and Howlett, 2023) is required. It is beyond the scope of this work and could be developed by other research efforts to analyze the different effects caused on the implementation and quality of environmental policies by the two time sequences identified here.

Comparative studies with other multilevel governance contexts especially in the Global South (Coe and Nash, 2023), could test the generalizability of these findings to local governments. Future case studies have the challenge of closely examining these cases, seeking to explain this combination of limited institutional development, a presumed reduced associativism, and “importing” an environmental agenda. Could political or party factors explain these processes?

An important gap that should be explored in future studies arises from data availability. Since the latest available information on environmental legislation in Brazil’s 5,570 municipalities is from 2020, it was not possible here to examine the top-down effect of the anti-environmental agenda implemented by the federal government during Jair Bolsonaro’s presidency (2018–2022). Likewise, the available data do not allow us to consider the influence of factors associated with gender and frequency of the municipal indigenous population on the probabilities of environmental legislation.

The last two decades were marked by an impressive capillarization of the environmental agenda in Brazilian municipal administrations: 78% of them have local environmental councils, and 81% have some sort of regulatory environmental legislation. The intergovernmental diffusion of this agenda and its local adoption by “state capacities” for environmental management are the answer to the expansion of environmental policies among municipal governments.

## Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

## Author contributions

AM: Conceptualization, Formal analysis, Investigation, Methodology, Validation, Writing – original draft, Writing – review & editing. DK: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing.

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The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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