Elections and Local Environmental Public Goods, 2000-2020*

Cesar B. Martinez-Alvarez[1]

[1]University of California, Santa Barbara

April 25, 2024

Abstract

What explains that some countries provide more local environmental public goods than others? Research in political science has studied the role of institutional and ideological characteristics on variables such as air pollution and greenhouse gas emissions. In this paper, I employ remote sensing data to analyze the relevance of political factors on the provision of two types of local environmental public goods—air quality, approximated by mortality rates from air pollution, and ecosystem conservation, measured with tree cover loss. Methodologically, I base the analysis on two-way fixed effects models and staggered differences-in-differences for a sample of units near international borders. My results show that both changes in democratic institutions and the ideological orientation of individual governments have heterogeneous effects on environmental quality.

*Draft not for citation or circulation.

Introduction

What explains that some countries provide more local environmental public goods (LEPG) than others? A vast area of research in the social sciences has studied the role of macro-level institutional frameworks, in particular regime type, to answer this question. The emerging consensus is that democratic institutions are associated with better environmental quality. This is partially because governments in democracies are both more likely to implement energy and environmental policies that reduce different forms of pollution (Bayer and Urpelainen, 2016) and are more responsive to the preferences of their electorates (Schaffer, Oehl and Bernauer, 2022).

Another, smaller, area of scholarship focuses on how the ideology of the ruling coalition affects the provision of these local public goods. Some scholars show that countries with leftist governments invest more in designing and enforcing effective environmental policies (Wang et al., 2022) than governments from different ideological origins.

Despite the improvements in our understanding of the supply of local environmental public goods, the current research offers only a partial overview of this issue for three reasons. First, the literature on the relationship between politics and local environmental quality focuses on explaining how institutions affect variables such as the absolute or per capita levels of toxic air pollutants. Nonetheless, we have quite limited evidence on how the same factors influence the quality of life of affected populations, which is mediated by governments responses to environmental degradation, in addition to those environmental variables themselves.

Second, the majority of the existing research focuses on one type of LEPG, in particular the emission of air pollutants and carbon dioxide. Governments, however, have attributes to shape a wide array of environmental outcomes, ranging from water quality and availability to deforestation and ecosystem conservation. Despite the relevance of these other LEPG, we know very little about why countries vary across each other and over time in their provision. Third, scholars have studied mostly a relatively small sample of industrialized democracies, which is an issue for the overall generalizability of their findings. A key reason behind this limitation is the lack of reliable data to measure the provision of LEPG in low- and middle-income countries.

In this paper, I employ remote sensing and geospatial data to address the three aforementioned gaps in the literature. The main research question that guides this study is, what explains that some governments provide more local environmental public goods than others? Following the existing literature in political science, I argue that both institutional frameworks (regime type) and the ideological identity of the ruling coalition, in particular the national executive, are associated with the provision of local environmental public goods. Specifically, I hypothesize that the presence of democratic institutions, democratically-elected leftist leaders, and environmentally-oriented governments is associated with higher levels of LPGE provision.

To do so, I study two types of local environmental public goods—mortality rates associated with air pollution and deforestation rates—for all countries in the world from 2000 to 2019. Countries that either transition from one regime type to another or that elect a leftist or an environmentally oriented leader are quite different from those that did not for reasons that are directly associated with the outcome variables in the study. To allay some of these endogeneity concerns, my research design is based on two sources of variation in both regime change and rule by a leftist or a climate-oriented leader.

First, I follow some recent studies in both economics and political science that leverage domestic or international borders as a source of variation in several independent variables (Wuepper, Wiebecke, Meier, Vogelsanger, Bramato, Fürholz and Finger, 2024; Wuepper, Crowther, Lauber, Routh, Le Clec'h, Garrett and Börner, 2024; Mangonnet, Kopas and Urpelainen, 2022; Beacham, N.d.). Specifically, I employ areas near to the borders between countries to construct samples of more comparable treated and control units, that differ mostly in their exposure to the political variables mentioned above (either a change in their political regime or a left-wing or an environmentally-oriented government). Second, I use the differential timing of exposure to estimate a staggered difference-in-difference for this smaller, more comparable, subset of units.

At the country level, I find that the relationship between regime type and the provision of these two LEPG is ambiguous at best. Although the levels of democracy are associated with the overall rates of deforestation and mortality rates from air pollution, changes in these institutional

variables are not correlated with land use change, only with air pollution outcomes. At the individual government level, in contrast, I find that the ideological orientation of individual governments, both in terms of the left-right divide and the specific relevance of the environment in their policy agendas, are associated with the provision of LEPG, both forest conservation and air quality. Specifically, I find that left-leaning governments are associated with both a higher mortality rate from air pollution and a lower deforestation rate; the public goods provision trajectories of environmentally-oriented leaders are similarly ambiguous, as they lead to lower levels of air pollution and higher levels of tree cover loss in areas not protected by law.

This paper makes three contributions to the existing literature. First, my empirical findings show that, in addition to long-standing democratic institutions, the ideology and identity of individual governments may be crucial factors that explain why some countries provide more local public goods that benefit citizens. Hence, my analysis adds further evidence to the argument that elections are crucial to address global and local environmental problems.

A second contribution of this study is to test relatively well-established theories in political science with novel remote-sensing data. As mentioned before, many of the existing studies on the relationship between regime type and ideology and local environmental quality (mostly air pollution) base their conclusions on a relatively small subset of rich and industrialized democracies. Nonetheless, we know from some recent climate and environmental politics research that low- and middle-income countries face distinctive trade-offs and political challenges to implement policies that support sustainable transitions (Hochstetler and Kostka, 2015; Hochstetler, 2020). In this paper, I leverage recent advances in remote sensing technology to study the provision of LEPG with a very high level of granularity for a much larger subset of countries.

Finally, the third contribution of this paper is to expand the definition of environmental public goods by including land use change, which mostly accrues to rural dwellers, as well as mortality rates from air pollution, which affect in particular citizens in urban areas. It is important to mention that, in contrast to other issues like climate change and air pollution, deforestation has received only limited attention from scholars in political science. Hence, this paper also contributes

to understand why some countries lose their forest more quickly than others.

This paper proceeds as follows. In the first section, I provide an overview of the existing literature on the provision of local environmental public goods. In section two I make the case to study air pollution and deforestation as local environmental challenges of global implications. In the following section I describe my empirical approach, based on both the use of international borders to construct more comparable samples of "treated" and "control" units and the staggered exposure to regime change and different types of governments. Section four presents the main empirical findings of the paper. The last section concludes with a discussion of the paper's implications and areas for further research.

Literature Review

What explains that some countries have better environmental quality than others? Throughout this paper, I will employ the terms *environmental quality* and *local environmental public goods* somewhat interchangeably. Strictly speaking, they refer to two different concepts. Environmental quality is the state of the ecological conditions of a place. As governments provide more local environmental public goods (defined by their non-rival and non-excludable nature), the overall quality of the environment improves. In this paper, my main focus is on how the characteristics and policies of governments affect the actual outcomes associated with environmental quality.

Political science research has developed at least two broad explanations to account for the variation in environmental quality across countries. First, scholars have studied how macro-level institutional arrangements, in particular regime type, affect environmental policy outputs and outcomes. The central argument in this strand of research is that governments in democracies are better equipped to translated the preferences of the electorate into specific policy outputs and outcomes (Schaffer, Oehl and Bernauer, 2022; Bernauer and Koubi, 2009; Farzin and Bond, 2006; Bättig and Bernauer, 2009; Min, 2015). Given that public officials depend on the electoral support of the majority of citizens to win elections, democratically-elected leaders are more supportive of government actions and policies that benefit large segments of the population. These include, for

example, strategies to reduce air pollution and improve air quality (Bayer and Urpelainen, 2016).

Starting with environmental and energy policy outputs, some studies have compared the performance of democratic and non-democratic regimes on the implementation of specific sustainable transitions strategies. For example, Bayer and Urpelainen (2016) show that feed-in tariffs (a government scheme that favors the expansion of cleaner sources of electricity, in particular solar and wind) are more likely to occur in democracies, because these policies have widespread positive externalities and benefit key electoral (rural) constituencies. Moreover, Schaffer, Oehl and Bernauer (2022) show that, in a sample of rich industrial democracies in the OECD, leaders implement policies that closely follow the preferences of the public on environmental issues.

In terms of environmental and energy policy outcomes, an emerging consensus shows that democratic regimes indeed provide more environmental public goods than others. For example, Min (2015) shows that access to electricity, a key driver of local development, is higher in democratic countries than in other political regimes. Studies focusing on environmental and energy policy outcomes (emissions) reach a similar conclusion. In one of the earliest studies on the topic, Bernauer and Koubi (2009) show that the overall levels of air pollution are lower in democratic countries than in authoritarian ones. Policardo (2016) employs an interrupted time series to analyze how regime transitions affected the levels of air pollution for a sample of countries that experienced a substantial change in their political institutions.

The aforementioned research does not imply that leaders in authoritarian countries do not have incentives to provide environmental public goods. For example Alkon and Wang (2018) show that when air pollution decreases, the public opinion on the regime in China follows suit. Other scholars have shown that reducing air pollution in their districts benefits the political career opportunities of mayors in China (Shen, 2022; Wu and Cao, 2021). Finally, Anderson et al. (2019) employed experimental approaches to show that citizens' monitoring of firms is causally related to reductions in local pollution in China as well.

Nonetheless, despite the emerging consensus about the role of democracy on the environment, there are several caveats in this literature. First, the relationship between regime type and policy

output is mediated by institutional quality and state capacity, particularly among young democracies. For example, Herrera (2017) studies subnational variation in the implementation of reforms to the provision of water in Mexican municipalities, finding substantial variation across space and over time.

In addition, not all studies find the same positive effects of democratic institutions, particularly when analyzing other environmental outcomes. A growing literature on deforestation suggests that governments in democracies have incentives to allow private actors to degrade ecosystems. For example, Sanford (2023) finds that proximity to elections is associated with tree cover loss among democracies. At the subnational level, Xu (2020); Pailler (2018); Cisneros, Kis-Katos and Nuryartono (2021) have reached out similar conclusions in Brazil and Indonesia, respectively. Mangonnet, Kopas and Urpelainen (2022) show that Brazilian presidents are electorally strategic in the designation of protected areas—municipalities ruled by the opposition are more likely to become a national park. Finally, Kashwan (2017) argues that land inequality is associated with less protection of ecosystems, particularly among democratic countries. Hence, the relationship between democracy and environmental quality may be heterogeneous across different ecological outcomes.

The second approach that political scientists have employed to explain why some countries have better environmental quality than others centers on the political ideology and composition of governments. The central argument in these studies is that politicians from left-wing political parties have a strong affinity for both pro-environmental policies (Wang and Keith, 2020; Neumayer, 2004) and the intervention of the state in the economy (Meltzer and Richard, 1981). These two factors—relative importance of environmental issues and the willingness to implement such policies—imply that leftist governments could be more effective at improving environmental quality.

In general, these scholars have pointed out to the historical contradictions of leftist political parties in the West; on the one hand, these groups have been promoters of industrialization and economic growth (Neumayer, 2003), but have policy agendas that advance the living conditions

of workers and the broader population (Boix, 1997, 2003), which could include policies that improve environmental quality. The issue ownership of the environment by leftist political parties is, nonetheless, far from direct and universal. For example, Mildenberger (2020) argues that carbon-intensive industries have also been represented in both left and right political parties, which makes it more complicated the implementation of successful climate policy.

As for the quantitative studies of the relationship between ideology and LEPG, most of the initial work focused mostly on Western Europe and analyzed how variables such as the number of seats from leftist political parties translated into measures of environmental quality (Neumayer, 2003; King and Borchardt, 1994; Garmann, 2014). More recently, Wang et al. (2022) expand the scope of the study to the Global South; they find that when countries are ruled by leaders espousing a leftist political ideology, the levels of carbon emissions are lower.

Finally, a third emerging approach to understand variation in environmental quality centers on the specific role of leaders, particularly the extent to which they have agendas closer to environmental issues. A long scholarly tradition in political science focuses on the relevance of individual-level decisions to explain policy outcomes, especially on issue areas like international security and diplomacy (Goldsmith, Horiuchi and Matush, 2021).

Quantitative studies in the social sciences have analyzed the importance that individuals have on different types of outcomes. For example, Jones and Olken (2005) employ a source of quasi-exogenous variation (the result of assassination attempts against political leaders) to estimate the impact of a killing on the overall economic performance of a country. On energy policy in particular, Martinez-Alvarez et al. (2022) employ fine-grained data on fossil fuels taxes and a randomization inference approach and conclude that leaders have a limited impact on energy taxes. Qualitative work in this area suggests that individual leaders, particularly those with stronger or more apparent environmental commitments may be more effective at providing local environmental public goods.

Despite the advances in our understanding of cross-national differences in environmental quality, the aforementioned studies have some limitations. First, with very few exceptions, studies

tend to focus on either policy outputs or specific outcomes, but not so much on the actual impact that political institutions have on environmental quality—for example, by analyzing emissions instead of the public health consequences of these.

Second, the vast majority of the current research centers on emissions of pollutants, either CO2—for those studies on climate change—or toxic chemicals—for research on air quality. Nonetheless, as mentioned above, governments have the potential to influence other environmental outcomes, including land use and land use change, water availability, water quality, among many others. Finally, except a handful of studies, the literature analyzes environmental quality in industrialized democracies in the Global North. This gap responds to the relative lack of available data to measure LEPG in low- and middle-income countries. To address these gaps in the literature, this study focuses on outdoor air pollution and ecosystem conservation as key measures of environmental quality at the local level.

Outdoor Air Pollution and Deforestation as Local Environmental Problems of Global Relevance

As mentioned above, a large share of the current research on environmental politics has focused on understanding the supply of climate policy—or actions that reduce greenhouse gas emissions (Mildenberger, 2020). Nonetheless, other severe ecological challenges have received relatively less scholarly attention. I focus on air pollution and ecosystem conservation as key local environmental public goods that affect the public health, livelihoods, and economy of citizens and communities around the world. In this section, I describe their causes and impacts, policies to address them, and their distributional dimension.

Air Quality

Clean air is one of the most fundamental public goods that governments can provide to citizens. Nonetheless, outdoor air pollution is still one of the leading mortality causes around the world. According to Lelieveld et al. (2015) approximately 1.5 million premature deaths globally are at-

tributed to toxic air. Although the majority of these are concentrated in the Global South, and despite large reductions in pollutant emissions in industrial democracies, air quality is a major problem worldwide (Southerland et al., 2022).

As with climate change, air pollution is a complex, multi-cause phenomenon. There are several pollutants that represent risks for human health, for example particulate matter of different dimensions, carbon monoxide, nitrogen oxide, sulfur dioxide, among others. Each of them has its own set of causes, impacts, and political economy dimensions.

In general, for all of them, we can think about two categories of sources: (1) stationary and (2) mobile. The former type of sources describe industrial facilities that emit toxic waste as a byproduct of their activities. These include, for example, oil refineries, that transform crude oil into products such as gasoline and diesel, as well as coal power plants, which burn fossil fuels to generate electricity. There is, indeed, a close correlation between reliance on dirty source of power and the disease burden from air pollution (Kopas et al., 2020). In contrast, mobile sources refer mostly to vehicles used for transportation.

The government policies necessary to reduce outdoor air pollution depend, therefore, on the specific source they target. For example, by promoting the transition away from fossil fuels in the electricity or transportation sectors, leaders can indirectly contribute to reduce air pollution from power plants or vehicles (Lelieveld et al., 2015). In other cases, governments can mandate zoning regulations that forbid the location of polluting facilities near urban areas (Taylor, 2014), invest in mass transit, or implement policies that increase the costs of driving private vehicles, such as pollution taxes.

As a political economy problem, policies to abate air pollution have widespread benefits and concentrated costs—just like actions to reduce greenhouse gas emissions. Recent scholarship shows that, although the improvements in air pollution benefit all citizens and communities, disadvantaged communities are particularly favored, given their historical exposure to air pollution (Hajat, Hsia and O'Neill, 2015). The distributional impacts of policies to abate air pollution differ from point to mobile sources. As for the former, the closure of polluting facilities imposes costs on

specific industries. In contrast, policies that increase the cost of driving, for example by making fuels more expensive, impact broader segments of the population, making them more politically challenging (Mahdavi, Martinez-Alvarez and Ross, 2022). For example, Colantone et al. (2024) shows that when the local government restricted the driving area in downtown Milan, affected citizens were more likely to vote for a right-wing political party.

Degradation of Ecosystems

The other local environmental public good that I study in this paper is the conservation of forests. Forests and other ecosystems represent a key element in the global climate system; as some of the most important terrestrial sinks of carbon, their protection is part of the global strategy to reduce greenhouse gas emissions (Taye et al., 2021). Nonetheless, recent studies suggest that their ecological degradation could turn them into net sources of carbon dioxide, therefore contributing to accelerate climate change (Gatti et al., 2021).

Aside from their climate role, forests provide a wide array of local public goods. For example, these ecosystems are crucial to regulate water and nutrients cycles, store water, and host biodiversity, among many others. In addition, hundreds of millions of individuals live in proximity to forests and therefore derive their livelihoods from them (Erbaugh et al., 2020; Shackleton and de Vos, 2022).

Although deforestation in temperate forests has decreased over time, it is still a major challenge in tropical areas. For example, according to Global Forest Watch, the world lost approximately 488 million hectares of tropical forests from 2000 to 2023; Brazil, Indonesia, Bolivia, and Peru have been some of the leading countries in terms of tree cover loss during this period (Watch, 2023). In terms of the causes, the expansion of the agricultural frontier is, by far, the largest contributor to this problem (Balboni et al., 2023).

There is a wide array of policies that governments can implement to reduce the degradation of valuable ecosystems. By far the most popular globally are the natural protected areas, of which there are multiple types and categories (Geldmann et al., 2019). In contrast to air quality, which is

an inherently local public good, the benefits of forest conservation are both local and global. For example, the creation of a national park that protects a forests contributes to reduce the degradation of that particular ecosystem, providing benefits to nearby communities and cities; at the same time, it captures carbon dioxide, therefore contributing to limit greenhouse gas emissions.

In terms of the political economy of deforestation, the opportunity costs of protection depends on the value of the activities that substitute the forest as the main land use in a place. Given that the vast majority of deforestation in tropical regions respond to the expansion of livestock and commercial crops, a key constituency affected by the creation of protected areas are agro-industries and large landowners (Bragança and Dahis, 2022; Mangonnet, Kopas and Urpelainen, 2022). Nonetheless, in many cases local communities that engage in subsistence farming can also suffer the consequences of more limited opportunities to use their lands.

In summary, air quality and ecosystem protection represent key local environmental public goods which both vary substantially across countries and over time and that are essential from a socio-ecological perspective. They share many similarities, in particular the diffuse nature of their benefits—despite the global role of forests to address climate change; in both cases, improving air pollution and preserving the functioning of forests benefits relatively large segments of the population—in the case of forests, these benefits are even global. Second, their costs are concentrated in smaller constituencies, for example power plans and refineries (for air pollution) and the agribusiness (for deforestation).

I follow the existing literature and hypothesize that, given the diffuse benefits and concentrated costs of air quality and ecosystem protection, democratic countries, left-leaning governments, and environmentally-oriented governments have more incentives to provide air quality and preserve ecosystems.

Research Design

The main goal of this research project is to understand how institutional and ideological variables affect the provision of local environmental public goods worldwide. As a vast area of research

shows, estimating the effects of institutional variables on economic and environmental outcomes is quite challenging from a causal point of view for at least two reasons (Acemoglu, Johnson and Robinson, 2001). First, it is quite possible that countries that either transition from one political regime to another or elect a leader with a specific ideology are quite different from the rest for reasons that also affect their willingness and capacity to provide LEPG. For example, countries that systematically elect left-leaning politicians may have electorates that are more progressive and supporting of environmental policy than those electing a different type of leaders. Hence, the complexity of the relationship between institutions and public goods is confounded by the presence of multiple omitted variables.

Although I do not claim to fully address these issues in this paper, my research design is based on two sources of variation that, taken together, provide a more rigorous approach to study this relationship by creating relatively more comparable sets of treated and control units; that is, by combining cross-section and temporal variation I analyze urban areas and forested pixels exposed to different versions of the main "treatment" variables.

The first one of these sources of variation comes from country boundaries. Recently, scholars in economics and political science have employed the areas neighboring domestic and international borders to gain some causal leverage on the role of political variables. For example, Mangonnet, Kopas and Urpelainen (2022) show that presidents are electorally strategic in the designation of national parks. Magaloni, Díaz-Cayeros and Ruiz Euler (2019) demonstrate that localities ruled by traditional institutions in Oaxaca, Mexico, have higher levels of public services provision than those governed by mainstream political parties. In both studies, the authors focus their analysis on areas near the borders of municipalities, which allows them to estimate a geographic regression discontinuity and estimate a local average treatment effect of their variables of interest.

At the international level, Beacham (N.d.) analyzes the role of natural resource dependence on the designation of protected areas by focusing on pixels close to inter-state boundaries. Other scholars have employed a similar approach to estimate the causal effect of environmental and agricultural policies on deforestation (Wuepper, Crowther, Lauber, Routh, Le Clec'h, Garrett and

Börner, 2024; Wuepper, Wiebecke, Meier, Vogelsanger, Bramato, Fürholz and Finger, 2024; Burgess, Costa and Olken, 2023).

Although recent research suggests that country borders are by no means random, as they follow either geographic or political dimensions (Paine, Qiu and Ricart-Huguet, 2021), they can still be useful to understand the variation in the provision of public goods, especially environmental ones. To illustrate the potential of international borders to study the drivers of air pollution, consider the following two examples. Brownsville, United States, and Matamoros, Mexico, are neighboring cities separated by the Rio Grande, sharing quite similar geographic and geo-economic conditions.[1] Although their overall levels of particulate matter emissions are almost identical (9.3 and 10.1 respectively), their mortality rates associated with air pollution are very different (15.5 versus 11.5 cases per 100,000).

Karlsruhe in Germany and Strasbourg in France are separated by barely 82 kilometers and the Rhine river. Despite having nearly the same level of emissions (16.6 and 17.2), their public health outcomes are quite apart (47 versus 32 deaths per 100,000 inhabitants). To put these numbers in context, the difference in air pollution mortality rates between these two cities is the same as between the top 1 and top 179 most polluted cities in the United States (Porterville and Santa Maria, both in California). Therefore, international borders offer an opportunity to compare urban areas with similar drivers of air pollution, but different institutional and political frameworks.

Inter-state boundaries offer a similar opportunity to understand the drivers of deforestation as a function of political variables. For example, the Amazon rainforest spans nine South American countries (Brazil, Peru, Colombia, Venezuela, Ecuador, Bolivia, Suriname, Guyana, and French Guiana). Although the topographic, hydrological, and ecological conditions do not change at the borders between any two countries, the reach of the state, and therefore the enforcement of different forms of environmental policies, do. This makes some regions of the forest "exposed" to different levels of conservation efforts. Environmental economics research has employed these country boundaries as a source of variation to explore the role of policies in explaining deforestation (Burgess, Costa and Olken, 2023).

[1] Nonetheless, Matamoros is larger than Brownsville

The Mesoamerican Rainforest is the northermost tropical forest in the Western Hemisphere, divided among Mexico, Guatemala, and Belize. Similar to the Amazonian rainforest, the inter-state borders cross over similar ecological, topographic, and ethnic territories, making some of them "exposed" to a specific set of conservation and development policies.

The second source of variation that I leverage in this paper comes from the staggered adoption of the three main independent variables. During the period of analysis, countries around the world experienced changes in their political regimes and elected governments with different ideological orientations at different points in time—including never. This process created different "cohorts" of exposed units at different moments in time, which I leverage in my estimation strategy.

Methods and Data

Construction of the sample of units

I measure the provision of local environmental public goods at the local level with two units of analysis, one for each type I analyze in the paper. For mortality rates associated with air pollution, I analyze 12,990 cities; for each of them, I employ their latitude and longitude coordinates. For deforestation, the unit of analysis are pixels of land around all the international borders globally. I create a buffer of 100 kilometers around the inter-state lines and then divide this area in squared pixels, which results in 175,000 units. I then remove all of the polygons that are located exactly along the border, as these overlap with more than one country.

To determine the samples of "treated" and "control" units, I first create the list of countries that experienced either a political regime transition, elected a leftist government, or were ruled by a nominally environmentally-oriented leader—these represent the "treated" countries. I then select only the border buffers corresponding to these countries and all of their "non-treated" neighbors. Finally, I subset to only the cities and pixels that overlap with the above selection of borders.

To illustrate this process, suppose that the only treated country in South America is Bolivia.

The sample of pixels and cities includes all of the units located within the 100 kilometer buffer on the Bolivian side, as well as the units located, along the border with Bolivia, in Brazil, Paraguay, Argentina, and Peru—all of Bolivia's neighbors, which then become part of the control group. This means that the pixels in those neighboring countries that do not correspond to the segment of the border with Bolivia will not be included. For example, the border of Peru and Ecuador is not included in this case.

It is important to mention that, to measure the provision of ecosystem conservation as a local public good, the pixels effectively included in the sample are those that were covered by forests in 2000 according to remote sensing data—this excludes other types of ecosystems and urban areas. Given that the goal of the empirical test is to analyze the tree cover loss trajectories of pixels subject to different political regimes and governments with different ideological orientations, it is essential to include only pixels vulnerable to lose forests.

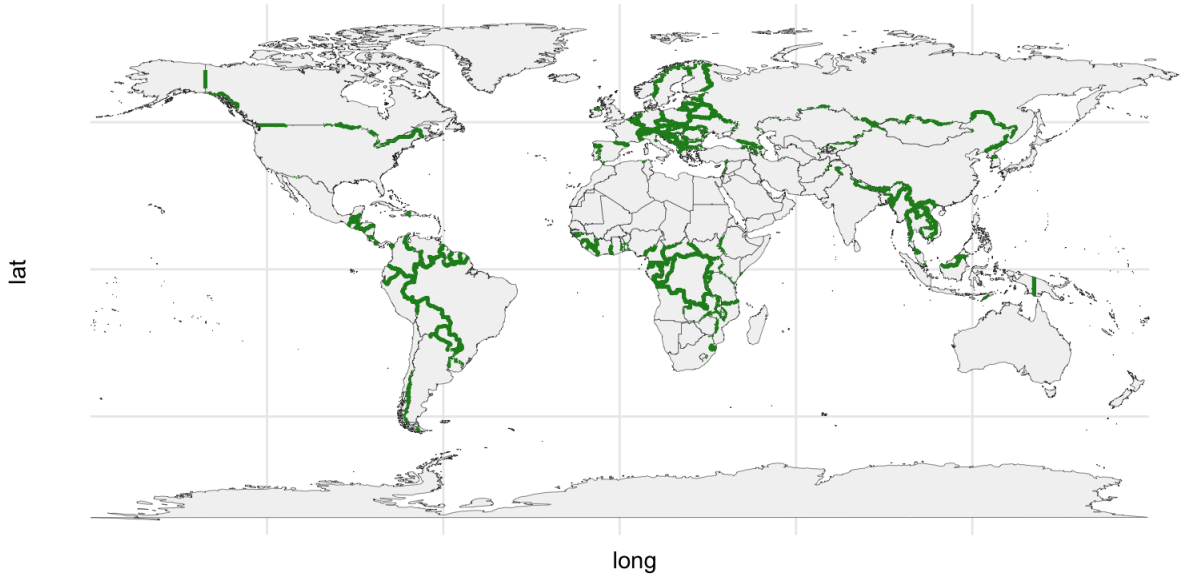

Figure 1: **Location of forested pixels analyzed in the sample (those around international borders)**.

Figure 1 shows the global distribution of pixels around international borders covered by trees in 2000. Figure 2 shows the geospatial distribution of all cities in the sample (including those inside and outside of the buffer around the borders). Figure 3 shows one of the three resulting subsamples (for cities located along the borders of countries ruled by a left-leaning government); the geospatial distribution of the other subsamples are located in the Online Appendix.

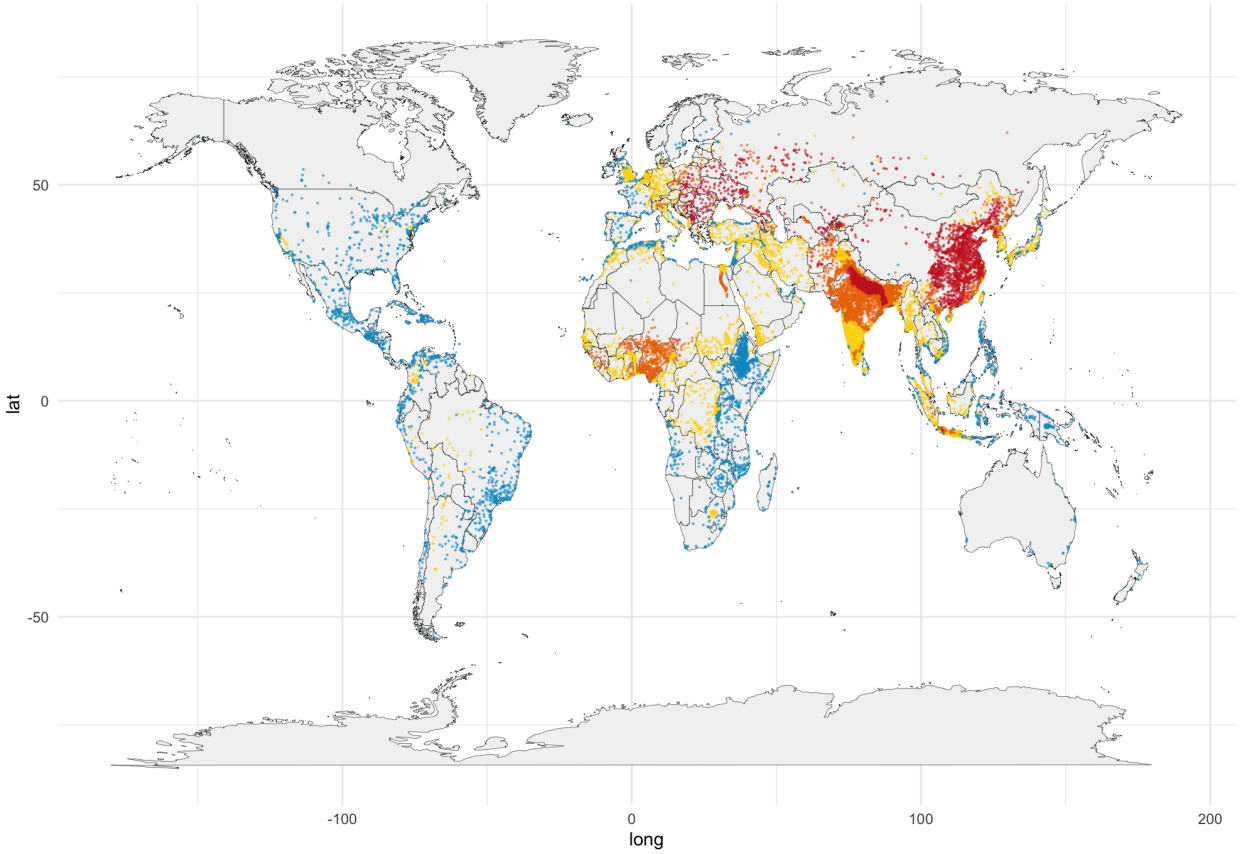

Figure 2: **Distribution of the 12,990 cities**. Cities in red belong to the top quartile of the air pollution mortality distribution; cities in orange are in the second quartile; cities in yellow in the third quartile; and cities in blue in the lowest quartile.

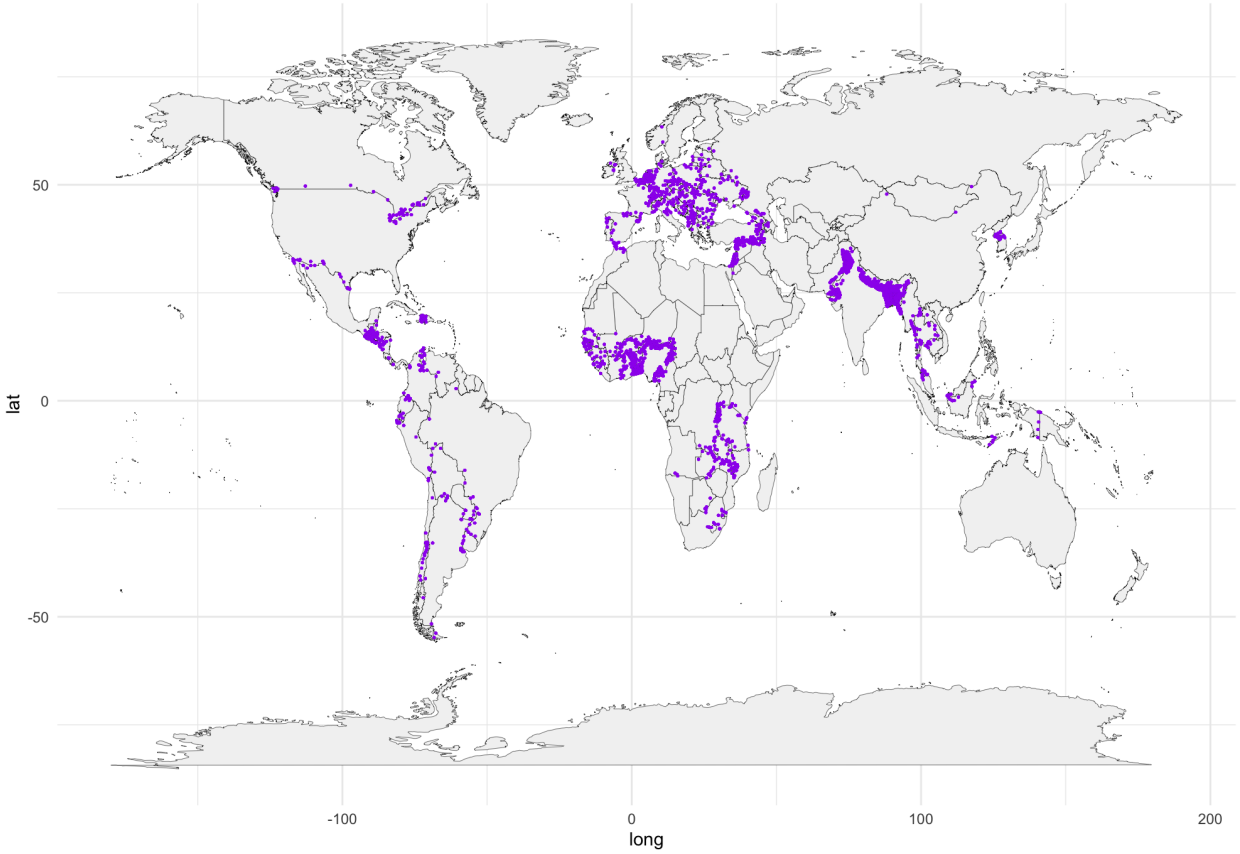

Figure 3: **Distribution of the cities along one of the buffers**. Cities located around the international borders of countries that experienced a left-wing government.

Data Sources

The data on both local environmental public goods is derived from remote sensing sources. This represents an advantage compared to administrative records. First, it is available for more countries and years; in contrast to data used in prior studies that focus heavily on the Global North, this allows me to make inferences about the role of political institutions and the ideological orientation of leaders for a broader sample of countries. Second, the satellite origins of the data reduces concerns about measurement error and lack of transparency in reporting (Martinez, 2022).

The data on mortality rates associated with different air pollutants comes from the Milken Institute for Public Health at the George Washington University (Southerland et al., 2022). The

data measures, for each one of the cities in the sample, the overall levels of emissions associated with: (1) particulate matter smaller than 2.5 micrometers, (2) nitrogen dioxide, and (3) ozone. In addition, the authors also calculate the disease burden related to each source, employing epidemiological models. The resulting dataset measures the mortality rates from each pollutant at the city-year level from 2000 to 2019.

I approximate ecosystem degradation by measuring the amount of tree cover loss at the pixel level. The data comes from Hansen et al. (2013). The authors employ satellite imagery and a machine learning algorithm to classify areas into forested and non-forested in the year 2000. In addition, the dataset specifies whether a given pixel covered by trees in 2000 was later on deforested and, if so, the year of occurrence from 2001 to 2022.

In this paper, I use three main independent variables: (1) regime change, (2) left-leaning (democratically-elected) political ruler, and (3) climate-oriented government. To approximate the first one, I employ two different measures of democracy, the Polity IV score (Users'Manual, 2002) and the database on political institutions from V-Dem (Lindberg et al., 2014). As mentioned above, for the analysis on the relationship between regime change and local environmental public goods, I do not include all the countries in the sample, as most of them did not experience any changes in their macro-level institutional frameworks during this period. Instead, I subset to a sample of 42 countries that did change their regime from 2000 to 2018, including both those that transitioned from a non-democracy to a democracy and those that had some level of democratic backsliding.

I approximate the influence of a democratically-elected left-leaning government using data on the political ideology of leaders by Herre (2023). The author codes whether the executive of any given country is associated to leftist, rightist, centrist, or no specific political ideology.

Finally, to classify governments according to their nominal support for environmental policies, I develop a new measure that combines two elements. First, political leaders can support a climate-oriented agenda by engaging in diplomatic negotiations and raising the salience of the issue at the international level, for example in international organizations such as the United Nations. Second, political leaders can also strengthen their environmental commitment by imple-

menting more ambitious energy and environmental policies domestically. Given the intermestic nature of climate change and other environmental issues (Keohane and Victor, 2011), it is necessary to conceptualize leadership in this area along both dimensions.

To approximate the role of climate and environmental issues in leaders' foreign policy, I use text data from all the speeches at the United Nations General Assembly, employing data from (Jankin Mikhaylov, Baturo and Dasandi, 2017). According to the authors, these speeches provide global leaders with the opportunity to articulate both what they perceive as the critical issues in the international agenda as well as what they believe their countries' priorities are. Moreover, an important advantage of this dataset is that it has full cross-national and temporal coverage, therefore reducing concerns about missing data.

However, it is also important to recognize its limitations; as any other political speeches, the remarks leaders make at the United Nations General Assembly are non-binding and mostly rhetoric. Nonetheless, they reflect at least the choice of topics governments want to emphasize to their international peers. Specifically, I calculate the term frequency-inverse density frequency of a handful of critical terms associated with either the clean energy transition or ecosystem conservation (depending on the environmental local public good) for the speeches of all executives from 2000 to 2022.

The second element of this measure centers on the domestic aspect of environmental and climate leadership, specifically on the policies implemented to address either the degradation of ecosystems or the energy transition. For air pollution, I employ the Database on National Climate Policies to measure the number of emissions-reduction policies implemented by each political leader over a year (Nascimento et al., 2022). The sectors included general climate change and energy laws, as well as actions focusing on the industry, transportation, and electricity sectors, as these are all drivers of outdoor air pollution.

For deforestation, as mentioned above, one of the most widespread and popular policies to reduce the degradation of ecosystems is the designation of natural protected areas. Using data from the International Union for the Conservancy of Nature, I measure the number of national parks

created and the total area protected during any given leader-year observation. Combining these two elements, I code a political leader as environmentally oriented if they both mentioned environmental issues at the United Nations General Assembly and implemented at least one policy domestically. See the Online Appendix for the list of leaders.

In terms of the methods, as mentioned above, I employ proximity to international borders as a strategy to create more comparable samples of units (pixels and cities). Given the temporal variation in the three independent variables of interest (change in political institutions, change in political ideology, and change in climate commitment), I use a difference-in-difference approach. Specifically, I employ a staggered difference-in-difference from Callaway and Sant'Anna (2021), to take advantage of the differential exposure of the units to different institutional frameworks and types of governments.

Empirical Findings

Descriptive Statistics

Outdoor Air Pollution

Cities across the world differ substantially in their mortality rates associated with air pollution. Among the 12,990 urban areas in the full sample (including both within and outside the buffer around international borders), the average mortality rate is 59 per 100,000 inhabitants for particulate matter smaller than 2.5 micrometers, 2.86 per 100,000 for ozone, and 30.36 per 100,000 inhabitants for nitrogen dioxide. Moreover, there are clear regional patterns for each one of these pollutants. For example, cities in Bulgaria, Serbia, North Macedonia, Ukraine, and China experienced the highest mean mortality rates for PM2.5 from 2000 to 2019, whereas urban areas in India, Nepal, China, Spain, and the United States had the largest impacts due to atmospheric ozone during the same years. As for nitrogen dioxide, cities in the United States, Jordan, Kuwait, Ecuador, and Bolivia had the highest averages.

Across the world, urban areas in Syria, Nepal, and Bhutan experienced the largest increases,

on average, in mortality rates from particulate matter; Bahrain, Bahamas, and Barbados had the cities with the largest increases in nitrogen dioxide mortality, whereas Nepal, India, and Lesotho ranked the highest for increases in ozone mortality—although it is important to mention that many of these countries had only one urban area in the sample.

In contrast, cities in Nigeria, Bulgaria, and Niger had, on average, the steepest decreases in mortality rates from particulate matter; similarly, cities in Canada, Slovakia, and the United States experienced the most significant drops in nitrogen dioxide public health impacts, while China, Ukraine, and Bulgaria had the best performers in terms of reductions of ozone mortality rates. To provide one example of the geospatial distribution of the mortality data, Figure 4 shows the cities in the sample with increases and decreases in one type of pollutant.

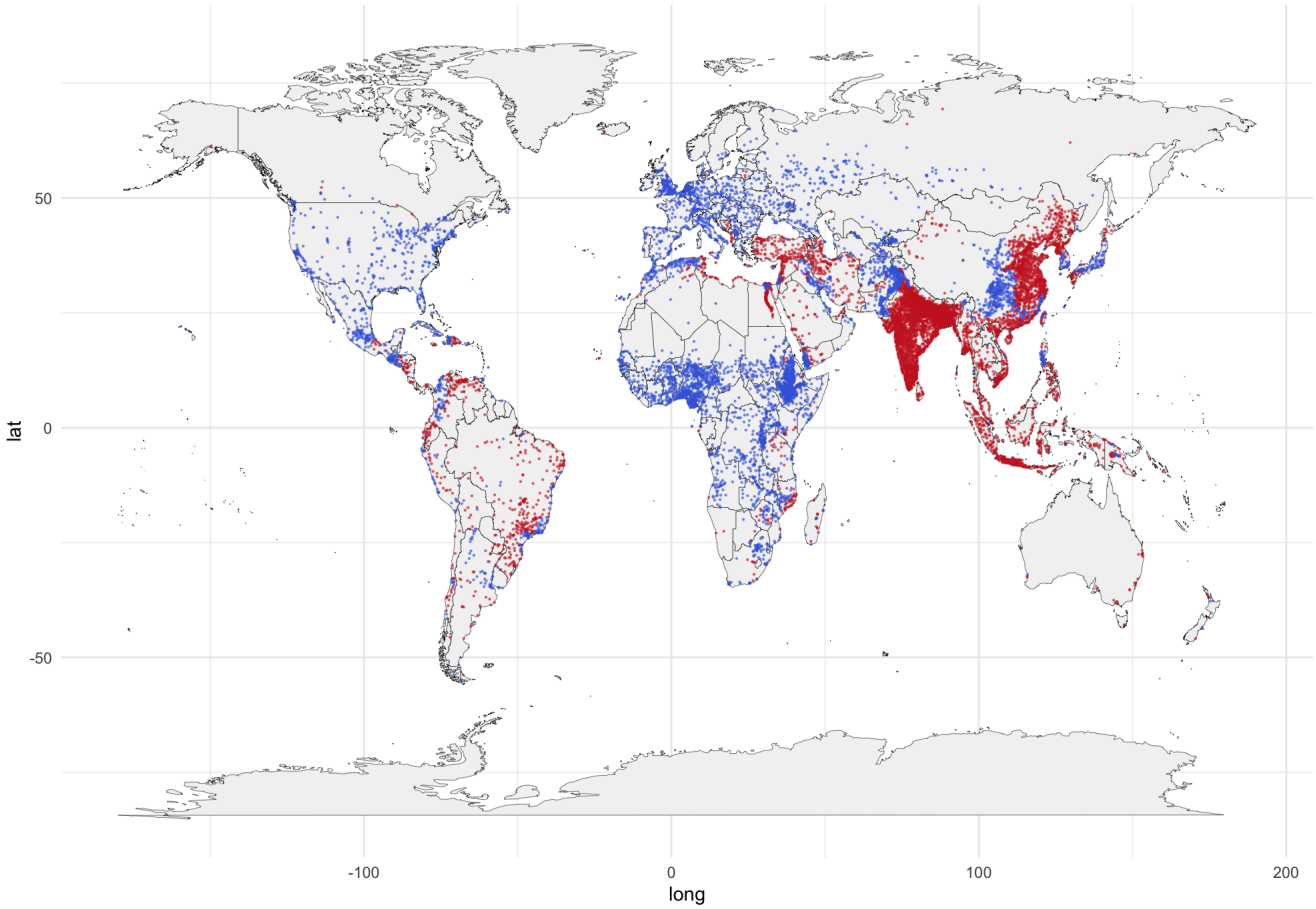

Figure 4: **Cities by their change in particulate matter mortality**. Cities in red experienced an increase in their mortality rates from particulate matter smaller than 2.5 micrometers from 2000 to 2019; cities in blue experienced a decrease in the same variable.

Finally, it is important to mention that, on average, the 12,990 cities in the sample experienced an increase in mortality rates from particulate matter and nitrogen oxide, but not a discernible change in ozone mortality—nonetheless, the large number of cities in China and India is partially driving this trend. Figures 5, 6, and 7 show the trends in the averages of the three pollutants for all cities in selected countries. As these figures show, most of the variation in pollution occurs across countries, with less so within them.

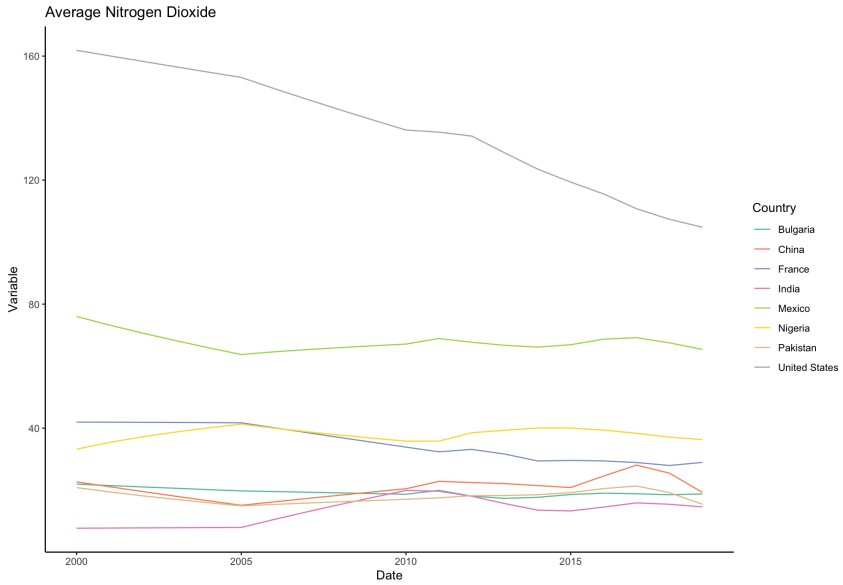

Figure 5: **Trends in nitrogen dioxide for selected countries**.

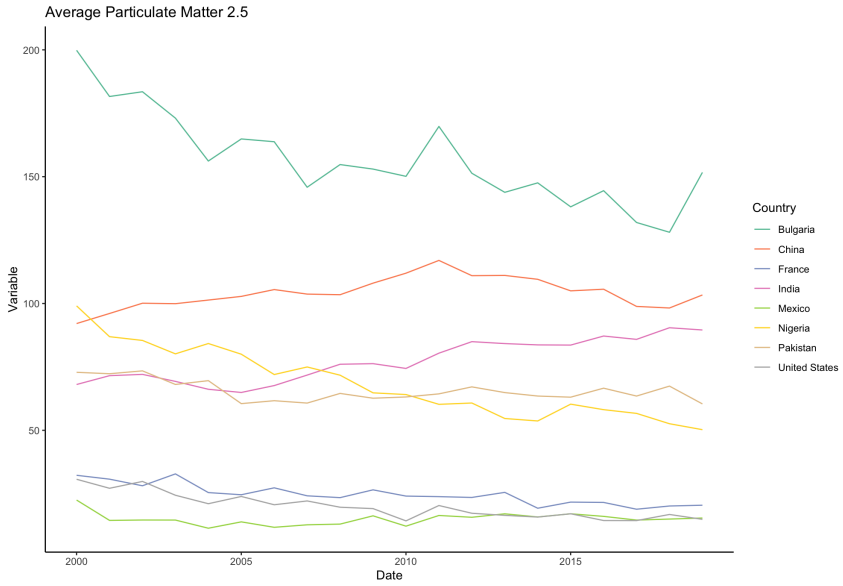

Figure 6: **Trends in PM2.5 for selected countries**.

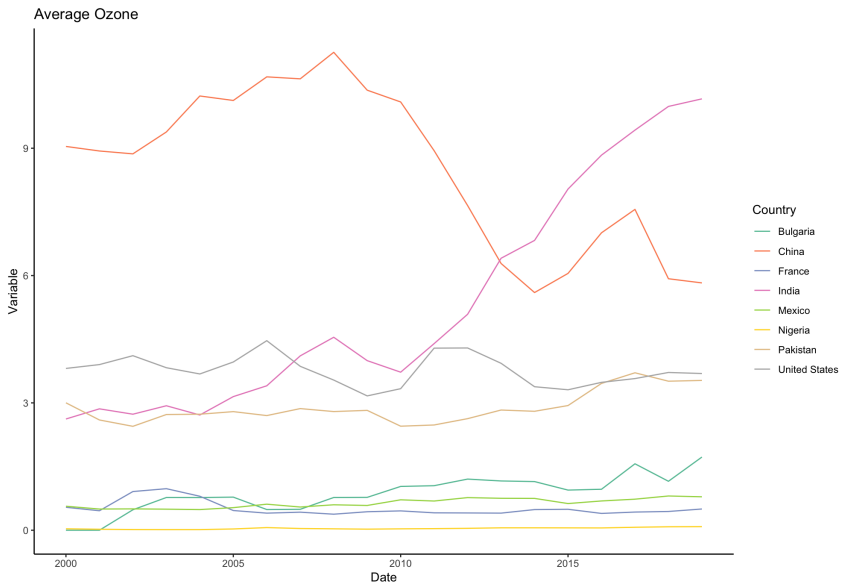

Figure 7: **Trends in ozone for selected countries**.

Ecosystem Degradation

Out of the 175,000 pixels in the sample of areas adjacent to international borders, the average percent of tree cover in 2000 was close to 10%. Approximately 43% of them had more than 10% of their area covered by forests and 20% of them were more than half forested. Tree cover loss, a measure of ecosystem degradation, was relatively high among forests along international borders. For those pixels with more than 10% of initial tree cover, the accumulated levels of deforestation reached 9.61% or 0.45% per year, on average.

The countries with the highest share of their international terrestrial borders covered by forests in 2000 were French Guiana (97%), Suriname (96%), Brunei Darussalam (93.5%), Guyana, and Equatorial Guinea (88%). 39 states had more than one half of their borderlands corresponding to tree cover. Among these, Cambodia, Liberia, Laos, Belize, and Malaysia experienced the highest rates of deforestation in their borders (at 32.5%, 24.8%, 23.16%, 22.83%, and 22.48%). Figures 8 shows the geospatial distribution of the pixels with deforestation in the sample.

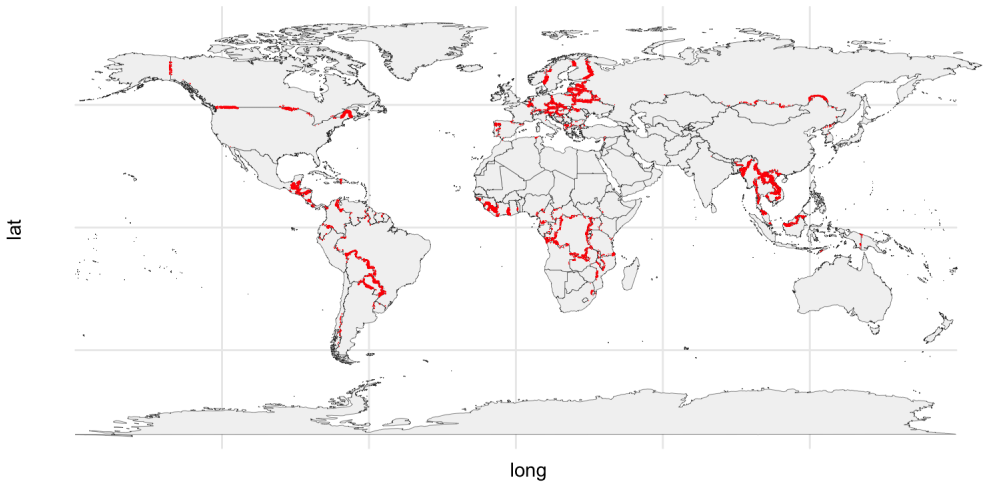

Figure 8: **Geographic distribution of pixels adjacent to international borders with some level of deforestation worldwide**.

Statistical Analysis

Regime Change and Environmental Local Public Goods

To recapitulate, the main goal of this paper is to investigate the relationship between regime type and political ideology and the provision of local environmental public goods. Starting with the role of macro-level political institutions, Table 1 and Table 2 present the results of an ordinary least squares regression with the two LEPG as dependent variables and a measure of political institutions as the key independent variable. For the models in Table 1, the main outcome variables

	NO_2	Ozone	PM2.5
Electoral Democracy (V-Dem)	-0.33^{*}	-1.04^{***}	-5.94^{***}
	(0.14)	(0.12)	(0.30)
Population	-0.00	0.00	0.00^{*}
	(0.00)	(0.00)	(0.00)
Num. obs.	38320	38320	38320
Num. groups: City	2267	2267	2267
Num. groups: Country	73	73	73
Num. groups: Year	20	20	20
R^2 (full model)	0.95	0.66	0.93
R^2 (proj model)	0.00	0.01	0.09
Adj. R^2 (full model)	0.95	0.63	0.92
Adj. R^2 (proj model)	0.00	0.01	0.09

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

Table 1: Democracy and Air Pollution Mortality

are the mortality rates associated with particulate matter smaller than 2.5 micrometers, nitrogen dioxide, and atmospheric ozone; for the models in Table 2, the outcome variables are tree cover loss in areas with more than 20%, 40% and 60% forest cover.

In both cases, the models include unit, country, and year fixed effects, as well as standard errors clustered at the country level—which corresponds to the level of treatment assignment. The sample in all of the cases corresponds to pixels in countries that experienced a regime change during the period of analysis and their neighbors.

The results suggests that changes in democratic institutions may have heterogeneous effects on the provision of local environmental public goods. First, changes in the levels of democracy are associated with more deforestation in border polygons; nonetheless, the coefficients are not statistically significant at the conventional levels. In contrast, we observe a strong correlation between changes in the measurement of democratic institutions and the mortality rates associated with air pollution, for particulate matter, nitrogen dioxide, and atmospheric ozone. The coefficients in the models suggest that urban areas near international borders that were exposed to a change in their political institutions experienced an improvement in their air quality compared to their geographic neighbors that did not.

	Model 1	Model 2	Model 3
Electoral Democracy Index	0.13	0.36	0.33
	(0.12)	(0.26)	(0.24)
Num. obs.	57664	344075	401739
Num. groups: country2	64	81	85
Num. groups: ID	3392	20365	23757
Num. groups: year	17	17	17
R^2 (full model)	0.28	0.23	0.23
R^2 (proj model)	0.00	0.00	0.00
Adj. R^2 (full model)	0.24	0.18	0.19
Adj. R^2 (proj model)	0.00	0.00	0.00

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

Table 2: Democracy and deforestation

Government Ideology and Environmental Local Public Goods

The next part of the analysis investigates the role of governments with different ideological orientations in the provision of local environmental public goods. Specifically, I compare the air pollution mortality rates and the tree cover loss in units that were exposed to leftist and nominally pro-environmental governments with neighboring units that were not exposed, leveraging the differential time of exposure. To do so, I estimate a staggered difference-in-differences design; recent studies suggest that two-way fixed effects models may introduce bias, by comparing early- and late-treated units. As a result, the econometrics literature has developed a wide array of new estimators. I employ the method proposed by Callaway and Sant'Anna (2021) to a estimate a difference-in-differences with multiple treatment periods.

I first discuss how the accession to office of a democratically-elected left-wing government affects the provision of local environmental public goods. Figure 9 includes three models, one for each of particulate matter, nitrogen dioxide, and ozone. As mentioned above, the sample includes only units in countries that experienced a left-wing democratic government and their immediately adjacent neighbors in countries that did not experienced this type of government. As the plot shows, exposure to the aforementioned treatment is associated with a relatively large increase in the three types of air pollution mortality analyzed. Although the effect is statistically significant for the three pollutants, it is stronger for particulate matter 2.5.

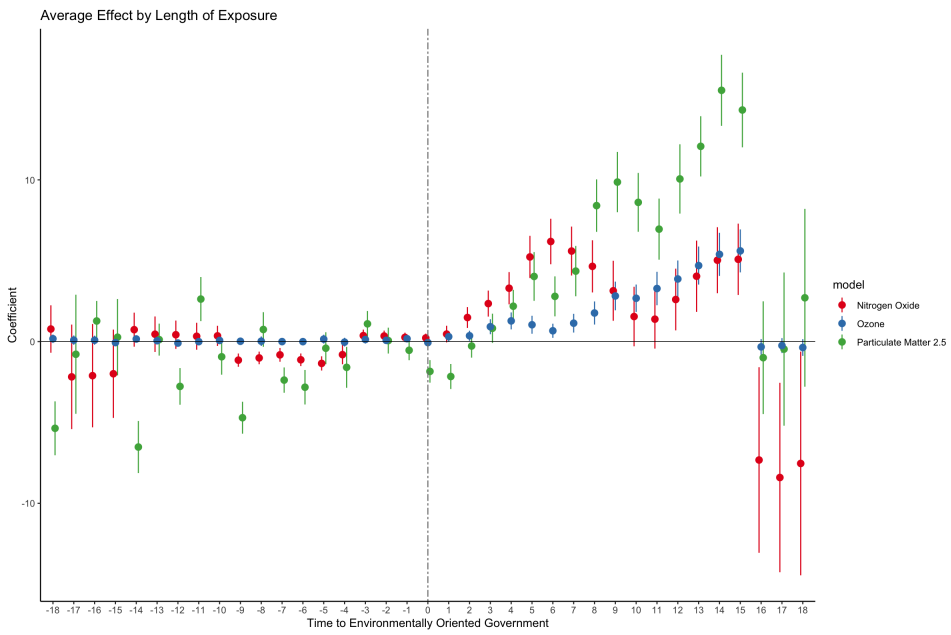

Figure 9: **Trends in air pollution mortality after the election of a left-wing government**.

Next, I estimate the same models, but using the overall levels of emissions as the main outcome variables to analyze whether the aforementioned results are driven by higher levels of emissions. As Figure 9 suggests, the accession to office of a democratically elected is not associated with changes in the absolute levels of toxic air pollution, only with mortality rates derived from them.

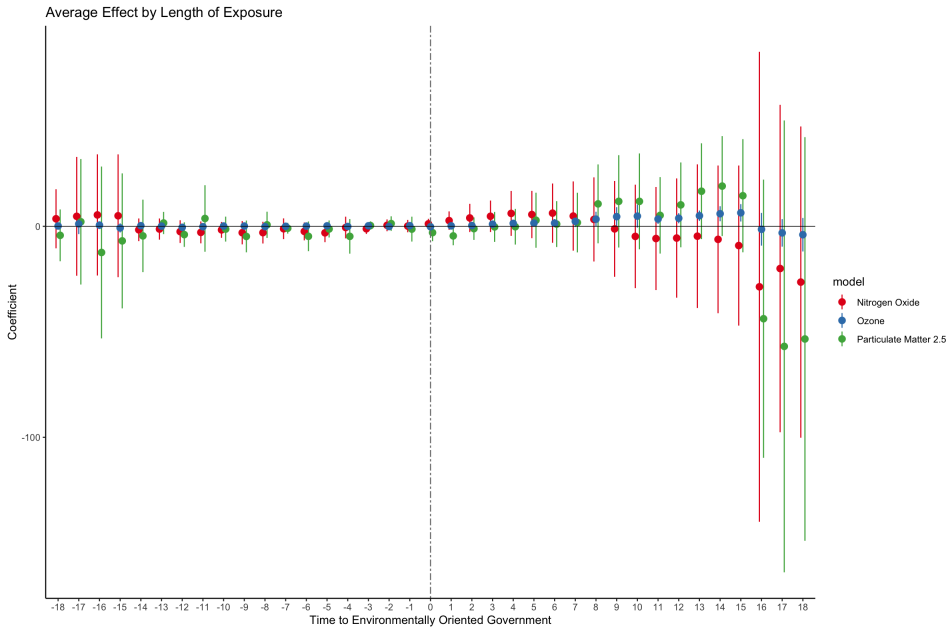

Figure 10: **Trends in air pollution emissions after the election of a left-wing government**.

Regarding the provision of the other local environmental public good (deforestation), I find that electing a left-leaning government is, in turn, associated with reductions in tree cover loss in forests exposed to this type of government compared to adjacent forests non-exposed. As Figure 11, the coefficients start decreasing approximately 3 years after the accession; in addition to their statistical significance, their magnitude is substantively relevant as well. Hence, these empirical findings suggest that the ideological orientation of governments may have heterogeneous effects on environmental quality.

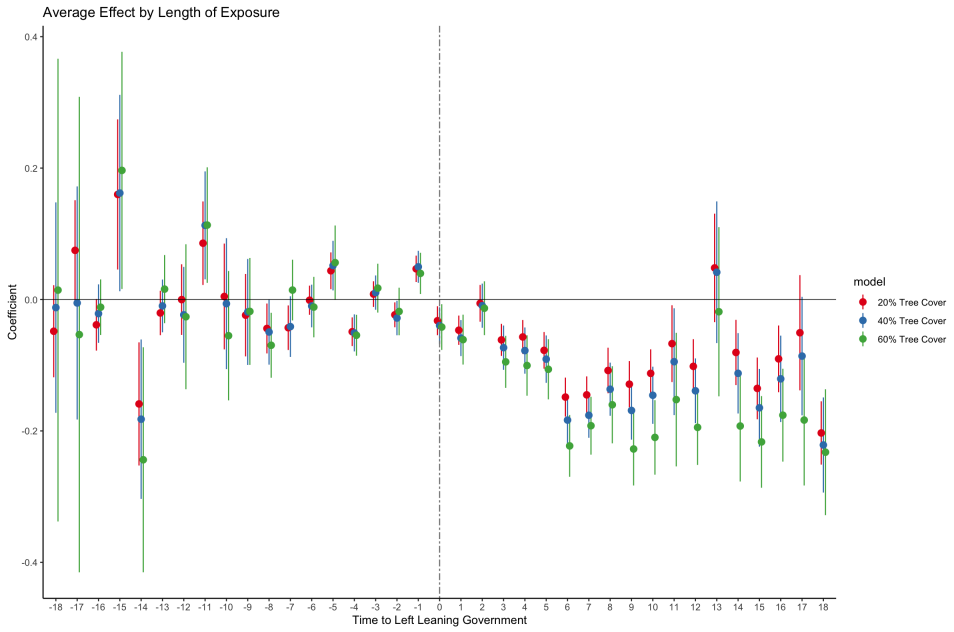

Figure 11: **Trends in deforestation after the election of a left-wing government**.

I use data on the timing and location of natural protected areas to explore one potential mechanism behind the aforementioned finding. I first divide the full sample into areas designated as protected and those undesignated. I find that the decrease in deforestation after the accession of a left-leaning democratic government is concentrated in areas under some type of official protection. In contrasts, forests that lack any conservation status experienced a much smaller decrease in tree cover loss (see Figures 12 and 13). These findings suggest that the better enforcement of environmental regulations may be a key mechanism why leftist governments provide more of this local environmental public good. Further analysis confirms that the election of a leftist political leader is associated with a higher probability of designating a pixel as protected (see Figure 14).

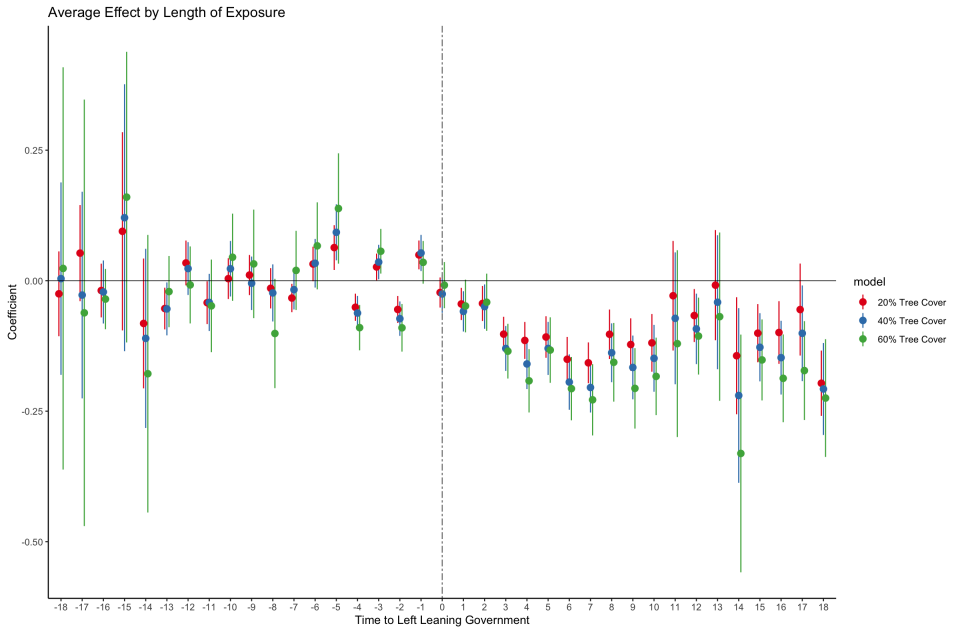

Figure 12: **Trends in deforestation after the election of a left-wing government (protected areas only)**.

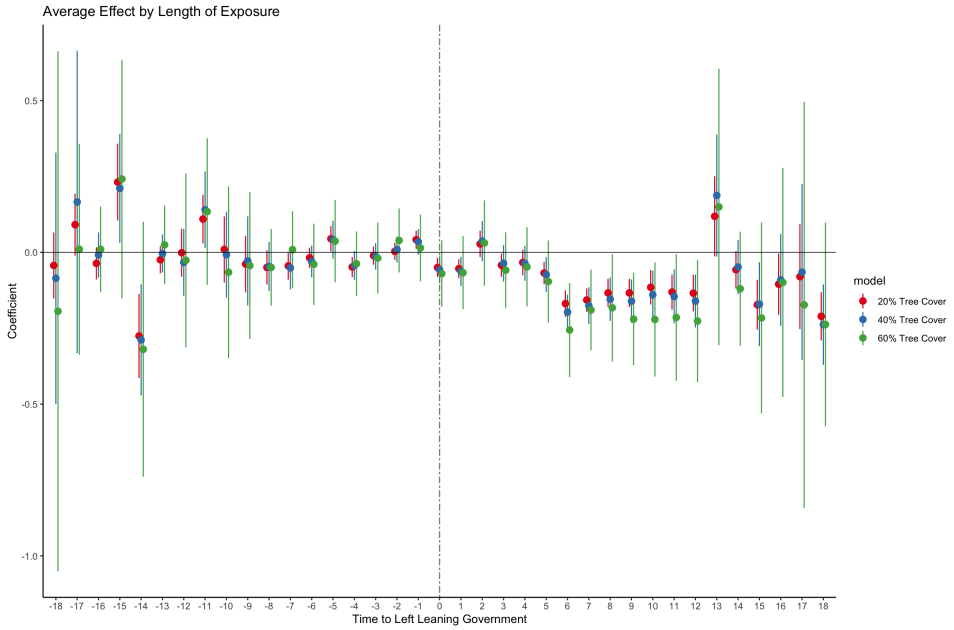

Figure 13: **Trends in deforestation after the election of a left-wing government (unprotected areas only)**.

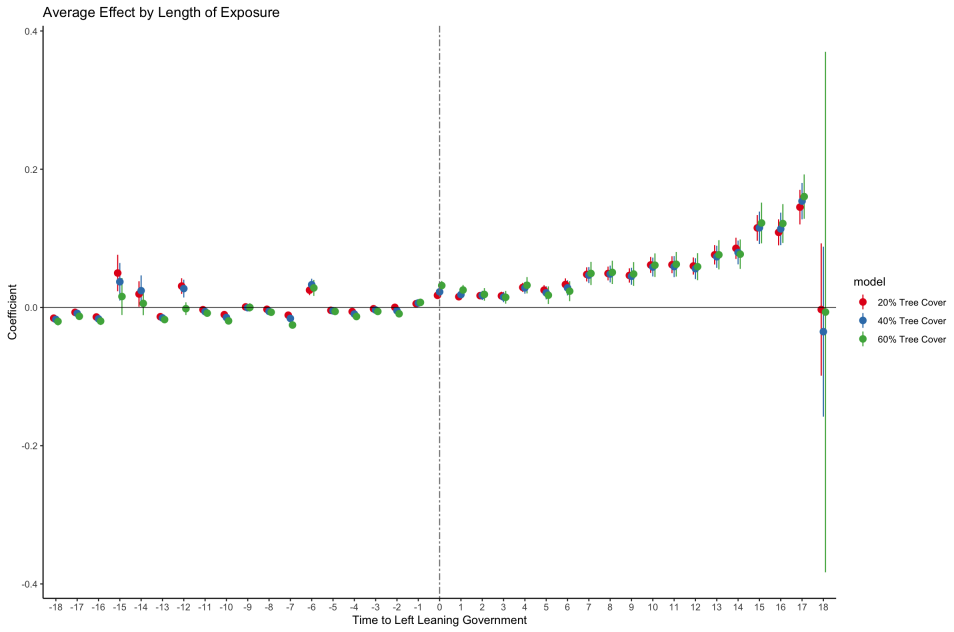

Figure 14: **Trends in the designation of natural protected areas after the election of a left-wing government**.

Finally, the last element of the analysis focuses on the relevance of leaders that are nominally pro-environmental, based on their diplomatic and policy record. The results are somewhat counterintuitive. On the one hand, the staggered differences-in-differences shows that after the accession to office of one of these governments, there is a noticeable decrease in the mortality rates from nitrogen dioxide, but an increase in the disease burden of particulate matter 2.5, as shown in Figure 15. On the other, they are also associated with an increase in tree cover loss (see Figure 17). Additional analyses show that such reduction in forest canopy is concentrated in areas that lack any conservation status—those protected did not experience any change in land use (Figure 19).

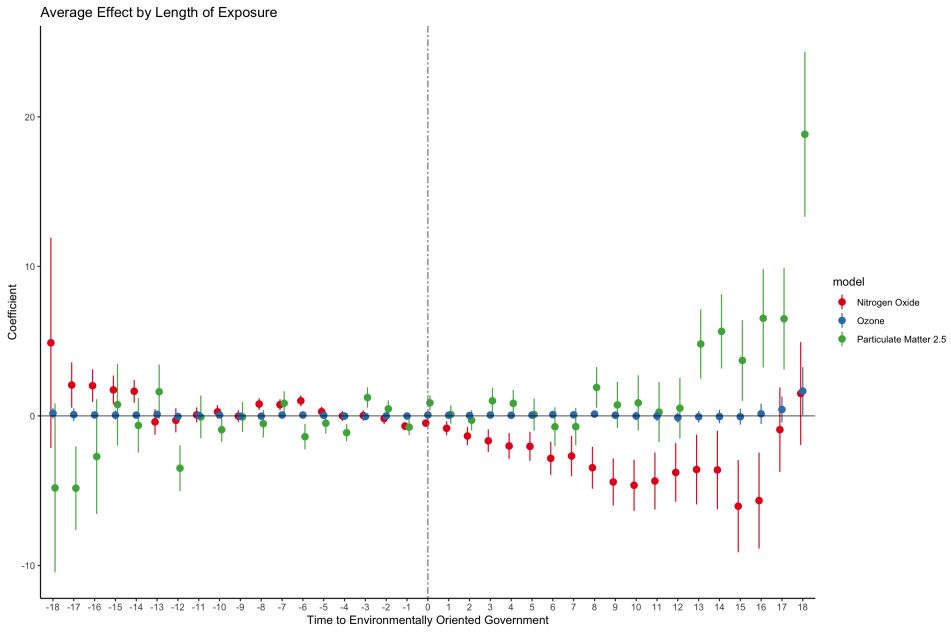

Figure 15: **Trends in the mortality rates from pollution after the accession to office of an environmentally-oriented leader**.

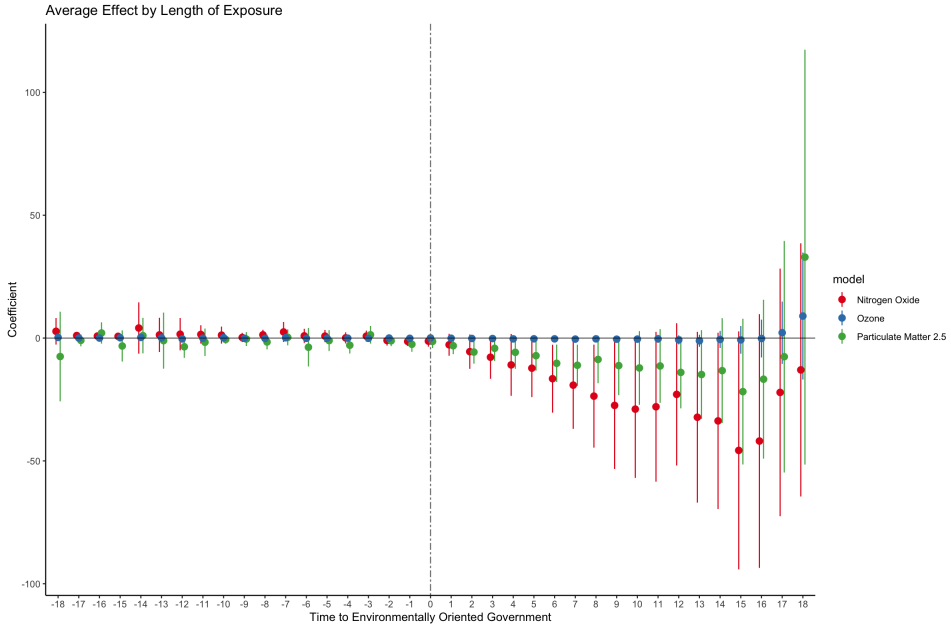

Figure 16: **Trends in pollution after the accession to office of an environmentally-oriented leader**.

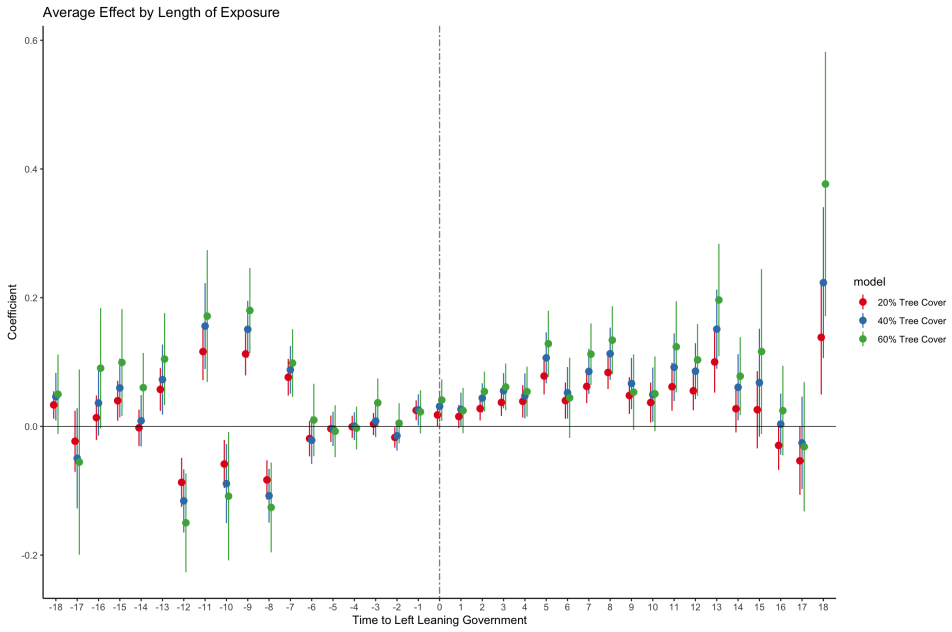

Figure 17: **Trends in deforestation after the accession to office of an environmentally-oriented leader**.

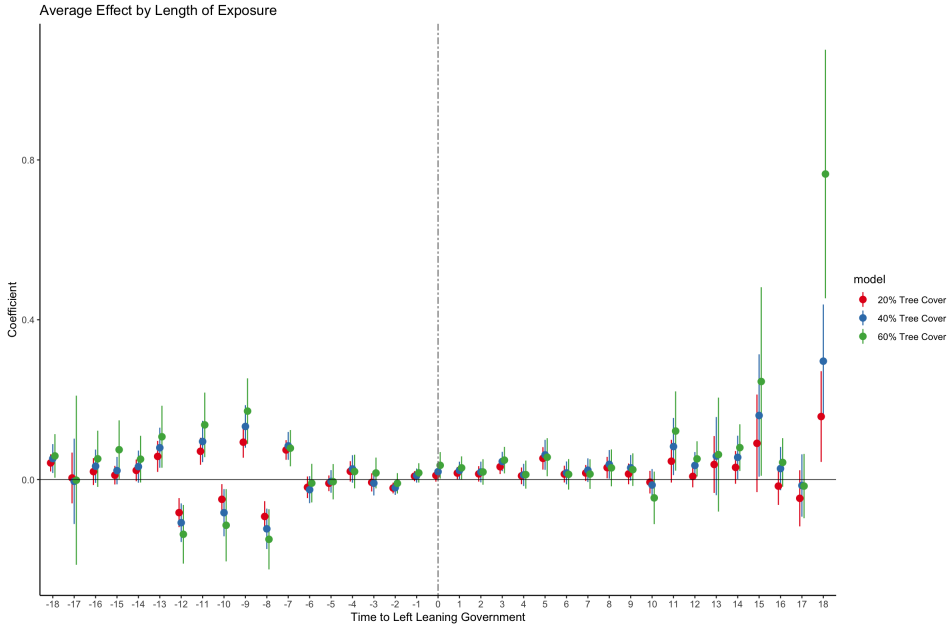

Figure 18: **Trends in the mortality rates from pollution after the accession to office of an environmentally-oriented leader (protected areas only)**.

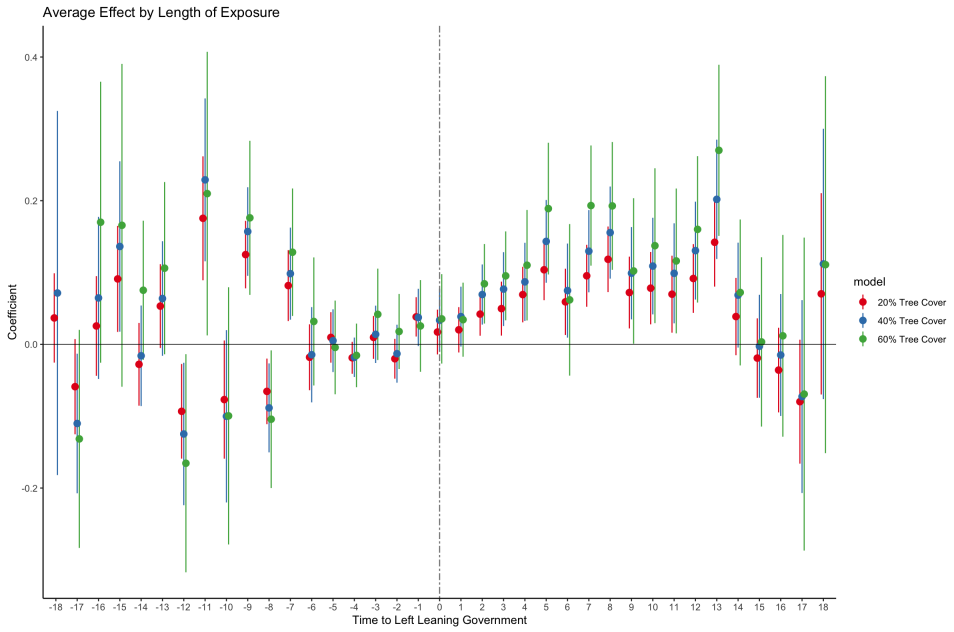

Figure 19: **Trends in the mortality rates from pollution after the accession to office of an environmentally-oriented leader (unprotected areas only)**.

Final Remarks

What explains that some governments are more effective at providing local environmental public goods than others? In this paper, I study the role of both institutional factors–regime type—and ideological variables—the accession of leftist and pro-environmental governments— in two measures of environmental quality: (1) mortality rates associated with outdoor air pollution and (2) tree cover loss, both of which derived from remote sensing data.

Countries that either transition from one type of regime to another or where a leader with specific ideological characteristics rule are different from those without these features for reasons that likely affect the provision of local environmental public goods. To allay some of those endogeneity concerns, my identification strategy relies on two sources of variation. First, I focus on units—cities and land pixels—that are close to terrestrial international borders. By doing so, my design compares neighboring units that differ in their exposure to different political variables—

regime type and ideological orientation of the chief executive. Second, within these samples, I take advantage of the staggered exposure to the main variables of interest, therefore estimating a difference-in-differences with multiple treatment periods.

My findings suggest that the variables that the existing literature has deemed relevant to explain cross-country differences in environmental quality may have heterogeneous effects on different local environmental public goods. First, in line with many of the current studies, I find that cities exposed to changes in political regime (specifically those that experience increases in their democratic indices) also tend to improve in terms of the air quality—for three different types of pollutants. In contrast, changes in political institutions do not seem correlated with changes in tree cover loss among the countries that went through a regime transition during the period of analysis.

Regarding the role of governments with specific ideological orientations, in this paper I analyzed how the trajectories of mortality rates associated with air pollution and the loss of valuable ecosystems changes when left-wing leaders are elected and when nominally environmental governments gain office. I find that left-leaning democratic leaders are associated with increases in the rates of air pollution mortality and decreases in the rates of tree cover loss. I test some of the potential mechanisms that could explain these results. Regarding air pollution, I find that the accession of a left-leaning leader is not associated with more concentrations of pollutants per se, only with mortality rates. As for forest degradation, further analysis shows that most of the association of leftist political governments and deforestation comes from better enforcement of environmental regulations—approximated by deforestation in natural protected areas. In addition, forests that became ruled by a leftist political party were more likely to be designated as protected compared to similar pixels at the other side of the border without this exposure.

Finally, the models analyzing the role of nominally environmental governments are counterintuitive. Although these leaders are associated with a lower rate of mortality from nitrogen dioxide, they are also correlated with a higher disease burden from particular matter and deforestation rates.

The next steps of the project involve further analysis of two mechanisms that could explain the air pollution findings. The first one is changes in the overall levels of economic activity after the accession to office of a left-leaning government, approximated with nighttime luminosity; the second mechanism is the implementation of policies that may incentivize the emission of specific types of pollutants, for example policies to make fossil fuels cheaper or promote certain sources of electricity generation. In addition to quantitative tests to tease out these variables, individual case studies of governments and leaders could be useful to trace back the mechanisms behind both sets of findings.

The vast differences across regions and countries in terms of their environmental quality is one of the central questions of environmental and energy politics research. This paper contributes to the existing literature in three ways. First, I leverage recent improvements in geographic information systems and remote sensing data to better measure the provision of environmental public goods, including those associated with energy and land use. Second, by doing so, I overcome some of the challenges faced by the existing literature and expand the sample to many more countries around the world, particularly in the Global South; for the case of deforestation, the use of remote sensing data ensures full temporal and cross-sectional coverage. Finally, this paper contributes to theorizing about the heterogeneous effects of political variables on environmental outcomes; instead of assuming that such institutional factors affect the environment in the same way, this paper addresses the differences across regions and types of environmental public goods.

References

Acemoglu, Daron, Simon Johnson and James A Robinson. 2001. "The colonial origins of comparative development: An empirical investigation." *American economic review* 91(5):1369–1401.

Alkon, Meir and Erik H Wang. 2018. "Pollution lowers support for china's regime: quasi-experimental evidence from Beijing." *The Journal of Politics* 80(1):327–331.

Anderson, Sarah E, Mark T Buntaine, Mengdi Liu and Bing Zhang. 2019. "Non-governmental monitoring of local governments increases compliance with central mandates: a national-scale field experiment in China." *American Journal of Political Science* 63(3):626–643.

Balboni, Clare, Aaron Berman, Robin Burgess and Benjamin A Olken. 2023. "The economics of tropical deforestation." *Annual Review of Economics* 15:723–754.

Bättig, Michèle B and Thomas Bernauer. 2009. "National institutions and global public goods: are democracies more cooperative in climate change policy?" *International organization* 63(2):281–308.

Bayer, Patrick and Johannes Urpelainen. 2016. "It is all about political incentives: democracy and the renewable feed-in tariff." *The Journal of Politics* 78(2):603–619.

Beacham, Austin. N.d. "Extractive "Protectionism"? Natural Resource Dependence and Protected Area Designation." . Forthcoming.

Bernauer, Thomas and Vally Koubi. 2009. "Effects of political institutions on air quality." *Ecological economics* 68(5):1355–1365.

Boix, Carles. 1997. "Political parties and the supply side of the economy: The provision of physical and human capital in advanced economies, 1960-90." *American Journal of Political Science* pp. 814–845.

Boix, Carles. 2003. *Democracy and redistribution*. Cambridge University Press.

Bragança, Arthur and Ricardo Dahis. 2022. "Cutting special interests by the roots: Evidence from the Brazilian Amazon." *Journal of Public Economics* 215:104753.

Burgess, Robin, Francisco Costa and Benjamin A Olken. 2023. National Borders and the Conservation of Nature. Technical report Working Paper. London School of Economics.

Callaway, Brantly and Pedro HC Sant'Anna. 2021. "Difference-in-differences with multiple time periods." *Journal of econometrics* 225(2):200–230.

Cisneros, Elías, Krisztina Kis-Katos and Nunung Nuryartono. 2021. "Palm oil and the politics of deforestation in Indonesia." *Journal of Environmental Economics and Management* 108:102453.

Colantone, Italo, Livio Di Lonardo, Yotam Margalit and Marco Percoco. 2024. "The political consequences of green policies: evidence from Italy." *American Political Science Review* 118(1):108–126.

Erbaugh, JT, N Pradhan, J Adams, JA Oldekop, A Agrawal, D Brockington, R Pritchard and A Chhatre. 2020. "Global forest restoration and the importance of prioritizing local communities." *Nature Ecology & Evolution* 4(11):1472–1476.

Farzin, Y Hossein and Craig A Bond. 2006. "Democracy and environmental quality." *Journal of Development Economics* 81(1):213–235.

Garmann, Sebastian. 2014. "Do government ideology and fragmentation matter for reducing CO2-emissions? Empirical evidence from OECD countries." *Ecological Economics* 105:1–10.

Gatti, Luciana V, Luana S Basso, John B Miller, Manuel Gloor, Lucas Gatti Domingues, Henrique LG Cassol, Graciela Tejada, Luiz EOC Aragão, Carlos Nobre, Wouter Peters et al. 2021. "Amazonia as a carbon source linked to deforestation and climate change." *Nature* 595(7867):388–393.

Geldmann, Jonas, Andrea Manica, Neil D Burgess, Lauren Coad and Andrew Balmford. 2019. "A global-level assessment of the effectiveness of protected areas at resisting anthropogenic pressures." *Proceedings of the National Academy of Sciences* 116(46):23209–23215.

Goldsmith, Benjamin E, Yusaku Horiuchi and Kelly Matush. 2021. "Does public diplomacy sway foreign public opinion? Identifying the effect of high-level visits." *American Political Science Review* 115(4):1342–1357.

Hajat, Anjum, Charlene Hsia and Marie S O'Neill. 2015. "Socioeconomic disparities and air pollution exposure: a global review." *Current environmental health reports* 2:440–450.

Hansen, Matthew C, Peter V Potapov, Rebecca Moore, Matt Hancher, Svetlana A Turubanova, Alexandra Tyukavina, David Thau, SV Stehman, Scott J Goetz, Thomas R Loveland et al. 2013. "High-resolution global maps of 21st-century forest cover change." *science* 342(6160):850–853.

Herre, Bastian. 2023. "Identifying ideologues: A global dataset on political leaders, 1945–2020." *British Journal of Political Science* 53(2):740–748.

Herrera, Veronica. 2017. *Water and politics: Clientelism and reform in urban Mexico*. University of Michigan Press.

Hochstetler, Kathryn. 2020. *Political economies of energy transition: wind and solar power in Brazil and South Africa*. Cambridge University Press.

Hochstetler, Kathryn and Genia Kostka. 2015. "Wind and solar power in Brazil and China: interests, state–business relations, and policy outcomes." *Global Environmental Politics* 15(3):74–94.

Jankin Mikhaylov, S, Alexander Baturo and Niheer Dasandi. 2017. "United Nations General Debate Corpus." *URL: https://doi. org/10.7910/DVN/0TJX8Y* .

Jones, Benjamin F and Benjamin A Olken. 2005. "Do leaders matter? National leadership and growth since World War II." *The Quarterly Journal of Economics* 120(3):835–864.

Kashwan, Prakash. 2017. *Democracy in the woods: Environmental conservation and social justice in India, Tanzania, and Mexico*. Oxford University Press.

Keohane, Robert O and David G Victor. 2011. "The regime complex for climate change." *Perspectives on politics* 9(1):7–23.

King, Ronald Frederick and Alexandra Borchardt. 1994. "Red and green: air pollution levels and left party power in OECD countries." *Environment and Planning C: Government and Policy* 12(2):225–241.

Kopas, Jacob, Erin York, Xiaomeng Jin, SP Harish, Ryan Kennedy, Shiran Victoria Shen and Johannes Urpelainen. 2020. "Environmental justice in India: incidence of air pollution from coal-fired power plants." *Ecological Economics* 176:106711.

Lelieveld, Jos, John S Evans, Mohammed Fnais, Despina Giannadaki and Andrea Pozzer. 2015. "The contribution of outdoor air pollution sources to premature mortality on a global scale." *Nature* 525(7569):367–371.

Lindberg, Staffan I, Michael Coppedge, John Gerring and Jan Teorell. 2014. "V-Dem: A new way to measure democracy." *Journal of Democracy* 25(3):159–169.

Magaloni, Beatriz, Alberto Díaz-Cayeros and Alexander Ruiz Euler. 2019. "Public good provision and traditional governance in indigenous communities in Oaxaca, Mexico." *Comparative Political Studies* 52(12):1841–1880.

Mahdavi, Paasha, Cesar B Martinez-Alvarez and Michael L Ross. 2022. "Why do governments tax or subsidize fossil fuels?" *The Journal of Politics* 84(4):2123–2139.

Mangonnet, Jorge, Jacob Kopas and Johannes Urpelainen. 2022. "Playing politics with environmental protection: the political economy of designating protected areas." *The Journal of Politics* 84(3):1453–1468.

Martinez-Alvarez, Cesar B, Chad Hazlett, Paasha Mahdavi and Michael L Ross. 2022. "Political leadership has limited impact on fossil fuel taxes and subsidies." *Proceedings of the National Academy of Sciences* 119(47):e2208024119.

Martinez, Luis R. 2022. "How much should we trust the dictator's GDP growth estimates?" *Journal of Political Economy* 130(10):2731–2769.

Meltzer, Allan H and Scott F Richard. 1981. "A rational theory of the size of government." *Journal of political Economy* 89(5):914–927.

Mildenberger, Matto. 2020. *Carbon captured: how business and labor control climate politics*. MiT Press.

Min, Brian. 2015. *Power and the vote: Elections and electricity in the developing world*. Cambridge University Press.

Nascimento, Leonardo, Takeshi Kuramochi, Gabriela Iacobuta, Michel den Elzen, Hanna Fekete, Marie Weishaupt, Heleen Laura van Soest, Mark Roelfsema, Gustavo De Vivero-Serrano, Swithin Lui et al. 2022. "Twenty years of climate policy: G20 coverage and gaps." *Climate policy* 22(2):158–174.

Neumayer, Eric. 2003. "Are left-wing party strength and corporatism good for the environment? Evidence from panel analysis of air pollution in OECD countries." *Ecological economics* 45(2):203–220.

Neumayer, Eric. 2004. "The environment, left-wing political orientation and ecological economics." *Ecological economics* 51(3-4):167–175.

Pailler, Sharon. 2018. "Re-election incentives and deforestation cycles in the Brazilian Amazon." *Journal of Environmental Economics and Management* 88:345–365.

Paine, Jack, Xiaoyan Qiu and Joan Ricart-Huguet. 2021. "Endogenous colonial borders: precolonial states and geography in the partition of Africa." *Available at SSRN 3934110* .

Policardo, Laura. 2016. "Is democracy good for the environment? Quasi-experimental evidence from regime transitions." *Environmental and Resource Economics* 64(2):275–300.

Sanford, Luke. 2023. "Democratization, elections, and public goods: the evidence from deforestation." *American Journal of Political Science* 67(3):748–763.

Schaffer, Lena Maria, Bianca Oehl and Thomas Bernauer. 2022. "Are policymakers responsive to public demand in climate politics?" *Journal of Public Policy* 42(1):136–164.

Shackleton, Charlie M and Alta de Vos. 2022. "How many people globally actually use non-timber forest products?" *Forest Policy and Economics* 135:102659.

Shen, Shiran Victoria. 2022. *The political regulation wave: A case of how local incentives systematically shape air quality in China*. Cambridge University Press.

Southerland, Veronica A, Michael Brauer, Arash Mohegh, Melanie S Hammer, Aaron Van Donkelaar, Randall V Martin, Joshua S Apte and Susan C Anenberg. 2022. "Global urban temporal trends in fine particulate matter (PM2· 5) and attributable health burdens: estimates from global datasets." *The Lancet Planetary Health* 6(2):e139–e146.

Taye, Fitalew Agimass, Maja Vinde Folkersen, Christopher M Fleming, Andrew Buckwell, Brendan Mackey, KC Diwakar, Dung Le, Syezlin Hasan and Chantal Saint Ange. 2021. "The economic values of global forest ecosystem services: A meta-analysis." *Ecological Economics* 189:107145.

Taylor, Dorceta. 2014. Toxic communities: Environmental racism, industrial pollution, and residential mobility. In *Toxic Communities*. New York University Press.

Users'Manual, Dataset. 2002. "POLITY™ IV PROJECT." *Polity* .

Wang, Congcong and Dan Keith. 2020. "The greening of European radical left parties: red and green politics." *Journal of contemporary European studies* 28(4):494–513.

Wang, Quan-Jing, Gen-Fu Feng, Hai-Jie Wang and Chun-Ping Chang. 2022. "The influence of political ideology on greenhouse gas emissions." *Global Environmental Change* 74:102496.

Watch, Global Forest. 2023. "Global Deforestation Rates Statistics by Country." *Update* .

Wu, Mingqin and Xun Cao. 2021. "Greening the career incentive structure for local officials in China: Does less pollution increase the chances of promotion for Chinese local leaders?" *Journal of Environmental Economics and Management* 107:102440.

Wuepper, David, Ilsabe Wiebecke, Lara Meier, Sarah Vogelsanger, Selina Bramato, Andrea Fürholz and Robert Finger. 2024. "Agri-environmental policies from 1960 to 2022." *Nature Food* pp. 1–9.

Wuepper, David, Thomas Crowther, Thomas Lauber, Devin Routh, Solen Le Clec'h, Rachael D Garrett and Jan Börner. 2024. "Public policies and global forest conservation: Empirical evidence from national borders." *Global Environmental Change* 84:102770.

Xu, Alice. 2020. "The Political Origins of Deforestation in the Brazilian Amazon, 2000-2012." *Available at SSRN 3707331* .