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INTRODUCTION

Latin America in the Anthropocene: development under planetary constraints

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Abstract
We describe the main insights from the papers included in this special issue, *Challenges for the Development of Latin America in the Anthropocene: Current Research in Environmental Economics*. The contributions are organized around three themes: the economic and welfare impacts of temperature variability, the role of institutions and user rights in shaping environmental governance and the effectiveness of regulatory instruments for managing ambient and atmospheric pollution. Together, these papers show that environmental outcomes in Latin America are deeply shaped by institutional capacity, governance quality and social inequality. By combining rigorous empirical analysis with attention to local contexts, they demonstrate how environmental economics can inform policy responses to the triple planetary crisis of climate change, biodiversity loss and pollution.

Keywords: climate change; climate impacts; environmental regulation; governance and institutions; pollution

JEL classification: Q53; Q54; Q56; Q58; O13; O44

1. Introduction

The Anthropocene has placed new opportunities and challenges around the pursuit of development. Human activity now shapes the Earth's ecological systems. For Latin America, this transformation is especially consequential. The Anthropocene further accentuates Latin America's longstanding tensions between development, equity and environmental stewardship. The region is home to a vast share of the planet's natural wealth, including more than 40 per cent of the global biodiversity (UNEP-WCMC, 2016). Its natural capital takes many forms, ranging from the Amazon rainforest and Andean glaciers to some of the world's most productive marine ecosystems. Yet it faces

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mounting pressures from deforestation, accelerating habitat conversion, biodiversity loss, water pollution, pervasive air pollution – four of the world's ten most congested cities are Latin American – and rapid urbanization. Moreover, the IPCC identifies Latin America as highly vulnerable to climate change.

The social costs of this environmental degradation are increasingly evident. For example, heat waves erode labour productivity and air pollution worsens health outcomes. Not only do these impacts have short-run welfare consequences but they also reinforce poverty traps.

Managing air quality, protecting biodiversity, regulating resource use and adapting to a changing climate are all facets of the same challenge: sustaining development within planetary limits. Overcoming this challenge demands effective environmental policies, yet opportunities for reform remain limited. Latin America's economic structure, rooted in the extraction of natural resources – along with its fragile institutions, inequality and fiscal constraints – limit the scope and continuity of environmental reforms. The COVID-19 pandemic exposed and deepened social and fiscal fragilities: although the region accounts for only 8 per cent of the world's population, it registered nearly 30 per cent of global fatalities (Bonilla *et al.*, 2023). In its aftermath, legitimate demands for employment recovery risk displacing environmental priorities (ECLAC, 2020; Lopez-Feldman *et al.*, 2020; OECD, 2020).

The region's wide variation in governance, income levels and environmental performance provides natural experiments for understanding how institutions, incentives and behaviour mediate the links between environmental shocks, economic outcomes and policy responses. Taken together, the papers in this special issue highlight both the challenges and the analytical opportunities that arise from this diversity. They show that gaps in adaptation, enforcement and data availability persist, but also that researchers in the region are developing increasingly sophisticated approaches to measure environmental impacts and evaluate policy interventions. The evidence presented here contributes to a clearer understanding of how environmental conditions influence economic performance and welfare in Latin America, and how institutional design and policy innovation can help mitigate those effects.

The papers in this special issue address these themes through complementary perspectives that fall broadly into three areas of inquiry.

2. Economic and welfare impacts of temperature variability in Latin America

Three papers in this issue analyse how temperature fluctuations affect economic activity, labour markets and well-being in Latin America, providing consistent evidence that extreme heat carries measurable social and economic costs. Arellano-González and Juárez-Torres (2026), Higa (2026) and Aromí *et al.* (2026) use high-frequency data and causal identification strategies to link temperature variation to growth, labour supply and subjective welfare. Despite differences in scale and method, all show that hotter conditions reduce productivity and well-being, with limited signs of adaptation over time. The combined evidence points to asymmetric, non-linear effects, stronger at high temperatures. It also underscores the importance of investing in climate-resilient infrastructure, improving data on sub-national climate

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and labour outcomes, and supporting adaptation policies that protect workers and households most exposed to heat stress.

Arellano-González and Juárez-Torres (2026) use a quarterly panel of Mexico's 32 states covering four decades (1980–2021) to estimate the effects of temperature on regional economic activity. They find a non-linear relationship consistent with previous global evidence: growth rates increase with temperature up to around 20°C but decline sharply beyond that threshold. The losses are concentrated in agriculture and manufacturing and are larger in the warmest months of the year. Simulations for mid-century warming scenarios suggest non-negligible reductions in national growth, with heterogeneous effects across states. These findings provide one of the first systematic estimates of the macroeconomic sensitivity of Latin American economies to temperature variation and highlight the limited adaptive response observed over time.

Higa (2026) examines the labour-market dimension of heat exposure using panel data from the Peruvian household survey (ENAHO) matched with local weather records for 2007–2015. The results show that higher temperatures significantly reduce the number of hours worked per week, with stronger effects among informal workers. Each additional day above 27°C reduces the average number of hours worked per week by 0.6, equivalent to a 1.5 per cent decline. The analysis also finds no evidence of intertemporal substitution; workers do not compensate for lost hours in subsequent weeks, indicating a persistent effect on labour supply. By identifying differences between formal and informal employment, the paper underlines how limited access to infrastructure and social protection can amplify the economic consequences of heat stress.

Aromí *et al.* (2026) extend the analysis of temperature effects to subjective well-being, using roughly 80 million geo-tagged tweets from Argentina between 2017 and 2022. Employing sentiment and profanity indices derived through natural-language processing, they document a pronounced decline in positive sentiment and a rise in aggressive expressions as daily temperatures exceed comfortable levels. The effects are driven mainly by an increase in negative expressions rather than a fall in positive ones, suggesting that extreme heat primarily heightens discomfort and irritability. The study demonstrates how social-media data can complement traditional well-being measures and broaden the evidence base on the social costs of temperature variability.

3. Institutions, user rights and governance

Institutions and governance shape how environmental policies work in practice, determining who participates, who complies and how effectively rules are enforced. In Latin America, these factors often explain as much as policy design itself. The papers by Albers *et al.* (2026), Uribe and Chávez (2026) and Tobin *et al.* (2026) show how user rights, monitoring capacity and contractual arrangements influence environmental and development outcomes across sectors as diverse as marine resource management, industrial regulation and small-scale mining. Despite their different contexts, all three studies point to a common conclusion: environmental interventions succeed only when they align with the institutional realities in which they operate.

Albers *et al.* (2026) investigate participation in marine resource projects in southern Chile, focusing on how user-rights regimes and disruption costs shape household

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decisions. Using survey data from coastal communities, they show that willingness to participate depends not only on potential monetary benefits but also on the compatibility of new projects with existing property rights and local work routines. Projects requiring substantial changes in travel distance or fishing patterns face lower participation rates, while those aligned with established rights and livelihoods attract greater interest. Participation also varies between collective and individual user-rights arrangements, with coordination difficulties reducing uptake under collective regimes. The authors conclude that policy efforts should account for this heterogeneity by targeting projects toward areas and households where rights structures and geographic conditions minimize disruption costs and facilitate participation.

Uribe and Chávez (2026) analyse monitoring and enforcement for environmental compliance in Chile using data on 6670 regulated facilities from 2013 to 2019. They find that inspections are limited in number but strategically targeted: the Superintendence of Environment (SMA) prioritizes sectors with higher environmental risks, such as agroindustry and mining, and facilities with prior non-compliance records. The likelihood of inspection also rises with the SMA's budget, showing that resource constraints directly affect enforcement capacity. Fines are higher for severe or repeated violations and are more frequent in the energy and mining sectors. The study documents further that fines imposed on one facility have spillover effects on others owned by the same firm, increasing their probability of compliance. Overall, the results indicate that targeted enforcement and penalty design can enhance compliance, although outcomes vary across sectors and depend on institutional resources and oversight intensity.

Tobin *et al.* (2026) examine small-scale gold mining in Ecuador, where informality and mercury use pose serious environmental and health risks. Using a discrete-choice experiment with women waste-rock collectors (*jancheras*), they assess the potential for selling ore to mercury-free processing plants as a pathway to cleaner and more profitable mining. The results show that while many miners are open to ore-selling, adoption is limited by formalization requirements, minimum-quantity constraints, lack of credit and storage and low trust in ore-testing. Offers that relax these barriers, such as dropping invoicing requirements or providing independent testing, substantially raise willingness to adopt. The study highlights that the success of cleaner technologies hinges less on technical feasibility than on contract design and the institutional conditions under which small miners operate.

4. Regulation to reduce ambient and atmospheric pollution

Understanding the performance of regulatory instruments under Latin America's diverse institutional conditions is essential for improving air quality and managing atmospheric emissions. Three papers in this issue address this question from complementary perspectives, combining theoretical and empirical analysis to assess how the design and implementation of environmental regulation influence its effectiveness. Belfiori (2026) examines carbon taxation, renewable energy and carbon capture within a unified climate–economy model of carbon markets. The analysis demonstrates that a single carbon tax can, in principle, generate an efficient market outcome by simultaneously pricing emissions and rewarding carbon sequestration. When a carbon price exists, all forms of carbon removal, technological and nature-based, acquire a positive

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value equal to the social cost of carbon, making additional instruments such as subsidies or "additionality" tests unnecessary. The paper challenges the widespread practice of valuing only incremental carbon capture and argues that, under a consistent carbon price, every ton of carbon removed should be compensated. While theoretical in scope, the framework is particularly relevant for Latin American countries, where large natural carbon sinks offer an opportunity for more equitable participation in global carbon markets and connect efficient pricing to broader questions of climate justice.

Concha and Rivera (2026) offer an empirical evaluation of air-quality warnings and temporary wood-burning bans in southern Chile, a region where residential heating is a major source of particulate pollution. Using high-frequency data on air quality and weather conditions, they assess the effects of different alert levels on particulate matter concentrations. Their results show that "emergency" warnings, which prohibit wood burning, reduce PM10 and PM2.5 concentrations by roughly 23 and 18 per cent, respectively, with stronger effects at night. Milder alerts, which only recommend voluntary reductions, have negligible impacts. The evidence confirms that effective enforcement can substantially improve air quality but also suggests that the policy's cost-effectiveness could be enhanced by complementing bans with longer-term measures such as incentives for cleaner heating technologies.

Gimenes and Fonseca (2026) study the regulation of agricultural fires in the Brazilian Amazon and examine how institutional capacity shapes the optimal choice of policy instrument. They develop a principal–agent model comparing command-and-control regulation with contract-based approaches under imperfect enforcement and asymmetric information. Using municipal-level data on land tenure, fire detections and deforestation for 772 municipalities, they simulate the performance of each instrument across different institutional settings. The results show that command-and-control regulation is generally more efficient than contracts and that its relative advantage increases when enforcement is weak, because fines generate revenue and help address adverse selection. Market-based contracts perform better only in municipalities with higher institutional capacity and clear property rights. The study concludes that credible environmental regulation depends on aligning policy instruments with the enforcement capacity of local institutions.

5. Looking ahead: lessons from Latin America

Collectively, the papers in this special issue advance our understanding of how environmental and economic systems interact in Latin America. They show that policy effectiveness depends on the social, institutional and behavioural contexts in which policies are implemented. The studies of temperature variability reveal that climate shocks already shape productivity, labour markets and welfare, often amplifying inequality. The analyses of user rights and enforcement demonstrate that even well-intentioned environmental measures require capable institutions and locally adapted governance. The assessments of regulatory instruments emphasize that policy success hinges on aligning tools with enforcement capacity and political feasibility.

Beyond their specific findings, the contributions illustrate the increasing analytical depth and policy relevance of environmental economics in Latin America. They highlight how researchers are combining innovative methods, new data sources and a

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stronger engagement with policy design to generate evidence that bridges environmental science and development policy. This synthesis of methodological rigor and regional insight is essential for addressing the environmental challenges facing the region and for contributing to global debates on sustainable and equitable growth.

Latin America's diversity of ecosystems, institutions and income levels offers lessons that extend well beyond its borders. The experiences analysed here suggest that effective environmental policy requires credible incentives and institutions capable of implementing them. As the region navigates the Anthropocene and confronts the triple planetary crisis of climate change, biodiversity loss and pollution, advancing this evidence-based approach will be critical for designing policies that are not only efficient but also equitable and politically feasible.

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