

**Do Environmental NGOs Matter? Correlations Between ENGO Operational Years
and CO₂ Emissions in U.S. Metropolitan Statistical Areas**

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ABSTRACT

This study investigates the relationship between environmental non-governmental organizations (eNGOs) and carbon dioxide (CO₂) emissions in metropolitan statistical areas (MSAs) across the United States from 2013 to 2022. The primary goal is to assess whether the total operational years of eNGOs within an MSA are correlated with changes in carbon dioxide emissions over time. Drawing on secondary data sources, the analysis integrates carbon dioxide emissions data, eNGO activity data, and a range of control variables, including population change, average January and July temperatures, percent of the population below the poverty level, percent of workers in manufacturing, percent of workers who drive alone to work, and the presence of local climate policies.

Using robust linear regression models, this quantitative study finds evidence of a relationship between greater cumulative eNGO operational years and the degree of change in carbon dioxide emissions. While the findings suggest that eNGOs may contribute to shaping urban decarbonization trends, the analysis also highlights the influence of additional factors, such as socioeconomic characteristics and policy environments, in driving these outcomes. The research does not claim causality but provides insight into the potential institutional role of eNGOs as actors in climate governance at the metropolitan level. The results contribute to the broader literature on civil society and climate action by offering quantitative data-driven evidence on how eNGO presence may be linked to emission patterns in urban areas. This work informs future studies aiming to disentangle the mechanisms by which eNGOs affect

environmental outcomes and provides practical implications for policymakers and advocacy groups working toward urban sustainability and carbon reduction goals.

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CHAPTER ONE

INTRODUCTION

A major worldwide threat, climate change calls for major carbon dioxide (CO₂) emissions reductions to mitigate catastrophic environmental effects (IPCC 2022). Urban areas are critical focal points in addressing these challenges, as they contribute more than 70% of global CO₂ emissions due to concentrated population density, economic activity, transportation demands, and industrial operations (Fragkias et al. 2013; Center for Sustainable Systems 2019). Particularly in the United States, metropolitan statistical areas (MSAs) also known as metropolitan areas, defined as areas with dense urban centers and economically linked suburbs, account for a significant portion of the country's total emissions; thus, metropolitan-scale climate governance is fundamental to effective climate action (Gurney et al. 2022). Scholars have found that addressing climate change in this environments requires not only government policy interventions (Osberghaus et al. 2010; Broto & Westman 2020), but also active participation of civil society participants, especially eNGOs. Policy lobbying, public education, grassroots mobilization, monitoring regulatory compliance, and local sustainability projects are just a few of the several functions eNGOs do (Bomberg 2007; Fisher 2010). Often acting as middlemen between scientific knowledge (Philips & Morton 2013) and pragmatic climate action, these groups strive to guarantee that underprivileged populations have representation in climate governance procedures and help to bridge these gaps.

Despite growing recognition of eNGOs as key actors in climate governance, empirical research on their quantifiable impact on carbon emissions remains limited, particularly at

the metropolitan scale. Existing studies have primarily focused on national-level analyses (Li et al. 2021), organizational case studies (Carpenter 2001), or single-sector investigations like power plant emissions (Grant & Vasi 2016). This research gap is problematic given that metropolitan areas represent critical sites of both emissions' generation and climate governance innovation. The absence of systematic, quantitative evidence on eNGO effectiveness at the metropolitan scale impedes the development of evidence-based approaches to climate governance in these crucial regions. Moreover, while studies have examined whether eNGOs influence climate policy and environmental governance (Pacheco-Vega 2015), there is a notable absence of quantitative research assessing whether these organizations have a measurable impact on actual CO₂ emissions reductions in the US at the MSA level. Additionally, research has typically measured eNGO presence through simple counts of organizations (Fraser & Temocin 2021) rather than considering their operational longevity and accumulated expertise.

These limitations point to a clear need for research that examines the relationship between eNGO operational years and CO₂ emission reductions at the metropolitan level over an extended timeframe, while controlling for relevant socioeconomic, demographic, and geographic factors. Such research would provide more robust evidence on eNGO effectiveness in climate governance and contribute to more targeted approaches to emission reduction in metropolitan regions. This research directly addresses these gaps by systematically investigating if sustained eNGO presence, measured through cumulative operational years, affects CO₂ emission trends across U.S. metropolitan regions from 2013 to 2022. Operational longevity, rather than merely organizational

quantity, is considered a more nuanced indicator because eNGOs typically build stronger community trust, policy expertise, and institutional capabilities over extended periods (OECD 2015; Kinzig et al. 2021).

To examine this relationship, I employed robust linear regression analysis, a method well-suited to environmental and social data prone to non-normal distributions, heteroskedasticity, and outliers (Dervilis & Cross 2015; Bowlby & Gibson 2015). The model controlled for key demographic, socioeconomic, and climatic variables, including population size, poverty rate, climate condition (temperature), transportation behaviors (e.g., solo commuting rates), and industrial activity (manufacturing employment), following prior empirical studies (Shi 2001; Fragkias et al. 2013; Santamouris et al. 2015; Zhang et al. 2022).

The findings reveal that MSAs with longer standing eNGO presence experienced smaller increases or greater reductions in CO₂ emissions over the decade. This suggests that sustained eNGO activity contributes meaningfully to urban decarbonization. By quantifying these associations, this research provides evidence-based insights for scholars, urban planners, and policymakers. It also carries broader significance for communities and civil society at large. Understanding the impact of organizational persistence underscores the importance of not only integrating eNGOs into formal climate strategies, but also encouraging society to form, support, and sustain environmental organizations as enduring partners in climate action. These results affirm that long-term civic engagement is a critical component of effective urban climate governance.

Significance of Metropolitan-Scale Research on Environmental NGO Impact

While the literature documents eNGOs' influence on environmental outcomes, significant research gaps remain, particularly regarding (1) the extent to which eNGOs contribute to reductions in carbon emissions and (2) how this influence is shaped by the presence or absence of formal climate policies in urban areas. These gaps are especially pronounced at the metropolitan level, where emissions are highly concentrated, and governance systems are often fragmented. This thesis addresses these gaps by focusing on U.S. MSAs from 2013 to 2022, employing a combination of cumulative eNGO operational years, robust quantitative methods, and interaction modeling to assess how eNGOs affect, and are shaped by, urban contexts.

The originality of this research lies in four core contributions: (1) the selection of MSAs as the unit of analysis, (2) the use of eNGO operational longevity rather than presence alone, (3) the application of robust linear regression with controls and interaction terms, and (4) explicit attention to the urban-scale drivers that mediate or condition eNGO impact.

First, the selection of MSAs as analytical units represents a methodological advancement in assessing eNGO effectiveness. Prior studies have primarily focused on national-level patterns, organizational case studies, or sector-specific interventions (Fisher 2010; Grant & Vasi 2016). However, as Fragkias and their colleagues (2013) argue, metropolitan regions constitute critical sites of emission generation and potential mitigation due to their concentration of population, economic activity, and infrastructure. By focusing on MSAs, this research captures the geographic specificity of emission patterns and

governance arrangements that characterize contemporary urban systems. This approach enables a more nuanced understanding of how eNGOs operate within complex socio-ecological systems defined by specific spatial configurations, economic structures, and demographic compositions.

Second, the thesis innovates methodologically by examining eNGO operational years rather than simply counting organizations at a single point in time. This approach recognizes that organizational effectiveness is likely to increase with institutional longevity as eNGOs develop deeper knowledge, stronger networks, and greater legitimacy within their operational contexts (OECD 2015). As Kinzig and their colleagues (2021) demonstrate, the influence of eNGOs on environmental outcomes often manifests gradually through cumulative effects on institutional practices and social norms. By focusing on operational longevity, this research captures the developmental trajectory of eNGO influence that remains obscured in cross-sectional analyses. This temporal dimension represents significant advancement over existing approaches to measuring eNGO presence and impact.

Third, the quantitative research design employed in this thesis addresses methodological limitations identified in existing scholarship. As noted in the research literature, "the majority of current literature on eNGOs and environmental governance is categorized as public management, with qualitative analysis or case study being a main research direction" (Li et. Al 2021, p. 2). While these approaches provide valuable insights into eNGO operations, they often lack generalizability across contexts. This study employs robust linear regression models to estimate the statistical association between eNGO

presence and CO₂ emissions across MSAs. To account for the multi-causal nature of emissions, the models include control variables for population size, poverty rates, average climate conditions, transportation behavior, and industrial composition. Recognizing that correlation does not imply causation, this design allows for careful estimation of eNGO contributions within broader structural conditions. It also incorporates interaction terms to examine how eNGO effects vary depending on whether eNGO influence is conditioned by presence or absence of formal GHG emissions policy.

Fourth, the research addresses an important gap in understanding regarding the effectiveness of local-level climate governance. As Fudge and Peters (2009) explain, although policies increasingly expect local governments to take the lead in reducing carbon emissions, putting these plans into action has been difficult, especially when it comes to involving the public and making sustainability work at the local level. By examining if eNGOs influence municipal climate actions, this thesis illuminates a critical but understudied dimension of local climate governance. It responds directly to questions regarding the conditions under which local climate initiatives succeed or fail, potentially giving more effective approaches to metropolitan-scale emissions reduction.

Finally, the research design incorporates control variables that account for the multiple drivers of metropolitan emissions, including population dynamics, climate conditions, transportation patterns, poverty rates, and industrial composition. This comprehensive approach acknowledges the complex, multi-causal nature of emission trajectories and enables more precise isolation of eNGO effects. By controlling for these variables, this

thesis provides more robust evidence regarding the specific contribution of eNGOs to emissions reductions.

Organization of the Thesis

This thesis is organized into five main chapters, each building on the exploring the relationship between urban CO₂ emissions and the role of eNGO in shaping climate mitigation outcomes. Following the introduction, chapter 2 provides a comprehensive overview of the theoretical and empirical scholarship relevant to this study. It traces the emergence and evolution of eNGOs in the context of climate governance which examines their roles in emissions reduction, policy influence, and community mobilization. The chapter also reviews key debates in environmental sociology regarding urban emissions, equity, and the concept of eNGO operational longevity. Chapter 3 describes the research design and methodological approach. It defines dependent and independent variables, outlines data sources such as carbon dioxide emissions inventories and NGO databases and explains the use of robust regression models. This chapter also details the temporal scope (2013–2022), data cleaning procedures, and statistical controls applied in the analysis. Chapter 4 presents the empirical findings of the study. It reports on statistical outputs from the regression models and interprets relationships between urban socio-economic characteristics, eNGO presence, and CO₂ emissions levels. The chapter highlights variation across MSAs, discusses observed trends and anomalies, and identifies key explanatory patterns. Finally, chapter 5 interprets the findings through the lens of urban environmental sociology and evaluates their implications for climate governance theory and practice. It considers how eNGO longevity and density may shape

urban emissions trajectories and reflects on possible causal mechanisms. The chapter concludes by addressing study limitations, suggesting areas for future research, and offering policy-relevant insights for stakeholders working to advance equitable and sustainable urban climate strategies.

CHAPTER TWO

BACKGROUND AND LITERATURE REVIEW

The Emergence of ENGOs in Climate Governance

Globally, nationally, and locally, eNGOs have become important players in the terrain of climate governance (Kern & Alber 2008; Andonova et al. 2009; Bulkeley et al. 2012; Duffy 2013; Gordon 2016; Rodder 2020; Bolkvadze et al. 2024). Serving many purposes in tackling environmental issues, these civil society organizations act at the nexus of science, policy, and public participation. Policy lobbying, regulatory monitoring, public education, direct environmental action, and cooperative governance agreements between public and commercial sector institutions are activities engaged by eNGOs (Bomberg 2007). Their multifaceted approach to environmental preservation shows an awareness of the need for interventions in many spheres of social and economic life given the change of climate (Bomberg 2007; Bäckstrand 2008).

From early conservation groups like the Sierra Club, founded in 1892 (Clay 2024), eNGOs have long played a role in shaping broader environmental policy, initially focused on conservation and pollution control (Li et al. 2021), and later expanding to include climate change as it emerged as a major political issue (Reitig 2011; Partelow et al. 2020). These groups' growth sped up in the 1970s, a time marked by rising environmental awareness spurred on by major ecological disasters and the first Earth Day (Rome 2013). The 1992 Earth Summit in Rio, which inspired the founding of several eNGOs and established frameworks like the United Nations Framework Convention on Climate Change, was another turning point for global environmental governance (Betsill

& Corell 2017). These past events have served to shape the contemporary milieu of environmental campaigning and government in which eNGOs now operate. Since the 1990s, environmental policy has shifted from command-and-control regulation to more participatory and network-based approaches that incorporate diverse stakeholders (Fisher 2010). Within this framework, eNGOs have taken on more varied responsibilities in climate governance, serving as knowledge brokers, policy entrepreneurs, public educators, and accountability systems.

ENGOS exhibit considerable diversity in their organizational structures, tactical approaches, and geographic scales of operation (Princen & Finger 1994). Various national advocacy groups, regionally entrenched community organizations, and large multinational organizations like Greenpeace and the World Wildlife Fund (WWF) work together to combat climate change (Caniglia et al. 2015). As a result of this organizational variability, there are multiple avenues of impact on initiatives to reduce emissions. Evidence suggests that eNGOs have an impact on emissions via both direct and indirect means (Hadden 2015; Berny & Rootes 2018). For example, eNGOs may take legal action against polluters. Indirectly, they may use public pressure campaigns, technical assistance programs, and collaborative governance initiatives to influence emissions (Gough & Shackley 2001).

The ability of eNGOs to negotiate challenging sociotechnical systems and policy environments helps to determine their overall efficacy in lowering emissions. Longer operational histories are often associated with deeper institutional knowledge, stronger network connections, and increased policy expertise (OECD 2015), all of which may

enhance an organization's environmental impact. This temporal dimension of eNGO performance highlights the importance of tracking organizational presence over time, rather than merely counting the number of active organizations at a single point.

The mediating function of eNGOs also emphasizes the need to analyze their performance inside certain geographic and institutional settings (Kousky & Schneider 2003; Bulkeley & Betsill 2003; Betsill & Corell 2008; Grant & Vasi 2016; Ayana et al. 2018). Many contextual elements, including political opportunity structures, resource availability, public environmental consciousness, and economic conditions, mediate the link between eNGOs and emissions reduction (Kousky & Schneider 2003). These factors can either enable or constrain how eNGOs mobilize resources and engage with stakeholders. In some contexts, strong community ties and local legitimacy further enhance their ability to influence policy and behavior. Grant and Vasi (2016) offer empirical data showing how local environmental groups, by improving the efficacy of subnational climate legislation, both directly and indirectly reduce the carbon dioxide emissions of power plants. This result implies that eNGOs function not just as autonomous players but also as accelerators enhancing the effect of official legal systems.

The Role of ENGOS in Carbon Dioxide Emissions Reduction

ENGOS as Policy Actors

Globally, eNGOs are essential to the development and execution of climate policies (Betsill & Corell 2007). Groups like Climate Action Network (CAN) make use of their worldwide connections to push for strong pledges to reduce emissions at international forums like the United Nations Climate Change Conferences (Tosun & Schoenefeld

2016). Notable agreements, such as the Paris Agreement, have been made more accountable because of CAN's efforts (Reser, n.d.). But how much sway they have is highly conditional on the political climate in which they function. According to Schwartz (2004), eNGOs in nations like China are compelled to embrace cooperative rather than combative tactics due to stringent government laws that prohibit them from publicly questioning state policy. The scenario highlights the persistent conflict in environmental sociology about how to balance the autonomy of civil society with state supervision (McLaughlin 2017).

On the flip side, eNGOs in Tunisia play an important role in promoting climate education, participating in international climate dialogues, and creating national climate strategies (Youssef 2021). This case study exemplifies how eNGOs are increasingly functioning as "knowledge brokers" entities (Philips & Morton 2013), that can advocate for underrepresented groups and simplify complicated scientific facts into policy that everyone can understand. The success of such efforts frequently depends on strong partnerships with governmental bodies; for example, Tunisian eNGOs with international backing and governmental collaboration were notably effective in influencing climate policy outcomes (Youssef 2021). Similarly, Ethiopian eNGOs successfully influenced national forestry policies by demonstrating sustainable practices, offering robust evidence, forming strategic alliances, and optimizing their limited resources, despite lacking formal political access (Ayana et al. 2018). In Vietnam, eNGOs trained local shrimp farmers in sustainable aquaculture practices, effectively integrating these practices

into national climate policy frameworks and advocating for community land rights (Triyanti et al. 2024).

ENGOs have also greatly influenced regional and national level climate policy in the United States. For example, the Natural Resources Defense Council (NRDC) was instrumental in founding the Regional Greenhouse Gas Initiative (RGGI) in the Northeast by means of research, legal knowledge, and stakeholder involvement, producing significant emissions reduction from power plants (Osofsky & Levit 2012; Ramseur 2019). Likewise, Assembly Bill 32 in California was shaped by grassroots mobilization, sustained advocacy by environmental NGOs, and a strong focus on environmental justice (London et al. 2013). Campaigns such as the Sierra Club's *Beyond Coal* significantly contributed to the retirement of many coal-fired power plants by leveraging litigation, grassroots organization, and strategic alliances (Drake & York 2021; Rea et al. 2024; Dai & Spires 2018). While broader market shifts, especially the natural gas boom, were also key factors (Mendelevitch et al. 2019), eNGOs' efforts played a critical role in accelerating plant closures and shaping public and regulatory discourse, thereby contributing to the national decline in power sector emissions (Brauers et al. 2020). These cases highlight how important eNGOs are to fair and sustainable environmental governance since they promote social fairness as well as science-based policy, therefore promoting their dual purpose. However, how these impacts translate to smaller metropolitan scales remains insufficiently addressed and warrant further investigation.

Community-Based Initiatives and Public Engagement

While eNGOs are active in shaping national and international climate policy, their impact is also evident in community-based initiatives that empower local actors and foster public engagement at the grassroots level. At the local level, eNGOs empower communities by encouraging low-carbon practices through inclusive projects and education. A U.S.-based NGO, GRID Alternatives, has installed over 2,300 solar systems for low-income households since 2011, leading to the prevention of over 6,000 tons of greenhouse gas emissions, equivalent to taking 1,200 cars off the road (GRID Alternatives 2023).

Tanzania's Yaeda Valley Conservation Initiative effectively combines carbon offset schemes with forest preservation to yearly avert roughly 22,000 metric tons of CO₂ emissions and so supporting Indigenous Hadza livelihoods (UNDP 2021). In Bangladesh, BRAC's climate programs distribute solar home systems and promote environmental education through village-level forums, enhancing resilience in flood-prone rural communities (Khan & Azad 2014; Rashid et al. 2017). Similarly, India's SELCO Foundation works to improve energy equity by deploying decentralized solar systems in off-grid areas, particularly among street vendors and rural schools (Subramaniam 2015; Jha et al. 2019).

Such initiatives exemplify environmental justice principles by prioritizing marginalized populations in climate governance (Bullard & Johnson 2000). Many eNGOs also function as innovators in public engagement, using participatory tools like citizen science projects, mobile-based carbon calculators, and digital storytelling to raise climate awareness and promote behavioral shifts. Organizations like Climate Cardinals, a youth-led

organization, translate climate resources into 40 languages, enhancing accessibility and inclusiveness (Reser, n.d.). According to the Alliance for Climate Education (ACE) Strategic Plan for the years 2017–2020, the organization's educational activities successfully increase high school students' climate awareness and motivate them to act. Some community-based eNGO efforts have achieved policy spillovers or scale-up effects. For instance, Denver's Climate Protection Fund was shaped through a collaborative process initiated by Resilient Denver, a grassroots community organization, whose early campaign for an energy tax led to the establishment of a Climate Action Task Force that informed the development of the city's municipal climate funding structures (City of Denver 2023). Similarly, programs like the World Wildlife Federation's Earth Hour demonstrate the symbolic and performative aspects of public engagement (Büchs et al. 2016). While their long-term effects remain uncertain, such actions help normalize low-carbon behavior in the public sphere.

These campaigns frequently employ emotionally resonant messaging and identity-based appeals to connect environmental concerns with local realities which aligns with social movement theory's concept of frame alignment (Snow et al. 1986). They also demonstrate resource mobilization strategies by leveraging volunteer networks and low-cost technologies to maximize their reach (McAdam et al. 1996; Luck et al. 2016; Brulle 2010). Over time, public engagement strategies have evolved from in-person town halls and printed educational materials to interactive social media campaigns and virtual advocacy events. For example, 350.org's digital organizing tools have mobilized

thousands globally on climate policy issues, showing how online activism can complement on-the-ground mobilization (Fisher & Nasrin 2021).

Market Transformation and Corporate Engagement

To accelerate decarbonization projects, eNGOs are partnering more with corporations. For instance, the Environmental Defense Fund (EDF) and the World Wildlife Fund (WWF) have collaborated with Walmart on Project Gigaton, a corporate initiative aiming to avoid one billion metric tons of greenhouse gas emissions from the company's global supply chain by 2030 (Walmart 2025). EDF provided technical guidance on emissions accounting, energy efficiency, and sustainable sourcing strategies to support this effort (EDF 2024; Walmart 2025). Another example is the Nature Conservancy's partnership with Microsoft, supporting the company's goal of becoming carbon negative by 2030 through carbon offset projects and land-based carbon removal initiatives (The Nature Conservancy 2020). In the transportation sector, EDF partnered with FedEx to advise on electrifying its fleet and developing low-carbon logistics strategies, directly targeting reductions in CO₂ emissions from delivery operations (Freiberg 2003). Such partnerships closely fit ecological modernization theory, which holds that institutional reform and technical innovation can coexist to enable both environmental conservation and economic progress (Mol et al. 2009).

ENGOS have also influenced corporate governance structures. Ceres, for instance, actively educates corporate leaders on integrating climate risks into strategic planning, highlighting the necessity for systemic transformations within capitalist frameworks to achieve sustainable goals (Toffel 2023). It also worked with General Motors (GM) to

advocate for clean energy procurement, helping push the company to commit to carbon neutrality across all global operations and products by 2040 (General Motors 2024).

Carbon Offsetting and Accountability Challenges

ENGOs actively shape carbon markets by advocating rigorous standards and transparency. Organizations like The Nature Conservancy have urged the Science Based Targets initiative (SBTi) to implement stronger carbon credit criteria that emphasize equity and accountability (The Nature Conservancy 2024). These efforts respond to the critique that poorly regulated offsets can exacerbate inequalities. For example, the Southern Cardamom REDD+ Project in Cambodia, which displaced Indigenous communities without effectively curbing deforestation (Cole 2024). While some NGOs have participated in or supported REDD+ initiatives, others have been critical of their social and environmental shortcomings (Saeed et al. 2017; Ramcilovic-Suominen et al. 2021; Andrews & Mulder 2024). Within the U.S., eNGOs such as WWF helped establish rigorous offset certification systems like the Gold Standard to ensure that carbon offsets meet high standards of sustainability and additionality (Bumpus et al. 2010; Bumpus et al. 2010; Blum & Lövbrand 2019). Their advocacy also contributed to significant reforms in California's cap-and-trade program, including offset usage limits and the creation of an Independent Offsets Task Force (Basseches et al. 2022). It highlights the influence of both mainstream and justice-oriented eNGOs in improving transparency and accountability.

ENGOs additionally serve as watchdogs, addressing governance shortcomings in emissions reporting and offset verification. The Environmental Investigation Agency

(EIA) uncovered unreported industrial emissions, prompting regulatory action (EIA 2022). CarbonPlan identified substantial over-crediting in California's forest offsets which revealed verification flaws and risks inherent in weak carbon accounting systems (Badgley et al. 2022). These advocacy efforts contributed significantly to California's 2023 transparency law, mandating detailed corporate disclosure of carbon credit purchases to mitigate risks from "junk credits" (Jiang et al. 2025). ENGOs are thus central to climate governance across multiple levels, leveraging policy advocacy, corporate engagement, and grassroots mobilization to reduce carbon emissions.

Critical Perspectives on ENGOs Contributions to Carbon Dioxide Emissions

Reduction

The role of eNGOs in mitigating climate change is often celebrated for its emphasis on advocacy, innovation, and public engagement (Betsill & Corell 2007; Rietig 2011; AUN 2023). However, a growing body of scholarly work complicates this narrative, raising critical questions about the efficacy of eNGO strategies in reducing CO₂ emissions, particularly in urban contexts (Holgate 2007; Kern & Bulkeley 2009; Bulkeley & Betsill 2013). These critiques focus on systemic limitations of market-based mechanisms (Bultheel et al 2016), structural barriers in cities (Seattle Office of Sustainability and Environment 2016), institutional shortcomings (Nordhaus 2010; Rosen 2015), and unresolved equity challenges (Haug et al. 2018; Shang 2023; Cole 2024), offering a nuanced perspective on the relationship between civil society action and emissions reduction.

Urban areas, responsible for over 70% of global CO₂ emissions, present unique challenges for eNGOs (Center for Sustainable System 2024). Hao and their colleagues (2022) and Shen and their colleagues (2023) demonstrate how digital technologies in non-pilot cities (often overlooked by eNGO programs) increase emissions due to industrial path dependency and energy-intensive practices. This underscores a critical gap in eNGO strategies: their focus on pilot cities or symbolic projects (e.g., renewable energy installations) may neglect entrenched urban systems resistant to decarbonization. Several U.S. case studies illustrate these structural challenges. For example, Seattle's Climate Action Plan, heavily backed by eNGOs, achieved around a 5% emissions reduction from 2008 to 2016, falling significantly short of its targets due to rapid population growth, voluntary policies, and inadequate structural reforms (Millard-Ball 2013; Seattle Office of Sustainability & Environment 2016). Similarly, the Weatherization Assistance Program aimed at household efficiency upgrades underperformed which achieved only 40% of anticipated energy savings, primarily due to optimistic engineering assumptions, limited community participation, and unforeseen behavioral responses (Fowlie et al. 2015). The Cape Wind offshore wind project in Massachusetts, endorsed by many eNGOs, was ultimately abandoned due to intense local opposition, regulatory complexity, and insufficient early stakeholder engagement, preventing substantial projected emissions reductions (Kimmell & Stalenhoef 2011). Beyond these structural and implementation challenges, scholars also point to limitations in how eNGOs approach policy and strategy on a broader scale. Critics argue that eNGOs often prioritize short-term, visible wins over systemic change. Rosen (2015) attributes the

failure of the Kyoto Protocol to its focus on incremental targets rather than transformative policies, an approach many eNGOs followed. Bultheel and their colleagues (2016) add that carbon markets, promoted as a compromise between economic growth and emissions reduction, perpetuated high-carbon industrial practices which allow wealthy nations to outsource emissions cuts. In line with these concerns, others highlight that the very arena where eNGOs are most active (international climate agreements) tends to lack enforcement mechanisms and it makes them more symbolic than effective which ultimately reinforce global inequalities between major emitters and the nation's most vulnerable to climate impacts (Barrett 2008; Nordhaus 2010; Keohane & Victor 2011; Stankovic et al. 2024).

A related concern lies in the uneven social impacts of climate approaches. ENGO strategies often overlook distributive justice in urban emissions reduction. Cole (2024) critiques offset projects for displacing Indigenous communities while failing to curb deforestation, a pattern observed in Cambodia's Southern Cardamom REDD+ Project. As Haug and their colleagues (2018) emphasize, carbon pricing policies, frequently supported or promoted by eNGOs, can have regressive impacts, particularly on low-income and marginalized populations, unless accompanied by deliberate revenue recycling and compensation strategies. The failure to equitably distribute environmental and health co-benefits, especially in historically disadvantaged urban communities, risks perpetuating environmental injustice (Haug et al. 2018). Moreover, Shang (2023) identifies that carbon pricing, when unaccompanied by socially conscious design, can exacerbate inequalities through channels such as job losses in carbon-intensive sectors

and increased living costs. Without targeted policy interventions, such as community-based revenue reinvestment or green job training, eNGO-backed strategies may fall short of fostering inclusive climate transitions (Shang 2023). These insights stress the importance of embedding distributive justice into environmental governance frameworks, especially in urban contexts.

These critiques do not dismiss eNGO contributions outright but rather call for a reorientation of strategies. Scholars argue that eNGOs could enhance their impact by shifting focus from market mechanisms to policies that directly regulate fossil fuel production, such as coal phase-outs and fossil fuel subsidy reforms (Benessaiah 2012). In cities, partnerships with labor unions and tenant associations could ground decarbonization efforts in community needs, ensuring that emissions reductions align with housing justice and workforce development (Hawkins 2016).

Operational Longevity as Institutional Capital in eNGOs

Operational longevity is not merely about organizational survival; it is the foundation through which eNGOs evolve into powerful institutional actors within environmental governance systems. Sustained activity across decades allows eNGOs to gain credibility, build expertise, and secure a lasting seat at decision-making tables traditionally dominated by governments and corporations. As Briguglio and their colleagues (2020) argue, institutionalized eNGOs, through years of consistent policy participation, become deeply embedded in governance frameworks, influencing environmental outcomes from within. Similarly, van Eeden and their colleagues (2025) highlight that persistence across

political cycles enables eNGOs to be seen as stable, trusted partners, enhancing their legitimacy and authority in policy arenas.

At the grassroots level, Hlahla and their colleagues (2015) and Touw (2021) demonstrate how eNGOs, by embedding themselves in local communities and building long-term stewardship programs, create sustained citizen networks that reinforce their societal authority. This transition from the periphery to the center of environmental decision-making fundamentally redefines eNGOs not just as advocacy groups but as enduring institutions shaping governance itself.

Recent scholarship further strengthens this framing. Organizational studies confirm that operational longevity plays a crucial role in nonprofit capacity, effectiveness, and influence. Herman and Renz (2008) emphasize that effectiveness is socially constructed and that organizations demonstrating sustained stakeholder responsiveness and governance quality are better positioned to secure legitimacy over time. Similarly, Forbes (1998) synthesizes two decades of research to argue that organizational survival and longevity are highly associated with a nonprofit's ability to manage complex stakeholder environments and resource dependencies.

Specific to eNGOs, empirical studies reveal the tangible outcomes of sustained presence. Tran (2020) finds that organizational centralization and age impact both internal and external perceptions of effectiveness and suggests that longer established eNGOs possess stronger reputational capital on the international stage. Savage and their colleagues (2009) similarly document how local environmental groups have proliferated since the

1980s, with many establishing long-term civic infrastructures essential for rural environmental governance.

From a resource mobilization perspective, Kim (2012) shows that older, professionalized organizations within the environmental movement experience lower mortality rates and greater resilience against external competition and resource scarcity, further illustrating how accumulated experience enhances influence. Supporting this, community-based conservation research by Fariss and their colleagues (2023) finds that project longevity significantly improves success rates, with older conservation projects more likely to achieve combined environmental and human well-being outcomes. Similarly, Mihaylov and Perkins (2015) argue that grassroots organizations anchored in place attachment and local identity demonstrate greater resilience and survival, embedding themselves more deeply into societal structures.

In the context of organizational efficiency, Peng (2024) provides quantitative evidence from China showing that NGO age correlates positively with program efficiency, particularly among social NGOs which suggests that operational maturity enhances professionalism and public trust. However, Ayayi and Wijesiri (2018) caution that while longevity offers advantages, it can also lead to organizational complacency and reduced efficiency if not accompanied by ongoing adaptive reform. Therefore, it is important to acknowledge that operational longevity is not without potential drawbacks.

CHAPTER THREE

DATA AND METHODS

This study examines how eNGOs impact carbon dioxide emissions at the MSA level, analyzing trends from 2013 to 2022. MSAs serve as the unit of analysis in this research, as they capture the economic and social interdependence of urban centers and their surrounding areas (Glaeser & Kahn 2008). MSAs are, by definition, a conglomeration of counties or county equivalents; although MSAs sometimes cross state borders, they never split county borders (U.S. Census Bureau 2023), making it relatively easy to aggregate county-level data to the MSA level.

Prior research indicates that carbon emissions from highway transport and residential sources in major metropolitan areas increased by 7.5% between 2000 and 2005, slightly lower than the national increase of 9.1% (Brown et al. 2008). While the evidence suggests that metropolitan areas may be making progress in reducing their carbon footprints, challenges remain, mainly due to suburban sprawl, which increases traffic, energy consumption, and pollution (Center for Sustainable Systems 2019). Examining MSAs allows an in-depth exploration of if eNGOs shape local environmental outcomes and what social factors contribute to CO₂ emissions.

Dependent Variable: Change in CO₂ Emissions (Δ CO₂)

The change in CO₂ emissions (Δ CO₂) is the dependent variable in this study. It is measured in metric tons as the absolute difference in emissions between 2013 and 2022 in each MSA in the United States. CO₂ emission data are obtained from the Vulcan Project, an initiative by Northern Arizona University that provides high-resolution, small-

scale estimates of fossil fuel carbon dioxide emissions at the county level. The Vulcan Project is supported by the National Aeronautics and Space Administration, the United States Department of Energy, the National Oceanographic and Atmospheric Administration, and the National Institute of Standards and Technology (Gurney et al. 2011). This study aggregates data from all counties within each MSA to analyze emissions at the metropolitan level, offering a more comprehensive understanding of urban emission trends than averaging across metropolitan areas (Gurney et al. 2019). CO₂ emissions are a major concern in efforts to mitigate climate change (OECD 2015). They serve as a key variable for assessing the effectiveness of environmental policies and initiatives and are widely used in both academic and policy contexts as a benchmark for climate progress. Although eNGOs work across a range of environmental issues — from conservation and education to environmental justice — many of their programs aim, either directly or indirectly, to reduce greenhouse gas emissions. These include advocacy for clean energy, sustainable transportation, urban planning reforms, and climate policy adoption. Therefore, changes in CO₂ emissions offer a meaningful and quantifiable outcome that aligns with core dimensions of eNGO activity and allows for comparability across regions. Measuring emissions at two points (2013 and 2022) allows for evaluating long-term changes rather than short-term fluctuations. For the purposes of this study, that change is measured as 2013 CO₂ emissions subtracted from 2022 emissions. Measuring total volume of change rather than rate of change was chosen because it is the amount of CO₂ taken from the atmosphere that most matters to planetary systems; moreover, a rate of change would disproportionately emphasize minor shifts in low-emission areas.

Analyzing emissions over a ten-year period provides insights into structural changes in emission patterns and helps evaluate the effectiveness of long-term mitigation strategies (Lamb et al. 2021). MSAs are an important unit of analysis because they capture economic and social connections where most human activities that contribute to CO₂ emissions occur (Fragkias et al. 2013). By aggregating emissions from all counties within each MSA, this study ensures a more accurate and representative measure of emission trends while accounting for county size and emission intensity differences.

Independent Variable: ENGO Operational Years

The operational years of eNGOs within each MSA serve as the key independent variable in this study. Operational years are defined as the total number of years each eNGO was active in each MSA over the ten-year study period (2013–2022). For example, in the Carson City, Nevada metropolitan area, there are two eNGOs: Clean Up the Lake and Sierra Nevada Journeys. Clean Up the Lake began operations in 2018 and thus operated for four years within the study period. Sierra Nevada Journeys, also founded in 2013, operated throughout the full ten years. As such, the total eNGO operational years for Carson City is 14. Rather than focusing solely on the number of eNGOs present (Fraser & Temocin 2021), this study uses cumulative operational years to better capture the sustained presence and potential influence of eNGOs, based on the premise that longer operational histories are associated with deeper institutional embeddedness and greater effectiveness in environmental governance and climate mitigation efforts.

This study used data on nonprofit organizations collected by the Internal Revenue Service (IRS). The primary data source was the Exempt Organizations Business Master File (EO

BMF), which was downloaded for each U.S. state from the IRS website. This file includes information on all registered nonprofit organizations in the country. To identify relevant eNGOs, the data was filtered using the National Taxonomy of Exempt Entities Codes (NTEE-CC). The analysis focused on nonprofits with the following "C" codes: C20 (Environmental Quality), C27 (Recycling), C30 (Natural Resources Conservation), C32 (Water Resources and Wetlands Conservation), C34 (Land Resources Conservation), C35 (Energy Resources Conservation), C36 (Forest Conservation), C50 (Environmental Beautification), and C60 (Environmental Education). These categories represent a broad spectrum of environmental nonprofit activities contributing to climate action on the metropolitan scale.

Following data collection, multiple preprocessing steps were taken to ensure consistency and accuracy. ZIP codes were standardized to five-digit formats to match geographic identifiers. Both the ruling year and tax period fields, which initially included month and day information, were truncated to four-digit years. The operational duration of each eNGO was then calculated by subtracting the ruling year from the most recent tax period year. To focus on eNGOs active during the study period, organizations whose most recent tax filings occurred before 2013 were excluded.

Each eNGO's ZIP code was geospatially matched with the ZIP Code Tabulation Area (ZCTA) shapefile from the U.S. Census Bureau to establish standardized spatial identifiers. These ZCTA-linked data were then joined to county boundaries using shapefiles from the National Weather Service (NWS). Subsequently, U.S. Census Bureau shapefiles for MSAs were used to assign counties to their respective MSAs by spatially

clipping county boundaries within MSA polygons. This spatial integration enabled the identification of eNGOs within each MSA. From this, two metropolitan-level indicators were generated: (1) the total number of environmental nonprofits active between 2013 and 2022, and (2) the cumulative years of eNGO operation within the MSA during the study period. These aggregated metrics formed the foundation for analyzing the geographic distribution and organizational longevity of environmental nonprofits across metropolitan regions in the United States (Straughan & Pollak 2008).

Control Variables

Percent Population Change

Population size is an essential control variable in this study, as larger populations in MSAs tend to produce higher levels of CO₂ emissions due to greater energy use, transportation demands, and industrial activities. Existing research shows that emissions scale with population; larger urban areas do not necessarily gain efficiency simply by being bigger (Fragkias et al. 2013). For example, a 1% increase in population has been found to correspond with a 0.76–1.28% rise in emissions, even after accounting for factors like economic output and technological development (Shi 2001; Zhou & Liu 2016). This evidence reinforces the need to control for population change when assessing the impact of eNGOs on emission trends. Including population change also helps address potential confounding effects and ensures that any observed changes in emissions are not simply a reflection of demographic differences between MSAs. Other studies have also shown that the population interacts with industrial structures in complex, nonlinear ways, further supporting its importance as a control variable (Chen et al. 2022). For this study, I

have used population data from the U.S. Census Bureau and calculated the percentage change in population between 2013 and 2022.

By incorporating population change into the analysis, this study considers baseline differences in urban scale, which aligns with sociological and environmental research. This approach emphasizes explicitly that population level, not just growth, shapes structural emissions patterns (Ribeiro et al. 2019; Liu et al. 2021).

Winter and Summer Temperatures

Given the significant influence of climatic factors on CO₂ emission patterns, this study includes two key climate control variables: winter temperature and summer temperature. These variables represent seasonal extremes in heating and cooling demand, which offer an evidence-based framework for analyzing how eNGO activities interact with climate-related energy use across MSAs in the United States. To capture seasonal extremes in heating and cooling demand, I used gridded monthly temperature data from the PRISM Climate Group, with a spatial resolution of approximately 11 km × 11 km per pixel. Specifically, I extracted data for January 2018 (winter) and July 2018 (summer). These raster files were clipped using the MSA shapefile, and zonal statistics were performed to calculate the average temperature for each MSA in both months. As this study is based in the United States, temperature is measured in degrees Fahrenheit (°F), which aligns with standard U.S. meteorological reporting and facilitates interpretation in relation to domestic heating and cooling demand.

Winter temperature, measured as the average January 2018 temperature, reflects the impact of cold season heating needs on emissions. Neumayer (2004) found that a

decrease in winter minimum temperature significantly raises national CO₂ emissions, with a one-standard-deviation drop leading to an increase of up to 41% in emissions. Similarly, Zhang et al. (2015) identified that warmer January temperatures in Northwest China substantially reduce household CO₂ output due to lower heating demand. Based on the July 2018 average, summer temperature captures the energy demand associated with cooling systems, particularly air conditioning. While typically lower in intensity than winter heating demands, elevated summer temperatures still contribute meaningfully to urban energy use and related emissions. Glaeser and Kahn (2008) highlight that cities such as Phoenix and Houston experience notable increases in emissions during the summer due to extensive air conditioning use. These dynamics are consistent with findings from Zhang et al. (2021), who observed that although cooling effects are generally weaker, they are becoming increasingly important in modern emission profiles.

While precipitation can influence specific environmental outcomes, it is not included as a control variable in this study for several methodological and theoretical reasons. First, the direct relationship between precipitation and CO₂ emissions is generally weak and inconsistent in the literature (Dziegielewska & Mendelsohn 2012). Unlike temperature, which has a well-established and quantifiable impact on heating and cooling energy use, precipitation primarily affects emissions in indirect ways, such as through transportation disruptions or air pollutant dispersion (Chang et al. 2023), and these effects are not easily captured in emission data (Glaeser & Kahn 2008; Price & Feldmeyer 2012). Moreover, several major empirical studies in environmental economics and urban energy research

exclude precipitation due to its limited explanatory power for CO₂ emissions at the metropolitan level (Neumayer 2004; Ribeiro et al., 2019; Luqman et al. 2023). While some recent climate-economic studies include precipitation for broader analyses of productivity or agriculture, these are often at national or rural scales, not urban-focused emissions contexts (Rigas & Kounetas 2023). Including variables with ambiguous or marginal effects can introduce noise and multicollinearity into regression models, potentially weakening the reliability of core findings. Given these considerations and theoretical alignment with prior CO₂ emissions modeling frameworks, this study focuses solely on temperature as the climatic variable of primary relevance.

GHG Emission Targets

This study includes state-level greenhouse gas (GHG) emissions reduction targets as a control variable given their influence on local CO₂ emissions within MSAs. Each state is dummy coded (1 for presence, 0 for absence) based on whether a state had carbon reduction policies in place at any time during the study period (2013–2022). This approach captures the policy environment within which eNGOs operate and provides context for variations in emissions reduction efforts across MSAs, albeit weakly. 28 states established explicit GHG reduction targets between 2013 and 2022 through legislative actions or executive orders (Dai et al. 2022). These targets typically set economy-wide emission reduction goals to be achieved by specific years (e.g., 2030, 2050) (Bromley-Trujillo & Holman 2020), thereby creating a policy framework conducive to emissions reduction initiatives. California and New York, for instance,

enacted comprehensive legislative frameworks aiming for substantial emissions reductions by mid-century (Bang et al. 2017).

Empirical research underscores the effectiveness of state-level GHG targets in driving emissions reductions and fostering supportive policy environments for local sustainability efforts (Lutsey & Sperling 2008; Yi & Feiock 2014). The variable used in this study is derived from the authoritative policy databases provided by the Center for Climate and Energy Solutions (C2ES).

Percent of Workers Driving Alone to Work

Automobile use is a major contributor to CO₂ emissions, accounting for approximately one-fifth of global emissions (Ritchie 2020). In the United States, the transportation sector is a significant source of domestic CO₂ emissions, primarily due to the burning of fossil fuels (Congressional Budget Office 2022). The commuting behavior of residents, particularly the percentage of workers driving alone to work, directly affects transportation-related emissions (Stanford Scope 3 Emissions Program 2024; Department of Energy 2024).

This study uses data on the percent of workers driving alone to work from the U.S. Census Bureau, using data from 2018, which serves as the midpoint between the two emission measurement years (2013 and 2022). Research indicates that urban planning policies to reduce single-occupancy vehicle use can significantly lower emissions (Newman & Kenworthy 1999). Including this variable in the analysis helps account for transportation habits as a potential confounding factor in understanding the relationship between eNGOs and CO₂ emission reductions.

Percent Population in Poverty

Socioeconomic factors, such as poverty, influence public support for environmental initiatives and access to low-carbon technologies and behaviors. Research by the UN Environment Programme (2022) suggests that addressing poverty and environmental issues together is necessary, as financial constraints can limit access to sustainable technologies and practices. This study uses the percent of the population living below the poverty line in each MSA (Price & Feldmeyer 2010), based directly on data from the U.S. Census Bureau. Data from 2018 will be used to represent the midpoint of the study period (2013–2022). Higher poverty rates may reduce the effectiveness of eNGOs due to lower public engagement or limited financial resources for adopting sustainable behaviors (Stepping & Pegels 2014). Additionally, as socioeconomic conditions shape the success of environmental advocacy efforts (Berny & Rootes 2018), controlling for poverty rates is essential to isolate the specific impact of eNGOs on CO₂ emission reductions across MSAs.

Number of Manufacturing Workers

Manufacturing is a highly energy-intensive sector and a major contributor to regional CO₂ emissions (Nicholson et al. 2023). Including this variable helps control for the industrial composition of MSAs, which may influence baseline emission levels independent of eNGO activity. Research has emphasized the need to consider industrial sectors when analyzing emission trends, as they play a critical role in shaping regional CO₂ outputs (Dietz & Rosa 1997). This study measures manufacturing using the number of manufacturing workers for the year 2018.

Analysis Method

To examine the relationship between eNGO operational years and CO₂ emission changes in U.S. metropolitan areas, this study employed a multi-step quantitative analysis.

Descriptive statistics were first calculated to summarize the central tendencies and variability of all key variables across the 360 MSAs. Next, robust linear regression models were used to assess the association between cumulative eNGO operational years and changes in CO₂ emissions from 2013 to 2022. Robust linear regression models were used due to heteroscedasticity that can occur when MSAs are in the same state, so error terms are correlated. The use of robust regression generates Huber-White estimators that adjust the standard errors for heteroscedacity.

Three models were estimated: a baseline model with only the key independent variable, a second model with population and climate controls, and a third model introducing an interaction term between eNGO presence and greenhouse gas (GHG) emission target policies. The third model was used because of the assumption that eNGOs can be more effective in receptive policy climates, but also because initial analysis yielded regression results that indicated that an interaction was distorting model findings. To further explore contextual variation, the dataset was split into two subsamples based on whether MSAs experienced an increase or decrease in emissions over the ten years being studied, and separate regression models were estimated for each group. A pairwise correlation analysis was also conducted to assess the relationship between baseline CO₂ emissions in 2013 and total eNGO operational years. This combination of statistical methods allowed

for a comprehensive assessment of both general and context-specific relationships between civil society activity and emissions trends.

P-Values in Population

In this study, I analyzed 360 MSAs treating the dataset as a complete population rather than a sample with some missing data. Because sampling is not involved, traditional p-values (which are designed to measure the probability of observing an effect due to chance when pulling subjects from the population in a random sample) do not apply in the same way. When the full population is studied, there is no sampling variability to estimate, and therefore statistical significance becomes less meaningful (Greenland et al. 2016). In this context, what matters more are the actual effect sizes and the strength and direction of relationships. Emphasizing p-values in such a case can be misleading and may encourage questionable practices like “p-hacking,” where data are manipulated to produce statistically significant results (Head et al. 2015). To avoid this, I focus on the substantive interpretation of the coefficients rather than whether they meet arbitrary significance thresholds.

CHAPTER FOUR

RESULTS

Descriptive statistics for the variables included in the analysis are presented in **Table 1**. On average, regions had 701.36 total eNGO operational years (SD = 771.99), with CO₂ emissions changing by 668 thousand metric tons between 2013 and 2022 (SD = 1,690,364), on average. The average percentage population change was 6.80% (SD = 8.77). The MSAs had mean January and July temperatures of 33.64°F (SD = 12.01) and 76.39°F (SD = 5.56), respectively. The poverty rate averaged 15.03% (SD = 3.97), and 80.22% of commuters drove alone to work (SD = 4.78). Manufacturing employment averaged 25,782 workers per MSA (SD = 48,757.96), and 57% of the MSAs were in a state with a greenhouse gas emission target policy.

Table 2 presents the results of robust linear regressions examining the association between the total operational years of eNGOs and changes in CO₂ emissions across 360 cases. Three models are reported, progressively incorporating additional controls. These models consistently demonstrated a negative association between total eNGO operational years and CO₂ emissions change. Since CO₂ change is defined as 2022 CO₂ minus 2013 CO₂, a negative smaller change means either slower growth (if the change is positive) or a greater reduction in emissions over time (if the change is negative), as seen in the number line shown in **Figure 1**. The idea is that if a regression slope is positive, there is a shift on the number line from left to right. In MSAs where CO₂ emissions increased between 2013 and 2022 (right side of the number line), a shift from left to right means more CO₂ is being emitted. Where emissions are decreasing (left side of the number

line), a shift from left to right means that the amount of CO₂ reduction is smaller.

Overall, the figure reinforces that negative coefficients mean less CO₂.

In Model 1, each additional eNGO operational year was associated with 0.48 thousand metric tons less change in CO₂. In other words, MSAs with longer eNGO presence tended to see smaller increases or larger reductions in emissions. This pattern persisted in Model 2 (-0.57) after adding controls for population change and climate conditions. The coefficient for the percent of workers driving alone to work remains negative (-51.76), suggesting that MSAs with more solo drivers experienced lower CO₂ growth. This may reflect other co-occurring urban features such as more compact development, shorter commute distances, or improved vehicle efficiency. Population change shows a positive association (14.50), indicating that MSAs with greater population growth tended to experience larger increases in emissions. The average January temperature is slightly negative (-1.15) and July temperature is positive (10.99). This implies limited or inconsistent seasonal effects. The coefficient for manufacturing employment is near zero (-0.01), suggesting minimal contribution in this model. The poverty rate shows a negative association (-34.58), meaning that MSAs with higher poverty levels tended to experience smaller increases or greater reductions in CO₂ emissions, though the causal mechanism behind this association may be complex and context-dependent. Together, these results suggest that structural and demographic conditions, especially population growth, commuting behavior, and poverty rates help shape emissions trajectories, while eNGOs continue to demonstrate an independent negative relationship with CO₂ change. Admittedly, interpreting these coefficients is not easy, since some metropolitan areas are

reducing emissions (i.e., experiencing negative growth) and some are increasing (i.e., experiencing positive growth). Later in this chapter, I provide models that are easier to interpret.

Model 3 examined how total eNGO operational years, the presence of a greenhouse gas (GHG) emission target policy, and their interaction relate to CO₂ emission change. It indicates that each additional eNGO operational year is associated with a negative CO₂ change of approximately 1,380 metric tons (-1.38). The presence of a GHG emission target policy was associated with a negative CO₂ change of about 123,480 metric tons (-123.48). The interaction term (+0.85) indicates that in regions with a policy, the CO₂-reducing effect of additional eNGO operational years was smaller than in regions without a policy.

This pattern is illustrated in the predictive margins graph (**Figure 2**). The graph plots predicted CO₂ change by eNGO operational years, separately for areas with and without a GHG policy. Both lines slope downward, showing that greater eNGO activity is linked to negative CO₂ change. However, the slope is steeper for regions without a policy, indicating a stronger CO₂-reducing association where no formal policy exists. The gentler slope for regions with a policy reflects the smaller net effect of additional eNGO operational years in these contexts. MSAs with higher population growth saw greater CO₂ emissions change. Each 1% increase in population was associated with an additional 15.72 thousand metric tons of CO₂ emissions change.

Table 3 presents separate models for regions with increasing and decreasing CO₂ emissions to see how the influence of eNGO operational years varies by context and to

make the models easier to interpret. In regions where CO₂ emissions increased over the ten-year period being studied (Model 1), each additional eNGO operational year was associated with a small rise in emissions (0.06, 0.27). It indicates that eNGOs did not appear to slow emission growth in these areas. By contrast, in regions where CO₂ emissions decreased (Model 2), each additional eNGO operational year was linked to a reduction in emissions (-0.30, 0.22) which suggests that eNGOs contributed more to emission reductions in these contexts compared to regions where emissions were rising. This directional difference points to the possibility that eNGOs may be more impactful in supporting or amplifying existing downward trends. Additionally, the average July temperature was positively associated with emission increases in Model 1 (34.16), while the number of manufacturing workers showed significant associations in both models: positively in areas with increasing emissions (0.01) and negatively in areas with decreasing emissions (-0.01). These findings highlight that the influence of eNGOs may vary by broader contextual factors such as climate and industrial structure, which also shape regional emissions trajectories.

One concern I had in creating these models is related to causality. In Table 3, places with increasing CO₂ were associated with more eNGO operational years. Thus, I wondered if eNGOs were more frequently located in places that were struggling to control emissions. The positive correlation ($r = 0.64$) in **Table 4** shows that MSAs with higher CO₂ emissions in 2013 also tended to have more eNGO operational years. In other words, eNGOs were most active in the regions where emissions were already highest at the start of the study period. While these MSAs had more eNGO presence, they were also large urban centers

with complex structural challenges including larger populations, extensive transportation networks, and substantial industrial activity, that contributed to ongoing emissions growth. The correlation helps explain why eNGOs were concentrated in these areas, but it also highlights why their efforts alone may not have been sufficient to counterbalance the strong forces driving CO₂ increases. So, the correlation does not imply causation but highlights a meaningful association between civil society activity and baseline emission levels.

CHAPTER FIVE

DISCUSSION AND CONCLUSION

My thesis provides evidence that eNGOs significantly influence urban CO₂ emissions trajectories in U.S. MSAs. MSAs with a longer standing eNGO presence tended to experience smaller increases or larger decreases in emissions over the decade studied. This suggests that sustained civil society engagement in environmental advocacy can contribute meaningfully to mitigating emissions growth.

These findings align with prior research on environmental governance and civic advocacy. For example, Li and their colleagues (2021) found that eNGOs had a measurable positive impact on environmental quality, such as air pollution reduction, in OECD countries. Similarly, local case studies indicate that communities with active environmental groups often achieve tangible emissions reductions. For instance, Grant and Vasi (2017) showed that U.S. power plants emitted less CO₂ in regions with more local eNGOs, partly because eNGOs enhanced the effectiveness of energy-efficiency policies. These parallels reinforce the view that eNGOs serve as important catalysts for urban emissions management by disseminating norms and practices that translate into real-world environmental benefits. Furthermore, the strong negative eNGO–emission relationship observed here is consistent with evidence that pro-environment civic capacity tends to spur broader climate actions. Municipalities participating in programs like the Cities for Climate Protection campaign were far more likely to host local environmental nonprofits, indicating that civic engagement and policy commitment often

go together (Zahran et al. 2008). This study extends that understanding by linking eNGO presence not only to policy adoption but also to quantifiable emissions outcomes.

Local Context and Structural Barriers

A further stratified analysis sheds light on how the eNGOs' impact varies depending on a city's emissions trajectory. MSAs were differentiated based on whether they saw overall emissions increases or decreases from 2013 to 2022. In MSAs with rising emissions, the coefficient for eNGO presence was essentially null and even slightly positive. This suggests that eNGOs in these areas struggle to curb the upward emissions trend. In contrast, MSAs with declining emissions exhibited a more appreciable negative association with eNGO operational years, indicating that eNGOs made a discernible difference in cities already cutting emissions, whereas their influence was minimal in cities with emissions still rising.

This discrepancy reflects underlying differences in local context and capacity. Declining-emission areas tend to be those that have embraced renewable energy, deindustrialization, energy efficiency, or proactive climate policies—settings where eNGOs can reinforce and accelerate existing decarbonization momentum. In such settings, eNGOs might amplify success by promoting behavioral changes, ensuring policy implementation rigor, or introducing innovative climate solutions, acting as force multipliers for ongoing emissions reduction efforts (Harris et al. 2022). Conversely, rising-emission areas often face strong countervailing forces such as rapid economic and population growth, expanding transportation needs, or new industrial activities (Sikder et al. 2022; Yi et al. 2022; Congressional Budget Office 2024). In such places, even motivated eNGOs may

struggle to counteract the sheer scale of emission drivers. For instance, MSAs with increasing emissions showed significant positive effects from manufacturing employment and hotter summer, factors associated with higher energy demand and emissions—which had a reduced or opposite role in declining-emission MSAs. This indicates that structural and economic conditions can overwhelm civil society efforts like eNGO activities when those conditions push emissions upward (Bolkvadze et al. 2024).

This finding resonates with political opportunity structure theory, which posits that social movements (here, eNGOs) are more likely to succeed when institutional contexts and public opinion are favorable, but face limitations in adverse or structurally entrenched conditions (Rootes 1999). Thus, it is not necessarily that eNGOs fail in rising-emission cities; rather, those cities present distinct challenges where technological and economic emission drivers overshadow advocacy. In declining-emission cities, eNGOs focus on supporting and accelerating transition strategies, and the data indicate they succeed there. For rising-emission cities, measurable success by eNGOs may require stronger policies and/or economic shifts. Overall, this underscores the broader theme that eNGO impact is context-dependent and most effective as part of an alignment of favorable conditions. It also highlights that for cities still struggling to peak their emissions, grassroots action alone is insufficient. A combined approach involving civil society pressure and robust policy and economic change is essential to alter trajectories.

It is also important to consider contextual nuances. Notably, MSAs with higher baseline CO₂ emissions in 2013 had significantly greater cumulative eNGO operational years. On one hand, this correlation suggests that eNGOs gravitate toward large, industrialized

cities with serious pollution challenges, which simultaneously produce substantial emissions and attract more advocacy resources. Prior literature notes that non-state actors mobilize where environmental risks are salient, often counterbalancing major emission sources (Grant & Vasi 2017; Li et al. 2021). On the other hand, these same high-emission urban centers have complex structural drivers, such as energy-intensive industries (Congressional Budget Office, 2024; Bellona Foundation, n.d.), extensive transportation demand (McDonald et al. 2013; Bleviss 2020), and rapid population growth (Bereitschaft & Debbage 2013; Fragkias et al. 2013), which are not easily offset. The concentration of eNGOs in these areas, while promising, does not guarantee swift emissions decline; it underscores that eNGOs often face uphill battles in locales where their presence may be most needed.

The data show that despite strong eNGO activity, these MSAs experienced ongoing emission pressures. This implies a complex, bidirectional relationship rather than simple causality. In fact, the correlation between initial emissions and eNGO presence highlights a responsive pattern, where advocacy is most active in high-emitting contexts. This aligns with broader environmental sociology perspectives, especially the STIRPAT framework (York et al. 2003), which argues that structural factors like population size, affluence, and industry dominate emissions, while activism and policy moderate these forces. In sum, eNGOs contribute to bending emissions trajectories downward, but their effectiveness depends partly on baseline challenges and the scale of emissions sources in each MSA.

ENGOs and Policy: Complementary Forces

A further key finding is that the effect of eNGO operational years was moderated by the presence of formal climate policies. Regression models reveal a smaller impact of eNGOs on CO₂ emissions change in MSAs that had formally adopted GHG emissions targets or climate action policies compared to those without such policies. In regions without formal targets, eNGOs exerted a stronger emission reduction effect; in policy-adopting areas, the marginal eNGO contribution was more modest. At first glance, this might imply a substitution effect where government policies address the “low-hanging fruit” of emissions reductions, leaving limited scope for NGO impact (Jorgenson et al. 2000; Wang & Sun 2022; Vandenberg et al. 2007). However, an alternative, likely complementary explanation is one of synergy and co-production. ENGOs may have been instrumental in policy formulation and implementation, effectively embedding their influence within governance frameworks (Newig et al. 2018). In cities with climate targets, eNGO influence might manifest mainly through official programs, such as helping design policies, mobilizing public support, or aiding enforcement, rather than showing as separate statistical effects (Aylett 2013; Bulkeley & Betsill 2013). This interpretation is consistent with collaborative governance and polycentric governance frameworks that emphasize multi-actor climate solutions involving governments and civil society working in concert (Ostrom 1996; Bulkeley & Betsill 2003). Grant and Vasi (2017) found local eNGOs amplify subnational policy effectiveness on energy efficiency by acting as policy amplifiers rather than substitutes. Similarly, in this study, MSAs with both formal GHG targets and active eNGOs achieved

the strongest emission reductions, even though the incremental effect of each additional eNGO was somewhat blunted.

From a governance perspective, this complementarity suggests that government policies provide regulatory frameworks and resources, while eNGOs add grassroots monitoring, innovation, and public engagement to ensure policy goals are realized on the ground. The nature and strength of local climate policies vary widely, from genuinely ambitious efforts driven by political will and local co-benefits (Salon et al. 2014) to symbolic or bureaucratic procedures (Krause 2013). The effectiveness of these policies is tightly linked to their earnest pursuit, political commitment, and enforcement; factors beyond the scope of this quantitative study but vital for future research.

Future Research Directions

This research adds to the growing literature on climate governance. It shows that the long-term presence of environmental NGOs is an important institutional factor linked to CO₂ emissions outcomes in U.S. metropolitan areas. Building on this key contribution, future research will expand in two main directions.

First, I plan to investigate how local political motivation, governance capacity, and the design of climate policies affect emissions outcomes at the metropolitan scale. This will involve exploring differences in policy ambition, implementation strength, and political will to better understand their interaction with civil society activity. Understanding the ways in which institutional commitment and policy environments shape or constrain eNGO effectiveness will provide valuable insight into the enabling conditions for successful emissions reductions.

Second, I will analyze the determinants of eNGO project placement, funding decisions, and strategic focus. Why do eNGOs choose to operate in some MSAs and not others? How do factors such as local institutional openness, civic infrastructure, or demographic characteristics influence these decisions? By combining quantitative longitudinal analysis with in-depth qualitative case research, this work will clarify how enduring eNGO involvement can be fostered and optimized within diverse urban governance contexts. Together, these future inquiries aim to deepen scholarly and practical understanding of how civil society, policy frameworks, and structural economic conditions coalesce to produce effective and equitable urban decarbonization strategies. At the same time, they will continue to center the foundational insight advanced in this thesis: that the cumulative, long-term presence of environmental NGOs constitutes a critical element of metropolitan climate governance.

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APPENDIX

Table 1. Descriptive Statistics

Variable	Mean	SD	Min	Max
Total eNGO operational years	701.3639	771.9938	20	5152
Change in CO ₂ emission in Thousand Metric Tons (2013–2022)	-667.9193	1690.364	-9800.925	4636.474
% population change (2013-2022)	6.80132	8.769239	-20.45701	40.89302
Average January temperature F (2018)	33.64444	12.01003	6	65
Average July temperature F (2018)	76.39167	5.559447	63	95
% population below poverty level (2018)	15.03056	3.965261	7	31
% population drove alone to work (2018)	80.225	4.777144	50	89
% workers in manufacturing	25782.97	48757.96	374	439059
GHG emission target policy	.5666667	.4962253	0	1
Observations	360			

Table 2. Robust Linear Regression of eNGO Operational Years on CO2 Emission Change

Variable	Model 1	Model 2	Model 3
Total eNGO operational years	-0.48** (0.16)	-0.57* (0.24)	-1.38 (0.62)
% population change (2013-2022)		14.50 (8.94)	15.72 (9.12)
Average January temperature F (2018)		-1.15 (8.48)	-0.62 (8.56)
Average July temperature F (2018)		10.99 (20.26)	10.85 (20.94)
% population drove alone to work (2018)		-51.76* (24.53)	-52.15* (23.43)
Number of manufacturing workers (2018)		-0.01 (0.01)	-0.00 (0.00)
% population below poverty level (2018)		-34.58 (20.29)	-39.72 (20.49)
GHG emission target policy		239.58 (211.02)	
policy=0			-1.38 (0.62)
policy=1			-123.48 (279.55)
Policy x Total eNGO operational years			0.85 (0.65)
Constant	-329.58** (113.29)	3495.62 (2478.69)	3878.35 (2378.88)
Observations	360	360	360
R^2	0.049	0.100	0.113

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$

Table 3. Regression Model for Decreasing and Increasing CO₂ MSAs.

	Model 1	Model 2
Total eNGO operational years (2013-2022)	0.06 (0.27)	-0.30 (0.22)
% population change (2013-2022)	0.31 (4.92)	11.28 (10.95)
Average January temperature (2018)	0.63 (6.08)	-5.80 (10.57)
Average July temperature (2018)	34.16* (16.54)	-21.57 (22.08)
% population below poverty level (2018)	2.29 (11.75)	-32.55 (27.77)
% population drove alone to work (2018)	1.84 (12.23)	-49.49 (33.18)
Number of manufacturing workers (2018)	0.01** (0.00)	-0.01** (0.00)
GHG emission target policy	25.04 (118.70)	336.16 (263.50)
Constant	-2596.36 (1396.18)	5247.88 (2883.34)
Observations	130	230
R^2	0.442	0.202

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$

Table 4. Pairwise Correlation

Variables	(1)	(2)
(1) Total eNGO operational years	1.000	
(2) Carbon dioxide emission in 2013	0.645	1.000

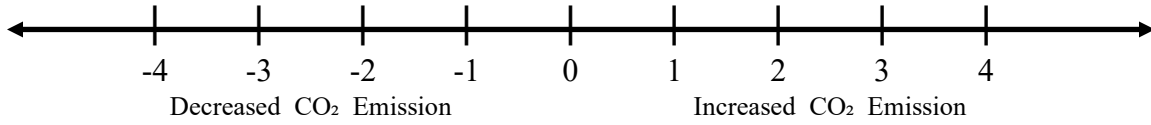


Figure 1. Number Line Aid in Understanding Coefficient Changes

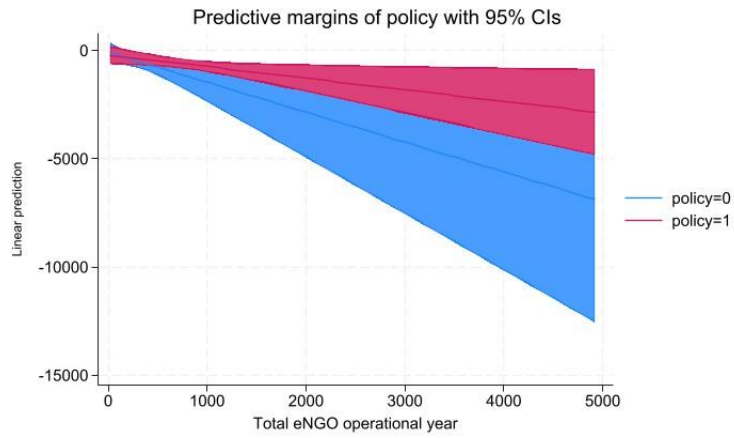


Figure 2. Predicted CO₂ Change by eNGO Operational Years and Policy Context

VITA

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