

Top-Down Vs. Bottom-Up: A Comparative Study of Governance Models in Climate Change Mitigation

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ABSTRACT: Two governance logics compete for dominance in climate mitigation policy today. One is top down: binding or quasi binding international agreement, negotiated by states and enforced, in theory, through treaty mechanisms. The other is bottom up: voluntary, decentralized action by cities, communities, and non state actors who do not wait for a treaty to move first. This study puts the two side by side through a comparative case analysis, the UNFCCC and its Paris Agreement architecture on the top down side, local and community climate initiatives, including networks like C40 Cities and ICLEI, on the bottom up side. Using Elinor Ostrom's polycentric governance theory as a lens, the paper asks how each model structures authority, accountability, and implementation capacity, and where each one fails to live up to its own goals. Drawing on UNFCCC synthesis reports, peer reviewed policy studies, empirical work on subnational climate networks, and comparative climate litigation evidence, the paper finds that the top down model buys legitimacy, universality, and a shared accounting framework, but pays for it with a chronic implementation and ambition gap, a direct consequence of its voluntary, consensus driven design. The bottom up model, meanwhile, offers experimentation, contextual legitimacy, and faster iteration, but struggles with fragmentation, uneven capacity across regions, and limited impact once measured against global targets. Neither model, the paper argues, is sufficient on its own. What the polycentric literature has been saying for over a decade, that the real task is linking scales together rather than picking one, still holds up as both the empirical trend and the better normative path forward.

KEYWORDS: Climate Governance, Top Down Governance, Bottom Up Governance, UNFCCC, Paris Agreement, Polycentric Governance Theory, Local Climate Initiatives, Climate Litigation, Commons Governance, Comparative Policy Analysis, Climate Change Mitigation

INTRODUCTION

Climate change mitigation is a governance problem before it is a technical one. Cutting emissions fast enough to avoid dangerous warming does not really hinge on whether low carbon technology exists, since it largely does. It hinges instead on whether political institutions can coordinate action across scales, from a single household up to the entire international system. For the last three decades, two governance logics have contended for primacy in climate policy. In the top down model, a central international authority sets collective targets and assigns, or invites, national commitments toward them. In the bottom up model, authority is scattered across many autonomous actors, national governments, but also cities, communities, and firms, each acting on its own terms, often well ahead of any international mandate.

The UNFCCC opened for signature at the 1992 Rio Earth Summit and entered into force in 1994. Its stated goal was to stabilize atmospheric greenhouse gas concentrations at a level that would prevent dangerous human interference with the climate system (UNFCCC, n.d.). That goal, however, was left deliberately vague in the treaty text itself. Turning it into anything measurable was pushed downstream to the Conference of the Parties (COP), the treaty's main decision making body, and to whatever protocols were negotiated under its umbrella (van Asselt, 2020).

The UNFCCC's first real attempt at an operational instrument, the 1997 Kyoto Protocol, was top down almost by definition. It set absolute, legally binding emissions caps for a fixed list of industrialized "Annex I" countries, and paired those caps with market mechanisms, the Clean Development Mechanism, Joint Implementation, and international emissions trading, meant to let countries meet their targets without excessive cost (van Asselt, 2020). The design did not hold up well. The United States signed but never ratified Kyoto, after the Senate made clear in 1997 that it would not accept binding targets that let major developing country emitters off the hook. Canada withdrew entirely in 2011 rather than face the non compliance penalties (IISD, 2020). That same fault line, the absence of binding obligations for large developing country emitters, kept resurfacing in later negotiations, and it is a large part

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of why the push for a binding Kyoto successor at the 2009 Copenhagen summit collapsed into a non binding political accord rather than the enforceable treaty its architects had sought (Ostrom, 2010).

The 2015 Paris Agreement was a direct response to that history of collapse. Instead of a centrally dictated cap, it established a system of voluntary, self determined Nationally Determined Contributions (NDCs), submitted by each country and reviewed on a five year cycle through what is called the Global Stocktake (Overholt et al., 2025). Paris retained some top down scaffolding, universal participation, common reporting rules under an Enhanced Transparency Framework, periodic ratcheting of ambition, but handed the substantive content of national targets back to the countries themselves. This is why scholars tend to describe it as a hybrid regime rather than a purely top down one (van Asselt, 2020).

Set against this is a fast growing body of bottom up climate action: municipal governments, transnational city networks such as C40 Cities, ICLEI–Local Governments for Sustainability, and the Global Covenant of Mayors for Climate and Energy, along with community and cooperative initiatives that design and implement mitigation projects independent of, and often ahead of, whatever their national governments have committed to (Kern and Alber, 2025; Sanderink and Nasiritousi, 2016). Elinor Ostrom, writing just before the 2009 Copenhagen summit, argued that betting everything on one global agreement to solve what is, in practice, a multi scalar collective action problem was a mistake, and that a polycentric system, overlapping local, national, and international efforts, offered a more realistic and more resilient path to actual mitigation (Ostrom, 2010).

This paper compares the UNFCCC, as the clearest top down case, against local and community climate initiatives, as the clearest bottom up case, to examine how each holds up against the criteria that matter most for mitigation: legitimacy, accountability, adaptability, and, ultimately, measurable emissions outcomes. The central question driving the paper is this: how do top down and bottom up governance models differ in their capacity to translate climate commitments into effective mitigation outcomes, and what do their respective limitations suggest about how global climate governance should be built going forward?

The remainder of the paper proceeds as follows. It first sets out the polycentric governance framework anchoring the comparison and situates the paper between the two literatures it seeks to bridge. It then details the qualitative comparative case methodology and the deductive coding procedure applied to the source material. The two empirical sections that follow examine the UNFCCC and Paris Agreement architecture, and local and community climate initiatives, in turn, against the same four evaluative criteria: authority and legitimacy, accountability, adaptive capacity, and implementation outcomes. A comparative analysis section then places the two cases side by side, and the paper closes with a synthesis that returns to the research question directly and identifies the limitations of the present study alongside a concrete agenda for future research.

APPLYING POLYCENTRIC GOVERNANCE THEORY

This paper draws on Polycentric Governance Theory, developed by Elinor Ostrom in the context of common pool resource management and later extended explicitly to climate change. Polycentricity describes a governance system made up of many independent centers of decision making, operating at different scales, that are formally autonomous from one another yet remain capable of taking each other into account through information exchange, emulation, and, where they choose, coordination (Ostrom, 2010).

Ostrom's earlier, foundational work on commons governance identified a set of design principles that recur in durable, self organized institutions for managing shared resources: clearly defined community boundaries, rules that fit local social and ecological conditions, collective choice arrangements that let resource users participate in modifying the rules that bind them, low cost monitoring, graduated sanctions for rule violations, accessible conflict resolution mechanisms, at least minimal recognition of the community's right to organize, and, for larger systems, governance activities nested in multiple layers (Ostrom, 2010). These principles matter for climate governance because they identify precisely the features, monitoring, sanctioning, and nested organization, that determine whether decentralized cooperation holds together or collapses into free riding, a question this paper returns to when assessing the bottom up case.

Ostrom's central claim, extended to the climate case, was that relying entirely on international efforts to solve global climate problems needed to be rethought, since a great deal of mitigation potential exists in small to medium scale governance units that can act more quickly than a consensus based international body, and whose experimentation generates comparative evidence about what works before it is attempted at larger scale (Ostrom, 2012). Rather than treating top down and bottom up governance as mutually exclusive alternatives, the polycentric lens treats them as complementary tiers of the same governance system: the international tier supplies universality, common accounting, and a floor of legitimacy, while the subnational and community tier supplies experimentation, contextual fit, and faster iteration.

Subsequent scholarship applying polycentricity to observed climate governance has found that the overall landscape has indeed become more diverse and multi levelled, with a much greater emphasis on bottom up initiatives, bearing out many, though not all, of Ostrom's predictions (Jordan et al., 2015, cited in Humanities and Social Sciences Communications, 2022). Experimental economic research designed specifically to test the polycentric hypothesis has found that decentralized, multi level institutional arrangements can outperform single level, centralized arrangements at sustaining costly cooperation, lending empirical support to Ostrom's claim beyond the observational record (Humanities and Social Sciences Communications, 2022). A parallel research

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agenda has also begun probing the democratic dimension of polycentric climate governance directly, asking how state authority, local action, and public preferences interact once governance is deliberately distributed across levels, rather than assuming that distribution is automatically legitimate (Kellner, Petrovics and Huitema, 2024).

This paper uses polycentric governance theory as an evaluative lens for comparing the UNFCCC and local and community climate initiatives. Rather than asking which model is unconditionally superior, it asks what distinct governance function each model performs, where each model's authority claims break down in practice, and how well the empirical record supports the polycentric expectation that the two tiers can be productively linked.

LITERATURE GAP

A substantial literature evaluates the UNFCCC and Paris Agreement in isolation, typically through the lens of international relations or international law, focusing on questions of ratification, compliance, and the ambition implementation gap in Nationally Determined Contributions (van Asselt, 2020; Overholt et al., 2025). A separate and growing literature evaluates subnational and transnational municipal climate governance, often through the lens of urban studies or polycentric governance, focusing on networks such as C40 and ICLEI and on community based or cooperative energy initiatives (Kern and Alber, 2025; Sanderink and Nasiritousi, 2016). A further strand examines private and voluntary bottom up mechanisms, including corporate disclosure and voluntary reduction pledges, largely as a supplement to, rather than in structured comparison with, the intergovernmental process (Banda, 2018).

These literatures rarely speak to each other in a structured, comparative way. Studies of the UNFCCC tend to treat subnational and community action as a peripheral supplement to the governance work occurring at the international level, while studies of city networks and local initiatives tend to treat the UNFCCC process mainly as backdrop or as the gap that bottom up action is filling. A separate body of work on the fragmentation of global climate governance has argued that the proliferation of overlapping institutions, agreements, and actors across scales is itself an object that needs deliberate management, rather than an incidental feature of an otherwise coherent regime, but this literature is generally oriented toward institutional design questions rather than toward a head to head evaluation of the top down and bottom up models on common criteria (van Asselt and Zelli, 2016).

Few studies place the two governance models side by side using a shared set of evaluative criteria, legitimacy, accountability, adaptive capacity, and measurable outcomes, to ask what each model is comparatively better or worse at accomplishing. This paper addresses that gap by conducting a structured comparative case analysis of the UNFCCC and of local and community climate initiatives, using polycentric governance theory as a shared analytical frame.

METHODOLOGY

This study employs a qualitative comparative case study design to examine top down and bottom up climate governance. The UNFCCC, encompassing the Kyoto Protocol and the Paris Agreement architecture, is selected as the case representing top down governance, while local and community based climate initiatives, including transnational municipal networks such as C40 Cities and ICLEI, are selected as the case representing bottom up governance.

These two cases were selected because they represent the clearest and most institutionally developed instances of each governance logic while sharing an identical policy objective, namely, the mitigation of greenhouse gas emissions, which allows variation in governance structure to be isolated as the primary explanatory variable, consistent with a most different systems comparative logic. Under that logic, the cases are deliberately chosen to differ on almost every structural dimension, source of authority, scale of operation, formal legal status, enforcement mechanism, while holding the outcome of interest, mitigation performance, constant as the shared object of evaluation. Any systematic difference in how the two cases perform against the study's evaluative criteria can then be attributed with greater confidence to governance structure itself rather than to some other confound (van Asselt and Zelli, 2016).

The research relies on documentary analysis of primary and secondary sources: UNFCCC and Paris Agreement texts and synthesis reports, UNEP Emissions Gap Reports, peer reviewed studies evaluating NDC implementation and C40/ICLEI network performance, city level greenhouse gas accounting standards, comparative climate litigation case law, and policy literature on polycentric and bottom up climate governance. Document analysis is well suited to comparative policy research because it enables systematic evaluation of how institutions frame, justify, and report on their own governance performance, while also allowing triangulation against independent empirical assessments produced outside the institutions being studied.

CODING AND ANALYTICAL PROCEDURE

Sources were reviewed and organized using a deductive coding framework built from the study's core evaluative criteria: (1) authority and legitimacy, the basis on which the governance body claims the right to set or endorse mitigation targets; (2) accountability mechanisms, how commitments are monitored, reported, and enforced or not enforced; (3) adaptive capacity, how quickly and flexibly the model can revise commitments or absorb new information; and (4) implementation outcomes, the measurable gap, where evidence exists, between pledged and achieved mitigation.

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The legitimacy code draws primarily on the basis of participation, near universal state ratification for the UNFCCC versus voluntary self organization and situated responsibility for local and community initiatives, and treats legitimacy as a claim that can be assessed independently of whether the underlying institution actually delivers emissions reductions. The accountability code focuses specifically on whether a monitoring and reporting architecture exists, and separately, whether any consequence attaches to non delivery, since these two features do not necessarily travel together. The adaptive capacity code focuses on cycle length, the interval between a commitment being made and being revisited, and on the number of actors whose agreement is required before a revision can occur. The implementation outcomes code is applied only where quantified evidence exists in the source material, and the analysis is explicit about the asymmetry this produces between the two cases, discussed further in the Comparative Analysis section. Within each code, the analysis further distinguishes between the model's stated design intent and its observed operating record, since a recurring theme in the literature on both cases is a gap between formal commitment and actual delivery. This distinction is treated as itself analytically significant rather than as a limitation to be explained away, since polycentric governance theory predicts that different tiers of a governance system will exhibit different characteristic gaps between design and delivery, and that those gaps carry diagnostic information about where each tier's authority claims are strongest and weakest (Ostrom, 2010).

A note on scope is warranted before turning to the empirical sections. "Top down" and "bottom up" are used throughout as descriptions of where formal authority to set a target originates, not as judgments about which actors are more sincere or more capable. A national government pursuing an ambitious NDC is not, on this definition, acting less genuinely than a city council adopting a net zero pledge, and the paper does not treat either governance logic as a normative default. Similarly, referring to local and community initiatives collectively as the "bottom up case" is a simplification made for comparative tractability, since that category in practice spans actors as different as a multinational city network with a permanent secretariat and a single neighborhood energy cooperative. Where the empirical record permits, the analysis below flags where a finding applies to the network tier specifically rather than to bottom up governance as a whole.

TOP DOWN GOVERNANCE: THE UNFCCC AND THE PARIS AGREEMENT

Authority and Legitimacy

The UNFCCC, adopted at the 1992 Rio Earth Summit, established the foundational objective of stabilizing greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system, and created the annual Conference of the Parties (COP) as its central decision making body (UNFCCC). Its first major operational instrument, the 1997 Kyoto Protocol, was explicitly top down in design. It dictated an absolute, legally binding cap on emissions divided among developed countries, with compliance mechanisms attached, and it channeled compliance through the Clean Development Mechanism, Joint Implementation, and international emissions trading, three flexibility mechanisms intended to lower the cost of meeting binding targets without weakening them (van Asselt, 2020).

This centralized model proved politically fragile. The United States, historically the world's largest emitter, declined to ratify Kyoto, and the absence of binding obligations for large developing country emitters became a persistent point of contention that colored the negotiations which followed. Canada's formal 2011 withdrawal from the Protocol, ahead of facing penalties for missing its target, underscored how little enforcement leverage a binding top down design actually carried once a major Party chose to exit (IISD, 2020). The 2015 Paris Agreement responded to this fragility by shifting from a dictated, centrally allocated cap to a system of voluntary, self determined Nationally Determined Contributions submitted by each Party, reviewed and updated on a five year cycle through a Global Stocktake process. Scholars characterize this as a shift from a top down Kyoto architecture to a hybrid Paris outcome that retains top down common rules for transparency and reporting while decentralizing the substantive content of targets (Overholt et al., 2025).

Accountability

The Paris Agreement's Enhanced Transparency Framework is itself a top down feature worth isolating analytically. It obliges every Party, regardless of how ambitious or unambitious its own NDC is, to report emissions inventories and progress using a common methodology, which is precisely what allows the aggregate implementation gap discussed below to be quantified at all. This is a structural feature that no bottom up initiative, however well intentioned, can replicate on its own, since a common reporting standard applied voluntarily by only some actors cannot produce a comparable global picture.

The UNFCCC's authority rests on near universal state ratification and a consensus based decision procedure, which grants it a degree of legitimacy that no other climate governance body can claim. It remains, in the words of one assessment, the approach with the highest degree of legitimacy even amid criticism of its slow pace (IISD, 2020). That same consensus requirement, however, is also its principal structural weakness. Reliance on consensus based decision making has been impeded by persistent divisions between developed, developing, and small island states, and critics point to a lack of enforceable accountability once a Party's NDC has been submitted, since Parties are obligated to pursue their targets but are not legally bound to achieve them (Umweltbundesamt, 2025).

Implementation Outcomes

This design produces a measurable and well documented implementation and ambition gap. The 2025 NDC Synthesis Report found that full implementation of the 64 new NDCs submitted for the 2035 target year would reduce global emissions by only about 17

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percent relative to 2019 levels, far short of the roughly 60 percent reduction the Intergovernmental Panel on Climate Change indicates is required to hold warming to 1.5 degrees Celsius (UNFCCC, 2025). A subsequent update to that report, issued ahead of COP30 and incorporating a larger pool of 113 Parties, found the projected reduction narrowing further to about 12 percent, underscoring how quickly the aggregate figure moves as additional Parties submit NDCs (UNFCCC, 2025b). Correspondingly, the UNEP Emissions Gap Report 2025 projects that full implementation of current NDCs would still leave the world on a trajectory toward 2.3 to 2.5 degrees Celsius of warming, and that current policies, as opposed to pledges, point toward roughly 2.8 degrees (UNEP, 2025). An independent assessment following the 2025 NDC submission round found that the new pledges close less than 14 percent of the additional emissions reductions needed by 2035 to remain consistent with the 1.5 degree goal (WRI, 2025).

Adaptive Capacity

At the same time, the 2025 synthesis process shows an institution adapting toward the polycentric model rather than resisting it. Ninety five percent of Parties reported engaging non Party stakeholders, including subnational governments, the private sector, and civil society, in NDC implementation, a twenty percentage point increase over the previous reporting cycle, suggesting a deliberate move to embed national targets into local delivery structures (UNFCCC, 2025). Read together with the finding that eighty nine percent of Parties now communicate economy wide targets, up from eighty one percent in the previous NDC round, the picture that emerges of the top down tier is not one of a static, closed regime but of an institution whose formal design is increasingly, if belatedly, converging on the polycentric prescription of embedding international commitments in subnational delivery (UNFCCC, 2025).

BOTTOM UP GOVERNANCE: LOCAL AND COMMUNITY CLIMATE INITIATIVES

Authority and Legitimacy

Where the UNFCCC derives authority from state ratification and international law, bottom up climate governance derives its authority from direct, situated responsibility for local emissions sources, infrastructure, and constituents, and from the voluntary self organization of communities and subnational governments to address risks to shared resources. Ostrom's foundational argument for this model was that many communities have historically developed effective, self governing institutions to manage shared resource problems without waiting for, or independent of, an external central authority (Ostrom, 1990), and subsequent scholarship has argued that this same capacity for self organization is transferable to climate mitigation at municipal and community scale (Milkoreit et al., 2013).

Accountability: Standards, Litigation, and Enforceability

The clearest institutionalized expression of bottom up climate governance is the rise of transnational municipal networks, chiefly C40 Cities, ICLEI–Local Governments for Sustainability, and the Global Covenant of Mayors for Climate and Energy, through which local leaders have formalized city to city climate diplomacy as a mechanism for shaping international climate policy from below (Kern and Alber, 2025). These networks supply cities with shared measurement standards, most notably the Global Protocol for Community Scale Greenhouse Gas Emission Inventories jointly developed by C40, ICLEI, and the World Resources Institute, along with peer learning platforms and, in some cases, targets that member cities are asked to adopt (C40 Cities, ICLEI and WRI, 2014). That standard exists specifically because cities are estimated to account for more than seventy percent of global energy related carbon dioxide emissions, which makes a common city level accounting method a precondition for any credible claim about aggregate bottom up impact, in much the same way the UNFCCC's transparency framework is a precondition for aggregate top down accounting (C40 Cities, ICLEI and WRI, 2014).

The scale of aggregate bottom up commitment is not negligible. The cities that disclose emissions data on the C40 platform account for roughly 0.6 gigatons of CO₂ equivalent annually, comparable to twice the annual emissions of Poland, indicating that even a relatively small network of large cities can represent a meaningful share of global emissions (C40 Cities, ICLEI and WRI, 2014). Beyond formal networks, community based and cooperative initiatives, particularly in the energy sector, such as municipally owned wind cooperatives in Denmark and locally owned renewable energy cooperatives (Energiegenossenschaften) in Germany, have been documented as a distinct channel through which polycentric governance enhances local resilience, allowing communities to design mitigation measures suited to local social and ecological conditions rather than applying a uniform template (Milkoreit et al., 2013). A further bottom up channel that operates outside both the intergovernmental process and the city network model is domestic climate litigation, through which citizens and civil society organizations use national courts to compel government climate action. The clearest example is the Urgenda case, in which the Supreme Court of the Netherlands, on 20 December 2019, upheld lower court rulings that the Dutch government was legally obligated to cut national greenhouse gas emissions by at least 25 percent below 1990 levels by the end of 2020, on the grounds that the state's duty of care under human rights law required it (State of the Netherlands v. Urgenda Foundation, 2019). The case is significant for this comparison because it produced an enforceable, court ordered emissions target, something neither the UNFCCC's consensus based process nor voluntary municipal pledges have managed to generate, even though the target itself was set at the national rather than the international or municipal scale. This illustrates that enforceability in bottom up adjacent climate governance has so far been achieved through domestic legal systems rather than through transnational city networks themselves.

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Implementation Outcomes

However, the empirical record on the mitigation impact of bottom up city networks is considerably more mixed than advocacy literature often suggests. A 2025 mixed methods analysis of the C40 Cities initiative found that network membership was associated with cities increasing or maintaining their stated climate ambition, but that the network's direct influence on actual city level policy planning and implementation was limited, meaning that the gap between pledge and delivery, familiar from the UNFCCC case, reappears at the municipal scale (Persson and Nasiritousi, 2025). Similarly, private and voluntary bottom up mechanisms more broadly, including corporate emissions disclosure, voluntary reduction commitments, and carbon labeling, face structural constraints that make them, on their own, unlikely to generate mitigation action at the scale required, even as certain other bottom up channels, such as climate litigation, have shown a demonstrated capacity to increase government accountability (Banda, 2018).

Adaptive Capacity and Structural Risks

Bottom up governance also carries structural risks distinct from, but analogous to, those of the top down model. Because authority is dispersed across many autonomous units with no central enforcement mechanism, bottom up systems remain vulnerable to free riding, since local actors can benefit from the reduction efforts of others without contributing proportionally themselves. Evidence based literature on cooperative commons governance argues that local sanctioning institutions, not simply voluntary goodwill, are what allow bottom up cooperation to outperform pure top down design where they exist ('Beating free riders in global climate action: An assessment', 2025). This is precisely the graduated sanctions design principle Ostrom identified in her earlier commons research, and its frequent absence in transnational city networks, which typically have no mechanism to penalize a member city that fails to deliver on a pledged target, helps explain why network membership tracks ambition more reliably than delivery (Ostrom, 1990). Fragmentation is a further concern. Without a coordinating architecture linking initiatives across scales, a multitude of well intentioned local and non state actions can proceed in parallel without coherence or comparability, undermining the aggregate accounting that global mitigation targets require (van Asselt and Zelli, 2016).

COMPARATIVE ANALYSIS: LEGITIMACY, ACCOUNTABILITY, AND IMPLEMENTATION OUTCOMES

Table 1. Summary comparison of the UNFCCC (top-down) and local/community climate initiatives (bottom-up) across the study's four evaluative criteria.

Criterion	UNFCCC / Top-Down	Local & Community / Bottom-Up
Authority & legitimacy	Near-universal state ratification; highest available international legitimacy, but requires consensus among ~200 Parties (IISD, 2020)	Situated responsibility and voluntary self-organization; strong contextual legitimacy but no claim to universal representation
Accountability	Common reporting via the Enhanced Transparency Framework, but Parties must pursue, not achieve, NDCs (Umweltbundesamt, 2025)	Shared standards (e.g. GPC) and domestic litigation (Urgenda) provide some enforceability, but no central sanctioning mechanism (Ostrom, 1990)
Adaptive capacity	Five-year Global Stocktake cycle; slow but synchronizes ~200 jurisdictions at once	Cities/communities can revise faster individually, but gains do not automatically propagate without networks like C40/ICLEI
Implementation outcomes	Precisely quantified gap: 12-17% projected reduction vs. ~60% needed; 2.3-2.8°C trajectory (UNFCCC, 2025; UNEP, 2025)	No equivalent aggregate accounting; measurable in parts (e.g. ~0.6 Gt CO ₂ e from disclosing C40 cities), but ambition tracks ahead of verified delivery (Persson and Nasiritousi, 2025)

The UNFCCC and local and community climate initiatives exhibit a striking structural symmetry: each model's core strength is also the direct source of its core weakness. The UNFCCC's near universal ratification grants it a legitimacy that no coalition of cities or communities can claim, since it alone can speak, however imperfectly, for the entire international community and set a common accounting framework against which all national and subnational effort can, in principle, be measured (IISD, 2020). That same universality, however, requires consensus among nearly two hundred Parties with divergent interests, which is precisely what has prevented the UNFCCC from imposing binding, adequately ambitious targets since the political failure of the Kyoto model, and what produces the persistent double digit percentage implementation gap documented in the 2025 NDC Synthesis Report and Emissions Gap Report (UNFCCC, 2025; UNEP, 2025).

Bottom up governance inverts this trade off. Local and community initiatives can move faster than an international consensus process, since a single city council or cooperative does not need to negotiate agreement among nearly two hundred parties before

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acting, and the resulting diversity of approaches generates comparative, real world evidence about what mitigation strategies work in a given social and ecological context, precisely the experimentation function Ostrom attributed to polycentric systems (Ostrom, 2012). Yet this same autonomy from central coordination is what produces the fragmentation, uneven capacity, and, per the 2025 C40 assessment, the limited translation of network level ambition into verified local implementation that characterizes the bottom up record (Persson and Nasiritousi, 2025).

On accountability specifically, neither model possesses a strong enforcement mechanism at its own native scale. Parties to the Paris Agreement are obligated to pursue their NDCs but not legally bound to achieve them, while city network membership has been shown to correlate with stated ambition more reliably than with delivered implementation (Persson and Nasiritousi, 2025). The one clear exception in the record examined here, the Urgenda ruling, achieved genuine enforceability, but did so by routing around both the international and the municipal network tiers entirely and locating enforcement in a national court applying domestic human rights law, which suggests that meaningful accountability in this field has so far been easier to achieve through litigation than through either intergovernmental consensus or voluntary network membership (*State of the Netherlands v. Urgenda Foundation*, 2019). The difference between the UNFCCC and city network cases lies less in enforcement than in feedback speed and grain: national governments report once every five years through a Global Stocktake covering an entire economy, while individual cities and communities can observe and adjust against their own emissions inventories on a much shorter cycle, even if that faster feedback loop does not by itself guarantee delivery (C40 Cities, ICLEI and WRI, 2014).

On implementation outcomes, the comparison is asymmetric in an important respect. Because the UNFCCC operates a standardized global reporting architecture, its implementation gap is precisely quantified: a 17 percent projected reduction against a needed 60 percent, narrowing to about 12 percent in the pre COP30 update as more Parties submitted NDCs, and a residual 2.3 to 2.5 degree warming trajectory even under full NDC implementation (UNFCCC, 2025; UNFCCC, 2025b; UNEP, 2025). No equivalent aggregate accounting exists for the totality of bottom up climate action, even though individual components, such as the roughly 0.6 gigaton annual footprint of disclosing C40 cities, are measurable in isolation (C40 Cities, ICLEI and WRI, 2014). This asymmetry itself is informative. It suggests that one underappreciated advantage of the top down model is not effectiveness but rather auditability, the capacity to know, in aggregate and on a common basis, how far short of the goal the system currently stands, a capacity that a purely bottom up system, however energetic, cannot straightforwardly replicate on its own.

The two models also diverge in how evenly their strengths and weaknesses are distributed across the world. The UNFCCC's consensus procedure gives small island states and least developed countries a formal seat at the table they would not otherwise have, which is part of what grounds the claim that it offers the highest available degree of legitimacy, but the same procedure means their negotiating leverage is diluted whenever a small number of large emitters coordinate a common position (IISD, 2020). Bottom up governance shows the inverse pattern: transnational municipal networks are disproportionately composed of large, wealthy, well resourced cities capable of building the technical and administrative capacity to disclose data on the C40 platform in the first place, which means the roughly 0.6 gigaton figure captures the mitigation activity of the most capable subset of cities, not a representative cross section of global urban emissions (C40 Cities, ICLEI and WRI, 2014). Both models, in other words, tend to reproduce existing asymmetries of capacity and resources even as they formally claim to represent an inclusive constituency, a pattern the polycentric literature has begun to interrogate directly rather than treat as incidental to the question of institutional design (Kellner, Petrovics and Huitema, 2024).

A final point of comparison concerns adaptive capacity narrowly defined, that is, the speed at which each model can revise its own commitments in light of new information. The UNFCCC's five year Global Stocktake cycle is, by design, slower than the annual or even continuous reporting cycles available to individual cities, but it is also the only mechanism in this comparison capable of producing a synchronized, economy wide revision across nearly two hundred jurisdictions at once. Bottom up actors can revise faster, but only for themselves. There is no mechanism by which one city's faster learning cycle propagates automatically to another city's target, absent the kind of peer learning infrastructure that networks like C40 and ICLEI exist specifically to provide (Kern and Alber, 2025).

SYNTHESIS

The comparative case analysis undertaken does not support the conclusion that either the top down or the bottom up governance model is, on its own, adequate to the scale of the climate mitigation challenge. The UNFCCC supplies universality, a common accounting standard, and the highest available degree of international legitimacy, but its consensus based design has consistently produced targets, and delivery against those targets, that fall well short of what the Intergovernmental Panel on Climate Change indicates is required (UNFCCC, 2025). Local and community climate initiatives supply speed, contextual fit, and genuine experimentation, exemplified by transnational networks such as C40 and ICLEI, by community based energy cooperatives, and by domestic climate litigation such as the Urgenda case, but they suffer from fragmentation, an absence of centralized accounting, and, per recent empirical assessment, a gap between stated network ambition and verified local delivery that mirrors the very implementation gap found at the international level (Persson and Nasiritousi, 2025).

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These findings are broadly consistent with the expectations of polycentric governance theory. Rather than validating a choice between centralized and decentralized governance, the evidence supports Ostrom's original claim that a system of overlapping, mutually aware governance centers, linked by shared information and common accounting standards even where their commitments remain formally autonomous, is more likely to close the mitigation gap than either model operating in isolation (Ostrom, 2010). The observed trend within the UNFCCC process itself, most notably the 2025 finding that ninety five percent of Parties now report engaging subnational and non state actors in NDC implementation, suggests that international climate governance is already moving, however unevenly, toward this polycentric linkage rather than away from it (UNFCCC, 2025).

The comparative implication for climate governance design is therefore not to select a preferred model but to strengthen the connective tissue between them. International frameworks should continue to supply the common accounting and legitimacy that only near universal ratification can provide, while explicitly building in the monitoring, disclosure, and sanctioning mechanisms that the commons governance literature identifies as the missing ingredient that allows bottom up cooperation to outperform goodwill alone (Ostrom, 1990). Absent that connective architecture, both governance tiers appear structurally prone to the same underlying failure: ambitious commitment that outpaces verified delivery.

Translating that connective tissue argument into concrete design terms, three features recur across the sources reviewed here as the most plausible linkage points between the two tiers. The first is mandatory but flexible subnational reporting nested inside the Paris Agreement's Enhanced Transparency Framework, so that city and community level data feeds upward into the same accounting system the Global Stocktake already uses, rather than remaining siloed in separate platforms such as the C40 disclosure system. The second is graduated, network level sanctioning of the kind Ostrom's commons research identifies as missing from most city networks, for instance conditioning continued C40 or ICLEI membership benefits on verified, rather than merely stated, progress against a member city's own inventory. The third is treating domestic climate litigation, exemplified by Urgenda, not as an anomalous one off but as a deliberate complementary accountability channel, since it is the one instance in this comparison where a court converted a voluntary sounding commitment into an enforceable one. Embedding a comparable domestic legal hook into more national implementing legislation could extend that channel beyond the small number of jurisdictions where it has so far arisen (State of the Netherlands v. Urgenda Foundation, 2019).

LIMITATIONS AND FUTURE RESEARCH

This study's conclusions are bounded by its method. A qualitative comparative case design built on documentary analysis of two paradigmatic cases can identify structural patterns with reasonable confidence, but it cannot, by itself, establish how representative the UNFCCC and C40/ICLEI are of the full population of top down and bottom up climate institutions, nor can it fully substitute for primary interview data with the officials and practitioners who operate these institutions day to day. The evidentiary asymmetry noted in the Comparative Analysis section, precise aggregate accounting for the top down case against fragmented, city by city data for the bottom up case, is itself partly an artifact of which sources are publicly available for documentary review, and a study incorporating direct engagement with non disclosing cities and smaller community initiatives might narrow, though it seems unlikely to eliminate, that asymmetry.

Three extensions would meaningfully strengthen the empirical base this paper draws on. First, a quantitative meta analysis pooling city level emissions outcomes across C40, ICLEI, and the Global Covenant of Mayors, rather than relying on a single mixed methods study of C40 alone, would test whether the pledge delivery gap identified here generalizes across networks or is specific to C40's institutional design. Second, a longitudinal comparison of NDC Synthesis Report findings across successive COP cycles, extending the single snapshot comparison used here into a trend line, would help distinguish whether the top down tier's movement toward polycentric linkage, evident in the 2025 non Party stakeholder engagement figures, is a durable structural shift or a one off feature of the pre COP30 reporting round (UNFCCC, 2025). Third, a systematic cross national inventory of climate litigation outcomes beyond the Urgenda case would clarify whether domestic courts represent a generalizable third accountability channel operating alongside the top down and bottom up models examined here, or whether Urgenda's outcome reflects features specific to Dutch law that are unlikely to recur elsewhere.

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