ARTICLE

Interprovincial Unionization and the Environment

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Abstract: The relationship between labour movements and the environment has been the subject of considerable debate but little empirical research. Using panel data for Canadian provinces between 2001 and 2019, this article investigates the relationship between unionization rates and two measures of environmental quality: greenhouse gas emissions and total particulate matter pollution. We find that higher unionization rates are associated with lower emissions for both these measures. This finding suggests that stronger labour organizations do not lead to detrimental environmental outcomes.

Keywords: unionization, environment, pollution, climate, Canada

Résumé : La relation entre les mouvements syndicaux et l'environnement a fait l'objet de débats considérables, mais de peu de recherches empiriques. À l'aide de données de panel pour les provinces canadiennes entre 2001 et 2019, cet article étudie la relation entre les taux de syndicalisation et deux mesures de la qualité de l'environnement : les émissions de gaz à effet de serre et la pollution totale par les particules. Nous constatons que des taux de syndicalisation plus élevés sont associés à des émissions plus faibles pour ces deux mesures. Cette constatation suggère que des organisations syndicales plus fortes ne conduisent pas à des résultats environnementaux préjudiciables.

Mots clefs : syndicalisation, environnement, pollution, climat, Canada

The relationship between unions and environmental outcomes is of keen interest, since unions are the primary political-organizational form of workers' power (at least in the Global North) and because conversations about socio-ecological transformations are no longer limited to the political margins. They have worked their way into factories, headquarters, boardrooms, and

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legislatures. Labour has a key role to play in these conversations and in the trajectory of socio-ecological transformation, not least out of self-interest and the defence of jobs, wages, and conditions of employment, but also because, as Stefania Barca stresses today, just as Marx stressed in the 19th century, "workers – broadly defined as those performing physical labour, including non-paid housekeeping and life-supporting work – are the primary interface between society and nature."[1]

Decisions about what gets produced and how are matters that capital tries to reserve exclusively for itself. Insofar as it is successful in doing so, it is capital that bears responsibility for socio-ecological transformation and ecological crisis. The climate crisis – along with the more general ecological crisis – is generated not through individual consumer choices but within Marx's "hidden abode of production."[2] Workers, as Matthew Huber points out, are the social force best positioned to effectively confront capital within that hidden abode.[3] How workers and their organizations act to shape production has consequences not only for their own well-being but for everybody's – human and non-human alike.

In the tradition of literature that attempts to quantify the impact of unions on the broader society in which they operate, this study conducts a quantitative analysis of the relationship between Canadian provincial unionization rates and measures of environmental sustainability.[4] Specifically, it looks at whether there is a connection between provincial unionization rates and two key environmental measures: greenhouse gas (GHG) emissions and total particulate matter (TPM). Ultimately, as is documented below, we find that higher unionization rates are associated with lower emissions for both these measures. For these specific findings to be rooted in an appropriate context, they need to be situated within a much broader, international conversation about the relationship between organized labour and the environment.

Unions can have an environmental impact in a number of ways. At the workplace level, unions can, and have, bargained for pro-environmental clauses in their collective agreements. To the extent that this occurs, it is possible that areas of higher unionization will have better environmental outcomes. Unions can also be effective beyond the benefits they can win for their membership. Non-unionized workers can receive many of the benefits, environmental or otherwise, obtained by unionized workers, as employers compete for workers

1. Stefania Barca, "On Working-Class Environmentalism: A Historical and Transnational Review," *Interface* 4 (November 2012): 75.

2. Karl Marx, *Capital*, vol. 1 (New York: Penguin, 1990), 279; Matthew Huber, *Climate Change as Class War: Building Socialism on a Warming Planet* (New York: Verso Books, 2022); Ian Hudson and Mark Hudson, *Consumption* (Cambridge, UK: Polity, 2021).

3. Huber, *Climate Change as Class War.*

4. For an early example of work quantifying unions' social impacts, see Richard B. Freeman and James L. Medoff, *What Do Unions Do?* (New York: Basic Books, 1984).

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and attempt to prevent unions in their workplaces. Additionally, unions are political actors that can influence public opinion, engage in lobbying, and support political parties. In political systems like those in Canadian provinces that this study investigates, in which policies are packaged into bundles under the broad banner of political parties, it is even possible for unions' political efforts to have an indirect effect. For example, if unions support a "left-leaning" political party because it will be more likely to implement pro-labour policies, that same party may also be more likely to pass environmental protection measures.

The connection between unionization and the environment may not be as readily apparent as the connection between unionization and what are traditionally seen as more "bread and butter" issues like wages and pensions. Yet previous studies have suggested that unions can act on a variety of issues that would not immediately be associated with the interests of a union. The authors of a recent study on the role of unions in a broader democracy observe, "In between elections, unions also help develop political interest and skills among workers who might not otherwise devote much time to thinking about politics. And, on a deeper level, unions shape how working-class Americans perceive their political and economic interests."[5]

For example, strong unions and high unionization rates have been crucial in winning universal, public health care.[6] Similarly, union members are more likely to oppose trade liberalization than other workers. On this issue, unions with more active communications efforts have a stronger effect on member opinions than do unions with more meagre information campaigns.[7] A union with a particularly strong information campaign, it has been demonstrated, can persuade its members to oppose policies that are in their own interest but harmful to workers as a broader group.[8] Research in the United States has shown that differences in subnational unionization rates can result in different voting patterns in different states. In states in which it is more difficult to form unions ("right to work" states), voter turnout is about two points lower than in others, and Democrat candidates fare two to five points worse. Even more

5. James Feigenbaum, Alexander Hertel-Fernandez, and Vanessa Williamson, "Right-to-Work Laws Have Devastated Unions – and Democrats," *New York Times*, 8 March 2018, https://www.nytimes.com/2018/03/08/opinion/conor-lamb-unions-pennsylvania.html.

6. Vicente Navarro, "Why Some Countries Have National Health Insurance, Others Have National Health Services, and the US Has Neither," *Social Science & Medicine* 28 (January 1989): 887–898.

7. Sung Eun Kim and Yotam Margalit, "Informed Preferences? The Impact of Unions on Workers' Policy Views," *American Journal of Political Science* 61 (July 2017): 728–743.

8. The International Longshore and Warehouse Union ran an information campaign to oppose free trade despite its potential to increase the volume of shipping. See John S. Ahlquist, Amanda B. Clayton, and Margaret Levi, "Provoking Preferences: Unionization, Workers' Attitudes toward International Trade, and the ILWU Puzzle," *International Organization* 68 (Winter 2014): 40.

tellingly, prior to the implementation of right-to-work laws, those states had almost identical voting patterns to other states.[9]

The empirical literature on how, and in what direction, labour unions affect the environment is scarce, but there has been considerable theorizing about the connections between unions and the environment as well as research on efforts that specific unions have undertaken to promote environmental policies beyond their obvious and immediate workplace interest in occupational safety and health.[10] Some scholars, considering the material interests of unions, suggest that there exists a binding trade-off between environmental protection and jobs.[11] As capital invests in labour-saving technology, environmentally damaging economic growth is the only way to maintain employment. Therefore, workers, and the unions that represent them, often oppose policies that protect the environment.[12]

It is not hard to think of unions that represent workers in specific industries, from fossil fuels to mining to logging, that might feel legitimately threatened by policies that protect the environment. Taking just one of many possible historical examples, during an intense period of conflict over forestry in British Columbia in the 1990s, one of the two major woodworkers' unions in Canada joined forces with timber capital in opposition to environmental regulations and wilderness set-asides, pitting its members against environmental organizations by insisting that environmental regulation and preservation were job killers.[13] As revealed in the "spotted owl" controversy in the US Pacific Northwest in the 1990s, and now again in the declining jobs-per-barrel figures for the Canadian oil sands, labour-saving automation is often a much bigger risk to workers' job security than environmental protection measures.[14] Yet the

9. James Feigenbaum, Alexander Hertel-Fernandez, and Vanessa Williamson, "From the Bargaining Table to the Ballot Box: Political Effects of Right to Work Laws," NBER working paper no. 24259, 2018.

10. Stefania Barca, "Laboring the Earth: Transnational Reflections on the Environmental History of Work," *Environmental History* 19 (January 2014): 3–27; Barca, "Labour and the Ecological Crisis: The Eco-modernist Dilemma in Western Marxism(s) (1970–2000s)," *Geoforum* 98 (January 2019): 226–235.

11. Nora Räthzel and David Uzzell, "Trade Unions and Climate Change: The Jobs versus Environment Dilemma," *Global Environmental Change* 21 (October 2011): 1215–1223.

12. Allan Schnaiberg, *The Environment: From Surplus to Scarcity* (Oxford: University of Oxford Press, 1980); Kenneth Gould, David Pellow, and Allan Schnaiberg, *The Treadmill of Production: Injustice and Unsustainability in the Global Economy* (New York: Paradigm, 2008); Camila Huerta Alvarez, Julius Alexander McGee, and Richard York, "Is Labour Green?," *Nature and Culture* 14 (March 2019): 17–38.

13. Alexander Simon, "A Comparative Historical Explanation of the Environmental Policies of Two Woodworkers' Unions in Canada," *Organization and Environment* 16 (September 2003): 289–305.

14. The 1990 listing of the spotted owl as "threatened," and the resulting limits on logging, pitted Pacific Northwest loggers against environmentalists in a bitter dispute.

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jobs-versus-environment trade-off is particularly salient when we acknowledge the crucial element that employment, at least in some industries, plays in identity formation. If people see their identity as "miners" or "steelworkers," it means that even the provision of alternative employment for those put out of work by environmental restrictions in a "just transition" may not be welcomed by the displaced workers.[15] Drawing on the same BC forestry example, Alexander Simon quotes the Industrial Wood and Allied Workers of Canada (IWA) regarding proposed reductions in the annual allowable cut, in which the IWA describes those reductions as a threat to forestry workers' "unique way of life."[16] There are certainly many examples of unions opposing specific environmental policies that were seen as detrimental to the industries in which they operate.[17]

More generally, protective environmental policy can increase production costs for firms, which can decrease overall investment and reduce employment. Though reductions in investment and employment are not inevitable results of environmental legislation and regulation, employers have successfully built alliances with workers and unions by claiming otherwise, enlisting workers to resist environmental measures by threatening plant closures and job loss.[18] As a result, especially since the late 1970s, many unions came to support employers and industry against environmental measures, and many continue to walk on eggshells around their members when it comes to the environment.

As recently as 2018, neither the environment nor climate change was listed as an issue that the American Federation of Labor and Congress of Industrial Organizations (AFL-CIO) "cares about."[19] In 2019, the AFL-CIO did not support

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See William G. Robbins, *Landscapes of Conflict: The Oregon Story, 1940–2000* (Seattle: University of Washington Press, 2004), 211. On Alberta's oil sands, see Ian Hussey, *The Future of Alberta's Oil Sands Industry: More Production, Less Capital, Fewer Jobs* (Edmonton: Parkland Institute, 2020), https://policycommons.net/artifacts/2276524/the-future-of-albertas-oil-sands-industry-more-production-less-capital-fewer-jobs/3036504/.

15. Räthzel and Uzzell, "Trade Unions and Climate Change."

16. Simon, "Comparative Historical Explanation."

17. For logging, see John Bellamy Foster, "The Limits of Environmentalism without Class: Lessons from the Ancient Forest Struggle of the Pacific Northwest," *Capitalism, Nature, Socialism* 3 (March 1993): 11–41; for nuclear power, see R. Logan and D. Nelkin, "Labour and Nuclear Power," *Environment: Science and Policy for Sustainable Development* 22, 2 (1980): 6–34.

18. Richard Kazis and Richard Grossman, *Fear at Work: Job Blackmail, Labor, and the Environment* (New York: Pilgrim, 1982); Fred Rose, "Labor-Environmental Coalitions," *WorkingUSA* 6 (December 2003): 51–70.

19. Dimitris Stevis, "Labour Unions and Green Transitions in the USA: Contestations and Explanations," working paper no. 108, Adapting Canadian Work and Workplaces to Respond to Climate Change (ACW), Toronto, 2019, https://yorkspace.library.yorku.ca/xmlui/handle/10315/39419.

the Green New Deal proposed by US President Joe Biden – a position that was justified by its president Richard Trumka, who stated, "the worker's interest wasn't really figured into it."[20] In a joint letter from the International Brotherhood of Electrical Workers and the United Mine Workers of America to the Committee on Energy and Commerce, also from 2019, relating to Biden's now dead-letter climate legislation, the two unions' international presidents wrote, "We are deeply concerned about the potentially adverse impacts of certain policy proposals that would severely reduce, if not outright eliminate, our nation's fossil fuel energy sector. There is simply no realistic prospect for a 'just transition' that could meaningfully offset the loss of well over one million skilled, high-paying jobs with good benefits in the electric utility, oil and gas, rail, and coal sectors."[21] As a result of this recent history, and of high-profile union support for anti-ecological development projects like the Keystone XL pipeline in the United States, or resistance from miners to coal phase-out in Poland or to a carbon tax in Australia, the view of unions and environmentalists as conflicting parties is commonplace and has a basis in real disputes.[22] While there is movement toward a "truce" between Scottish environmentalists and oil workers in the North Sea, one offshore worker summed up the state of relations by saying that "a couple of years ago the only thing we [oil workers and environmentalists] would have shared is a square go [meaning a fair fist fight]."[23] Moments of co-operation are celebrated as a possible "new leaf" being turned, against a backdrop of overall conflict.

However, many unions have a long history of promoting environmental issues and policies.[24] The collapse of what was a promising coalitional front of US workers and environmentalists fighting corporate power, and the subsequent split between the two, is located by historians in the mid- to late-1970s

20. Quoted in Umair Irfan, "The Green New Deal Is Fracturing a Critical Base for Democrats: Unions," *Vox*, 19 June 2019, https://www.vox.com/2019/5/22/18628299/green-new-deal-labour-union-2020-democrats.

21. L. R. Stephenson and C. E. Roberts to Honorable Frank Pallone Jr. and Honorable Greg Walden, Committee on Energy and Commerce, 12 February 2019, http://www.ibew.org/Portals/22/IBEW%20Letters/2019/IBEW%20UMWA%20Letter%20on%20Climate.pdf?ver=2019-02-13-102354-593.

22. Paul Hockenos, "As Pressures Mount, Poland's Once-Mighty Coal Industry Is in Retreat," *E360* (Yale School of the Environment), 20 October 2020, https://e360.yale.edu/features/as-pressures-mount-polands-once-mighty-coal-industry-is-in-retreat; Jacklyn Cock and Rob Lambert, "The Neo-liberal Global Economy and Nature: Redefining the Trade Union Role," in Nora Räthzel and David Uzzell, eds., *Trade Unions in the Green Economy: Working for the Environment* (New York: Routledge, 2013), 89–100.

23. Karl Mathiesen, "Greens and Rig Workers Call a Truce in Europe's Oil Capital," *Politico*, 3 June 2022, https://www.politico.eu/article/scotland-greens-rig-workers-call-a-truce-in-europes-oil-capital/.

24. Scott Dewey, "Working for the Environment: Organized Labour and the Origins of Environmentalism in the USA, 1948–1970," *Environmental History* 3 (January 1998): 45–63.

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– and took hold more strongly in the 1980s. The work of labour historians including Scott Dewey, Erik Loomis, and Chad Montrie uncovers a neglected past of farmers, workers, and unions pursuing conservation and environmental goals much earlier than that.[25] Montrie, in particular, not only emphasizes the role of working-class people in seeding environmental consciousness in the United States but shows that industrial transitions involve new labour processes and thereby change the way workers know and relate to nature. Montrie and other scholars provide important early histories of working-class environmental protection and advocacy that force us to rethink the common understanding of environmentalism as a middle-class, professional movement from the outset. They also provide analyses of the political-economic, industrial, cultural, and network conditions that have variously encouraged and discouraged working-class and union environmentalism.[26]

The story of trade unionist Tony Mazzocchi's environmental advocacy – and his work to tie worker health and planetary health together through the 1970s and 1980s as the citizenship-legislative director of the Oil, Chemical, and Atomic Workers Union (OCAW) – is fairly well known.[27] Mazzocchi is credited as pivotal in the passage of the *Occupational Safety and Health Act* and as having pioneered the concept of "just transition." However, industrial unions in the United States were demonstrating what now appears to be a startling ecological awareness even in the late 1940s through to the 1950s and 1960s. In addition to the United Auto Workers (UAW) and OCAW, the United Steelworkers, the United Farmworkers, and the AFL-CIO all advocated fiercely for strong regulations to ensure clean air and water. Figures such as the UAW's Walter Reuther and Olga Madar were making public arguments in the 1960s that connected worker struggles to the living conditions of working-class communities. Madar argued that better health and safety measures won in the plant were of little value when workers went home to find their communities

25. Dewey, "Working for the Environment"; Erik Loomis, "When Loggers Were Green: Labor, Lumber, and Conservation, 1937–48," *Western Historical Quarterly* 46 (November 2015): 421–441; Erik Loomis, *Empire of Timber: Labor Unions and the Pacific Northwest Forests* (New York: Cambridge University Press, 2016); Chad Montrie, *Making a Living: Work and Environment in the United States* (Chapel Hill: University of North Carolina Press, 2008); Chad Montrie, *The Myth of Silent Spring: Rethinking the Origins of American Environmentalism* (Oakland: University of California Press, 2018).

26. Loomis, *Empire of Timber*; Fred Rose, *Coalitions Across the Class Divide: Lessons from the Labor, Peace, and Environmental Movements* (Ithaca: Cornell University Press 2000); Rose, "Labor-Environmental Coalitions"; Dewey, "Working for the Environment"; Robert Gordon, "Shell No!": OCAW and the Labor-Environmental Alliance," *Environmental History* 3 (October 1998): 460-487.

27. Gordon, "Shell No!"; Sean Sweeney and John Treat, "Trade Unions and Just Transition: The Search for a Transformative Politics," *Trade Unions for Energy Democracy* (New York: CUNY The Murphy Institute and Rosa Luxemburg Stiftung New York Office 2018), https://unionsforenergydemocracy.org/resources/tued-working-papers/.

polluted.[28] Dewey quotes a UAW regional director's 1969 comments before the Senate Subcommittee on Environmental Pollution of the Committee on Environment and Public Works (the Muskie Subcommittee), which are, while likely not representative, remarkable for the radical view they reflect: "Better we tear the factories to the ground, abandon the mines, plug the petroleum holes and fill the fuel tanks of our cars with sugar than continue this doomsday madness … We demand that uncompromising and irreversible standards and controls be established to preserve our environment, no matter what the cost, no matter how great the violation of property rights, no matter what the effect on dividends and no matter what the effect on our own bold plans for collective bargaining."[29] While unions highlighted the job creation and workplace safety aspects of environmental measures, they did not cleave to an exclusively instrumental form of environmentalism. Rather, they expressed a "whole worker" orientation, in which defending members meant doing so in the workplace and outside of it, including ensuring a safe, healthy, and sustainable environment. Many unions were strong and vocal supporters of measures not just for clean air and water but for protected recreational and wilderness spaces.[30]

The specific histories and timelines of labour environmentalism differ from place to place, but accounts of union activism in defence of the environment have emerged from around the world. Verity Burgmann's "pre-history" of labour initiatives on behalf of environmental protection in Australia begins in the 1970s, with the establishment of the union-led Environmentalists for Full Employment, which effectively fought for a "jobs *and* environment" framework of labour activism – recognizing that the destruction of labour and the devastation of nature were jointly rooted in labour-saving, capital-intensive patterns of investment.[31] Without denying the durability and force of the jobs-versus-environment narrative in Australian politics, Burgmann argues that it is by no means uncontested within either the history or the contemporary ranks of Australian labour. James Patrick Nugent's work on the Canadian union response to climate change shows that significant work within high-carbon, industrial unions such as the Canadian Auto Workers (CAW) and the United Steelworkers of America (USW) went into preventing the emergence

28. Dewey, "Working for the Environment," 52.

29. Kenneth Worley, "Statement to the Subcommittee on Air and Water Pollution of the Committee on Public Works, United States Senate, Oct. 27, 1969," Washington, DC, 1970, 163, quoted in Dewey, "Working for the Environment," 56.

30. Dewey, "Working for the Environment."

31. Verity Burgmann, "From 'Jobs versus Environment' to 'Green-Collar Jobs': Australian Trade Unions and the Climate Change Debate," in Räthzel and Uzzell, eds., *Trade Unions in the Green Economy*, 131–145.

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of a labour-environmentalist split over global warming, beginning as early as 1980 and building through the 1990s.[32]

Nor is this history of union environmentalism limited to urban workers. In the forestry sector, the history of unions pushing for conservation and environmental goals goes back at least as far as the 1930s and 1940s, when the International Woodworkers of America (IWA) pushed a strong conservationist agenda (in opposition to its rival union, the United Brotherhood of Carpenters). The IWA talked about the need to maintain healthy forests for both the long-term security and the recreational enjoyment of forest workers.[33] When the bill for the creation of Olympic National Park was brought forward in 1938, industrial and commercial forces – as well as the United States Forest Service – strongly opposed the inclusion of the peninsula's forests within the park boundaries. The IWA, however, championed it as a means of preserving wildlife and forests from "greedy and rapid depletion" at the hands of corporate lumbermen. Loomis argues that, following that battle, "the IWA would make conservation central to its mission, providing the strongest working-class challenge to corporate forestry in the Northwest's history."[34] The IWA saw the roots of worker exploitation and environmental degradation as growing jointly in the soil of private, corporate control over US forests and forest management. Its leadership worked doggedly in the postwar period for a conservationist forestry, policed by a government that would actively regulate the pace and character of lumbering. From the 1950s through the 1970s, the IWA supported measures for expanded wilderness and roadless areas, stressing the importance of these areas in workers' leisure time. As in the case of urban union environmentalism, the IWA's conservationist agenda foundered on the economic instability and high unemployment of the 1970s, amid massive restructuring, automation, and capital flight within the timber industry. Loomis also points out that while the IWA leadership had evinced a union conservationism, they had failed to foster that framework within the rank and file, leaving them open to job blackmail and the scapegoating of environmentalists for unemployment.[35]

In Canada, Simon shows that the Pulp, Paper and Woodworkers of Canada (PPWC) – in contrast to its rival union, the Canadian IWA – has its own, more recent history of conservationist and preservationist environmentalism in forest policy and regulation.[36] In the 1990s, the PPWC, in coalition with environmental organizations, supported thoroughgoing reform of the

32. James Patrick Nugent, "Changing the Climate: Ecoliberalism, Green New Dealism, and the Struggle over Green Jobs in Canada," *Labour Studies Journal* 36 (March 2011): 58–82.

33. Loomis, "When Loggers Were Green."

34. Loomis, "When Loggers Were Green," 428, 429.

35. Loomis, "When Loggers Were Green."

36. Simon, "Comparative Historical Explanation."

forest industry's environmental practices and the establishment of protected wilderness areas. The PPWC argued that the need was for more jobs cutting fewer trees, rather than for preserving jobs by maintaining an unsustainable annual allowable cut. In *Labour/Le Travail*, John-Henry Harter's recent Gramscian analysis of the success and foundering of the Tin Wis coalition of First Nations, politicians, environmentalists, and unions reveals the opportunity for radical coalitions in British Columbia forestry, as well as the structural and ideological forces that work to undermine them in favour of state-corporate compromises.[37]

In terms of the Global South, while there is a shortage of literature on union environmentalism specifically, scholars and activists have long pointed out that working people have been at the forefront of environmental struggle. The "environmentalism of the poor" characteristic of resource and environmental conflict in the South is rooted in resistance to natural-resource extraction for environmental, cultural, and livelihood reasons.[38] One notable contribution within this tradition is João Paulo Cândia Veiga and Scott B. Martin's account of the Rural Workers Trade Union in Brazil – which worked to organize families and communities in opposition to destructive logging in the Amazon – in which the authors tie together issues of livelihood and environmental protection.[39]

The period of high-profile and high-visibility conflict between unions and environmentalists came to a full boil through the 1980s and 1990s. Then, in the late 1990s, a convergence of interests in resistance to trade and investor agreements that threatened both labour rights and environmental protection sparked episodes of renewed co-operation. Since the 2010s, the threat of climate change – and associated resource depletion in such sectors as timber and fisheries – has spurred some more significant efforts to rebuild bridges between labour and environmentalists. Beyond the "Teamsters and turtles" moment during the 1999 anti–World Trade Organization protests in Seattle, in which labour and environmentalists had clear common cause, unions are becoming more ecologically attuned, recognizing (again) that environmental conditions in workplaces and communities are the conditions of life for their members. At times, this attunement is the result of shifting structural conditions for the success of both labour and environmental movements. In an analysis of the potential for labour-environmental coalitions in South Korea

37. John-Henry Harter, "Histories of Environmental Coalition Building in British Columbia: Using History to Build Working-Class Environmentalism," *Labour/Le Travail* 90 (Fall 2022): 203–222.

38. Joan Martinez-Alier, *The Environmentalism of the Poor: A Study of Ecological Conflicts and Valuation* (Northampton, MA: Edward Elgar, 2003).

39. João Paulo Cândia Veiga and Scott B. Martin, "Climate Change, Trade Unions, and Rural Workers in Labour-Environmental Alliances in the Amazon Rainforest," in Räthzel and Uzzell, eds., *Trade Unions in the Green Economy*, 117–130.

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and Taiwan, for example, Hwa-Jen Liu argues that largely as a result of strategic concerns related to organizing and fluctuations in their respective bases of power, labour and environmental movements are "travelling towards each other."[40]

In the United States, a scan of union activities identified 50 "action-oriented initiatives" – which involved real commitment of union resources – to address climate change that were either ongoing or recently completed as of 2018.[41] Brian K. Obach found no conflict between labour leaders and environmental leaders in the United States, even in industries where job loss owing to environmental measures was a real possibility. Obach argued that this was due to the strategic behaviour of union leaders that changed with globalization and neoliberal policies.[42] Similarly, in the United Kingdom, new labour leaders are increasingly interested in climate change–related issues.[43] John Calvert shows that while unions' general capacity to influence the shape of environmental policy varies across European countries, overall, "labour has been a strong supporter of tough measures to address climate change."[44] This is a trend not limited to leadership but visible also within the rank and file. For example, Josef Ringqvist finds that union members across Europe – especially, though not limited to, those in the high-GHG industries of construction and transportation – are more likely than their non-union counterparts to prioritize environmental protection over economic growth and jobs.[45]

Over the last two decades, many Canadian trade unions – and they are far from alone on this internationally – have taken deliberate action to address the environmental crisis by forming coalitions with environmental groups, developing environmental policies, charting transition pathways, negotiating climate clauses at the bargaining table, and recognizing the climate crisis as a social crisis.[46] There is evidence not only that many unions are aware of the

40. Hwa-Jen Liu, "Will They Tie the Knot? Labour and Environmental Trajectories in Taiwan and South Korea," in Räthzel and Uzzell, eds., *Trade Unions in the Green Economy*, 162–178.

41. Stevis, "Labour Unions and Green Transitions."

42. Brian K. Obach, "Labour-Environmental Relations: An Analysis of the Relationship between Labour Unions and Environmentalists," *Social Science Quarterly* 83 (March 2002): 82–100.

43. Paul Hampton, "Trade Unions and Climate Politics: Prisoners of Neoliberalism or Swords of Climate Justice," *Globalizations* 15, 4 (2018): 470–486.

44. John Calvert, "Climate Change, Construction and Labour in Europe: A Study of the Contribution of Building Workers and Their Unions to 'Greening' the Built Environment in Germany, the United Kingdom and Denmark," Work in a Warming World (W3) working paper no. 2011-04, Toronto, 2011, 6.

45. Josef Ringqvist, "Union Membership and the Willingness to Prioritize Environmental Protection above Growth and Jobs: A Multi-Level Analysis Covering 22 European Countries," *British Journal of Industrial Relations* 60 (September 2022): 662–682.

46. For example, see Adapting Canadian Work and Workplaces to Respond to Climate

need for environmental action and for broad coalitions but also of the detrimental effect of adopting a jobs-versus-environment framework.

The union movement is far from monolithic in its active strategies regarding the environment (as the environmental movement is not monolithic regarding labour). Part of the explanation is that unions themselves have different ideologies. Those with an emphasis on "business unionism," which focuses on members' on-the-job interests, tend to be less supportive of environmental policy, while those geared more toward "social unionism," which views itself and its members as having broader social interests, are more supportive.[47] The tension between jobs and the environment also frames the type of environmental solutions sought by even those unions that are supportive. Broadly speaking, unions tend to favour what might be termed Green Keynesianism, in which environmental solutions rely on government intervention to guide economic actors through regulation and price incentives, but in a manner that protects workers and their jobs, in the context of an ecological modernizing framework.[48] As one study examining international trade unions' engagement with the United Nations' climate change negotiations between the 1990s and 2020 concluded, unions are "torn between the competing priorities of ensuring workers' economic security and protecting the climate."[49]

The fragility of union environmentalism is well illustrated by the "pendulum swing" of South African labour from its much-lauded commitments to

Change (ACW), Green Collective Agreements Database (Toronto: ACW, 2021), https://adaptingcanadianwork.ca/green-collective-agreements-database/; ACW and United Steelworkers, "Climate Change and Just Transition: What Will Workers Need?," ACW, Toronto, 2018; CUPE, "Working Harmoniously on the Earth: CUPE's National Environment Policy," CUPE, Ottawa, 2013, https://cupe.ca/cupe-national-environment-policy; Public Service Alliance of Canada (PSAC), "PSAC in the Fight for Climate Action and a Just Transition," PSAC website, 25 September 2020, http://psacunion.ca/psac-fight-climate-action-and-just-transition; Unifor Research Department, "Unifor Energy Policy: A Progressive Vision for Canada's Energy Future," Unifor, Toronto, July 2017, https://www.unifor.org/sites/default/files/legacy/documents/document/energy_policy_2017_eng_final_web.pdf; Blue Green Canada and Mantle314, "Buy Clean: How Public Construction Dollars Can Create Jobs and Cut Pollution," Blue Green Canada, Toronto, 2021, https://bluegreencanada.ca/wp-content/uploads/sites/19/2021/01/Buy-Clean-How-Public-Construction-Dollars-Can-Create-Jobs-and-Cut-Pollution-Eng-2-1.pdf; Canadian Labour Congress (CLC), "A Climate Emergency Action Agenda," CLC, Ottawa, 2021.

47. Derek Hrynyshyn and Stephanie Ross, "Canadian Autoworkers, the Climate Crisis, and the Contradictions of Social Unionism," *Labour Studies Journal* 36 (March 2011): 5–36.

48. Romain Felli, "An Alternative Socio-ecological Strategy? International Trade Unions' Engagement with Climate Change," *Review of International Political Economy* 21, 2 (2014): 372–398; Nugent, "Changing the Climate."

49. Adrien Thomas, "Framing the Just Transition: How International Trade Unions Engage with UN Climate Negotiations," *Global Environmental Change* 70 (September 2021): 102347; see also Adrien Thomas and Nadja Doerflinger, "Trade Union Strategies on Climate Change Mitigation: Between Opposition, Hedging and Support," *European Journal of Industrial Relations* 26 (December 2020): 383–399.

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climate action and just transition in 2013 to its concerted defence of fossil-fuelled power generation in 2018.[50] The National Union of Metalworkers of South Africa (NUMSA) sponsored a series of resolutions at the 2013 Congress of South African Trade Unions that amounted to a firm rejection of the jobs-versus-environment trade-off and affirmed developing countries' right to industrialize and responsibility to mitigate climate change. Only five years later, the same union was in court to try to stop renewable generation contracts from being signed and sounding alarm bells at the possible loss of employment within the coal supply chain. In part, the union was protesting not the move from fossil fuel per se but the fact that the government was signing agreements with private power generators, weakening the nationally owned electricity public utility Eskom. In its earlier critiques of government plans, NUMSA had in 2012 insisted on a renewables strategy that was socialized and democratically controlled. When South Africa instead mothballed Eskom coal-fired generating plants and turned to private renewable generation, NUMSA threatened "the mother of all strikes."[51]

The "Climate Emergency Action Agenda" of the Canadian Labour Congress (CLC) also reflects this tension between workers in fossil-reliant industries and unions' overall commitment to strong climate action.[52] The agenda – which stakes out a number of strong, pro-environment stands – advocates for a transition to a net-zero carbon economy by 2050, walking a razor's edge on the question of oil-and-gas phase-out. The CLC argues for the "responsible development" of Canada's natural resources, with a focus on benefitting workers rather than corporate bosses and as part of a just transition toward net zero (which does not necessarily involve leaving oil and gas in the ground). This razor's edge is not a product of a waffling leadership but actually a reflection of the fact that the membership of some of the CLC's affiliates bristle at the notion that their unions would advocate for the demise of their industry.

A recent set of interviews with unionized public- and private-sector workers in Manitoba revealed that while most participants share the CLC's characterization of "climate emergency," they hold varying views on the speed and depth of the required transition, on the "parties responsible" for climate change, and on who is likely to bear the costs of either climate change or energy transition.[53]

50. Dinga Sikwebu and Woodrajh Aroun, "Energy Transitions in the Global South: The Precarious Position of Unions," in Nora Räthzel, Dimitris Stevis, and David Uzzell, eds., *The Palgrave Handbook of Environmental Labour Studies* (Cham: Palgrave Macmillan, 2021), 61.

51. Sikwebu and Aroun, "Energy Transitions," 70.

52. CLC, "Climate Emergency Action Agenda."

53. Mark Hudson, "Not Far, Not Fast: Possibilities and Limits to Just Transition in the Eyes of Unionized Workers," paper presented at the Society for the Advancement of Socio-economics, Amsterdam, July 2022. About one-quarter of the sample were directly exposed to fluctuations in energy-sector employment, as they were based in Manitoba but worked out-of-province on energy projects.

The vast majority of participants were strongly supportive of unions taking a more active role in climate politics, including through collective bargaining, and only a small minority expressed employment-based or "lifestyle" anxieties about a zero-carbon energy transition. Nonetheless, a minority of participants viewed climate change as external to "core" union business, and others argued that any union action on climate change had to have the strong support of rank and file – for which there is currently not strong evidence. In the context of provincial government austerity, public-sector wage freezes, and economic instability, there were many other priorities on the union agenda. Participants confirmed that climate change is not a "water cooler" topic at work, nor is it very salient in their relations and communications with either their employer or their union.

While a significant literature of case studies and histories of labour environmentalism is emerging, there has been relatively little quantitative empirical research on the connection between material ecological outcomes and unionization. Empirical studies are especially important because, as we pointed out in the introduction, there may be connections between unionization and the environmental impact beyond the deliberate actions of unions. Of the few studies of which we are aware, one study on Organisation for Economic Co-operation and Development (OECD) countries between 1970 and 2014 found that higher unionization rates were associated with lower CO2 emissions per person.[54] Another, by one of the co-authors of this article, used Canadian time series data from 1969 to 2016 and found that collective bargaining coverage was also negatively related to CO2 emissions.[55]

We seek to advance the existing literature by investigating whether subnational structural differences in unionization can have a measurable impact on provincial-level environmental measures. This is particularly important when provinces have considerable discretion over the legislation that can facilitate or hinder union formation, which has led to very different contexts for unions and unionization rates in different provinces.[56] As Rodney Haddow demonstrates, there is sufficient interprovincial variation to make a subnational study every bit as relevant as comparisons between nations.[57]

54. Alvarez, McGee, and York, "Is Labour Green?"

55. Anupam Das, "Does Unionization Reduce CO2 Emissions in Canada?" *Environmental Science and Pollution Research* 30 (May 2023): 61455–61465.

56. Anupam Das, Mara Fridell, Ian Hudson, and Mark Hudson, "Do Governments Matter? Provincial Policy and Redistribution in Two Canadian Provinces, 1990–2010," *Review of Social Economy* 78 (April 2020): 203–233.

57. Rodney Haddow, "Power Resources and the Canadian Welfare State: Unions, Partisanship and Interprovincial Differences in Inequality and Poverty Reduction," *Canadian Journal of Political Science* 47 (October 2014): 717–739.

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Data

In our analysis, we use provincial annual data on several variables from 2001 to 2019. Greenhouse gas (GHG) emissions and total particulate matter (TPM) emissions represent environmental quality. Both GHG and TPM are measured in tonnes. The most significant human health issues are specifically associated with particulate matter with diameters of 10 microns or less (PM10), broken into categories of coarse and fine (PM2.5). However, particulate matter with larger diameters (up to 100 microns), including such pollutants as cement dust and fly ash, are also relevant. While they are in the atmosphere for a shorter time, and do not reach into the human respiratory system beyond the nostril and upper tract, they still have consequences for vegetation, built environments, and ecosystems.[58]

Our main variable of interest is the strength of unions, which is measured by the unionization rate (UNION): the percentage of employees who are in unions. The other frequently used measure of unionization is collective bargaining coverage, which is defined as the percentage of the workforce covered by a collective agreement. In Canada, there is little difference between these two measures.[59]

We control for macroeconomic factors including real gross domestic product (GDP) and the rate of unemployment (UN). GDP is measured in 2012 constant prices. Real GDP is meant to control for the overall size of the economy. All else being equal, provinces with smaller economies, like Prince Edward Island, will have lower emissions than larger provincial economies, such as Ontario. It would be misleading to conclude without controlling for the relative sizes of the two economies that because Prince Edward Island had lower emissions than Ontario, it has a better environmental record. The unemployment rate is used to measure economic fluctuations. In recessions, reduced economic activity should, all else being equal, result in lower emissions.

In the GHG equation, we also control for the share of resource-sector output (mining, quarrying, and oil-and-gas extraction) in total provincial output (RES). We use the size of the resource sector relative to the entire economy to account for the disproportionate impact that this sector has in generating emissions. In the TPM equation, we replace RES with the share of the combined output of the manufacturing and resource sector in total industry output (MFGRES). This is done to determine whether heavier manufacturing centres are more likely to have particulate air pollution problems. Table 1 provides the definition and data sources of the variables used in this study.

58. Reto Gieré and Xavier Querol, "Solid Particulate Matter in the Atmosphere," *Elements* 6 (August 2010): 215–222.

59. The choice between the two is of much more importance in a nation like France, where collective bargaining coverage is substantially higher than the unionization rate.

Table 1: Definitions and Data Sources of Variables

Variable	*Definition*	*Data source*
GHG	Total greenhouse gases CO2 equivalent (megatonnes)	Canada's Official Greenhouse Gas Inventory
TPM	Summation of total particulate matter emissions from ore and mineral, oil and gas, electric power generation, manufacturing, transportation and mobile equipment, agriculture, commercial, residential and institutional, incineration and waste, paints and solvents, dust and fires industries	Government of Canada, Environment and Natural Resources, Air Pollutant Emissions Inventory
UNION	Employees who are members of a union as a percentage of all employees	Statistics Canada, Table 14-10-0129-01 (formerly CANSIM 282-0220)
GDP	Gross domestic product in constant prices	Statistics Canada, Table 36-10-0222-01 (formerly CANSIM 384-0038)
RES	Ratio of output from mining, quarrying, and oil-and-gas extraction sectors and output from the total industries	Statistics Canada, Table 36-10-0488-01
MFGRES	Ratio of output from manufacturing, mining, quarrying, and oil-and-gas extraction sectors and output from the total industries	Statistics Canada, Table 36-10-0488-01
UN	Unemployment rate	Statistics Canada, Table 14-10-0090-01 (formerly CANSIM 282-0123)

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Table 2: Unionization Rates (unionized employees as a percentage of all employees), Canadian Provinces, 2001–2019

Year	*AB*	*BC*	*MB*	*NB*	*NL*	*NS*	*ON*	*PEI*	*QC*	*SK*
2001	22.4	33.7	35.4	27.4	38.6	28.2	26.3	28.0	37.0	34.8
2002	22.2	33.4	34.7	26.7	37.7	27.1	26.5	29.0	36.8	34.0
2003	22.3	32.3	34.9	26.3	37.7	27.1	26.6	28.6	37.4	34.0
2004	21.9	32.1	35.0	26.9	37.3	27.5	26.3	30.9	36.7	34.1
2005	21.6	30.8	34.6	26.6	35.9	28.1	26.9	30.6	36.7	34.1
2006	22.3	30.2	34.4	26.2	35.6	27.0	26.2	28.3	36.5	34.3
2007	21.9	30.3	35.2	26.6	35.8	28.2	26.4	28.1	35.8	33.2
2008	22.0	29.4	34.8	27.5	35.9	27.6	26.3	29.2	35.6	33.2
2009	22.8	29.8	34.5	27.8	37.2	29.4	26.2	30.0	36.2	33.6
2010	22.6	29.7	35.4	27.9	37.3	28.5	26.3	30.2	35.8	33.6
2011	21.6	29.3	34.4	27.5	37.2	29.1	26.0	29.2	35.6	33.2
2012	21.8	29.4	33.9	27.6	36.6	28.5	26.4	30.9	36.3	32.7
2013	21.1	29.6	33.8	27.7	37.9	28.7	26.4	32.6	36.2	32.4
2014	20.4	28.6	33.8	27.5	35.5	29.4	25.5	31.0	35.8	31.4
2015	21.8	29.0	33.7	28.4	35.1	29.2	25.1	31.9	36.0	31.6
2016	23.1	27.7	33.1	26.8	36.2	29.6	25.3	29.2	35.4	30.9
2017	23.2	28.4	32.7	27.7	36.9	28.8	25.1	29.0	35.2	31.1
2018	22.9	27.5	32.1	28.3	36.0	28.1	24.6	29.8	35.1	31.6
2019	22.8	27.6	32.9	27.9	35.8	28.4	24.9	29.2	35.9	30.2
Per cent change 2001–19	1.8	-18.1	-7.1	1.8	-7.3	0.7	-5.3	4.3	-3.0	-13.2

Source: See Table 1.

Tables 2, 3, and 4 show the interprovincial variation, and the trend over time, in unionization rates and the two environmental indicators. Unionization rates (Table 2) show considerable interprovincial variation; for example, Alberta's unionization rate remains consistently around 22 per cent, while Newfoundland's and Québec's rates are above 35 per cent throughout the period. With a few exceptions, unionization rates have declined over this period – most notably in British Columbia, where the unionization rate fell from 33.7 per cent in 2001 to 27.6 per cent in 2019.

Table 3: GHG per capita (tonnes), Canadian Provinces, 2001–2019

Year	*AB*	*BC*	*MB*	*NB*	*NL*	*NS*	*ON*	*PEI*	*QC*	*SK*
2001	74.2	16.3	17.2	30.3	19.1	23.1	16.9	14.7	11.4	64.9
2002	72.4	15.4	17.6	28.5	23.1	22.2	17.0	14.8	11.6	65.6
2003	73.7	15.3	17.9	28.2	22.8	23.8	17.0	15.3	12.2	67.5
2004	71.7	15.6	18.0	29.3	21.5	25.5	16.6	15.4	12.1	69.0
2005	70.9	15.0	17.5	26.8	20.5	24.7	16.4	14.8	11.6	68.3
2006	70.5	14.7	17.6	26.4	19.8	23.3	15.5	14.3	11.2	67.5
2007	71.5	14.6	17.9	26.5	21.8	25.2	15.7	14.7	11.4	69.0
2008	69.3	14.6	17.7	24.8	20.8	22.8	14.9	14.0	11.0	68.6
2009	65.7	13.7	16.5	24.4	19.5	22.1	12.8	13.7	10.6	66.2
2010	66.4	13.2	16.1	24.2	19.1	21.7	13.3	13.7	10.1	65.0
2011	67.8	13.2	15.8	24.3	19.6	22.3	13.1	14.7	10.3	63.6
2012	68.9	13.0	16.6	21.7	18.7	20.5	12.6	14.1	10.1	65.0
2013	68.8	13.1	17.0	19.3	18.9	19.5	12.5	12.1	10.0	66.0
2014	68.1	12.8	16.8	17.7	20.7	17.7	12.0	11.8	9.7	66.7
2015	67.2	12.4	16.4	18.1	20.9	17.9	11.9	11.5	9.7	68.0
2016	62.9	12.7	16.3	18.8	21.2	16.5	11.6	11.7	9.6	65.0
2017	63.9	12.8	16.6	17.3	21.1	17.0	11.2	11.6	9.8	66.1
2018	63.4	13.1	17.0	17.0	20.8	17.5	11.4	11.3	9.8	65.6
2019	63.2	12.9	16.5	16.0	21.2	16.7	11.2	11.2	9.8	63.8
Per cent change 2001–19	-14.8	-20.7	-3.9	-47.3	11.1	-27.5	-33.7	-24.0	-13.7	-1.7

Source: See Table 1.

GHG emissions per capita (Table 3) are significantly higher in Alberta and Saskatchewan than in the other provinces. Per capita GHG emissions are generally declining, particularly in New Brunswick and Ontario; however, total GHG emissions have not fallen in Canada, with reductions in Ontario offset by increases in oil-producing provinces. Total GHC emissions in Alberta increased by 22 per cent (from 226 to 275 megatonnes) from 2001 to 2019, while Saskatchewan's increased by 15 per cent (from 65 to 75 megatonnes).

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Table 4: TPM per capita (tonnes), Canadian Provinces, 2001–2019

Year	*AB*	*BC*	*MB*	*NB*	*NL*	*NS*	*ON*	*PEI*	*QC*	*SK*
2001	1.94	0.19	1.52	0.27	0.29	0.28	0.18	0.37	0.15	7.69
2002	1.83	0.20	1.55	0.23	0.27	0.24	0.17	0.35	0.14	7.42
2003	1.79	0.20	1.59	0.25	0.33	0.26	0.18	0.34	0.14	7.30
2004	1.83	0.19	1.45	0.26	0.29	0.25	0.17	0.35	0.14	7.05
2005	1.81	0.19	1.41	0.21	0.30	0.25	0.18	0.34	0.13	6.85
2006	1.87	0.21	1.52	0.27	0.30	0.27	0.18	0.35	0.14	6.81
2007	2.15	0.20	1.56	0.29	0.31	0.28	0.20	0.39	0.15	6.90
2008	2.41	0.20	1.60	0.30	0.33	0.25	0.18	0.33	0.15	7.07
2009	1.88	0.20	1.46	0.29	0.33	0.29	0.19	0.36	0.16	7.13
2010	2.11	0.21	1.56	0.28	0.32	0.27	0.21	0.36	0.17	6.96
2011	2.16	0.21	1.66	0.36	0.35	0.26	0.20	0.34	0.17	7.41
2012	2.38	0.24	1.62	0.25	0.42	0.26	0.23	0.36	0.18	7.95
2013	2.33	0.23	1.63	0.23	0.41	0.26	0.22	0.35	0.18	8.27
2014	2.26	0.22	1.55	0.24	0.40	0.25	0.21	0.33	0.18	8.02
2015	2.28	0.22	1.63	0.23	0.42	0.26	0.22	0.34	0.18	8.17
2016	2.27	0.21	1.60	0.23	0.43	0.27	0.23	0.35	0.18	7.98
2017	2.26	0.22	1.65	0.24	0.42	0.28	0.21	0.36	0.17	8.15
2018	2.24	0.22	1.70	0.23	0.42	0.26	0.21	0.34	0.18	8.18
2019	2.23	0.23	1.62	0.21	0.45	0.24	0.20	0.31	0.17	8.13
Per cent change 2001–19	14.6	21.5	6.30	-20.0	55.7	-14.0	11.2	-15.5	15.7	5.80

TPM emissions per capita (Table 4) are much higher in Saskatchewan than other provinces, with Alberta and Manitoba generating the second- and third-highest emissions per capita. Unlike GHG, TPM per capita has not declined over the period of this study.

Table 5: Variables Used in the Analysis

Variable	*Logarithmic transformation*	*Type*
Greenhouse gas emissions	LNGHG	Dependent variable
Total particulate matter emissions	LNTPM	Dependent variable
Unionization rate	LNCB	Variable of interest
Real gross domestic product	LNGDP	Control variable
Ratio of resource-sector output and total industry output	LNRES	Control variable
Ratio of the combined output of the manufacturing and resource sector and total industry output	LNMFGRES	Control variable
Rate of unemployment	LNUN	Control variable

Methods

In the regression analysis, we use the natural logarithmic transformation of all variables described in the earlier section. Table 5 explains these variables.

We estimate two equations. In the first equation, the unionization rate, real GDP, the rate of unemployment, and the ratio of resource-sector output and total industry output are used as determinants of greenhouse gas emissions. In the second equation, the ratio of the combined output of the manufacturing and resource sector and total industry output replaces the ratio of resource-sector output and total industry output as a determinant of TPM emissions.[60]

60. The two estimated equations are:

LNGHG = F(LNUNION, LNGDP, LNRES, LNUN)

LNTPM = F(LNUNION, LNGDP, LNMFGRES, LNUN)

Before conducting our statistical analysis, it was imperative to identify whether the variables exhibited any unpredictable systemic pattern. This was done by conducting unit root tests. We present a discussion on the unit root tests and relevant results in Appendix 1. After determining that the variables did present systematic patterns of unpredictability, we used the pooled mean group (PMG) method, proposed by Pesaran, Shin, and Smith. We discuss this method in Appendix 2. See William Greene, *Econometric Analysis*, 8th ed. (Hoboken, NJ: Pearson, 2018); M. Hashem Pesaran, Yongcheol Shin, and Ron P. Smith, "Pooled Mean Group Estimation of Dynamic Heterogeneous Panels," *Journal of the American Statistical Association* 94, 446 (1999): 621–634.

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Table 6: PMG Long and Error Correction: GHG Equation

Variable	*Coefficient*
Long run	
LNUNION	-3.477** (0.350)
LNY	-0.527** (0.093)
LNRES	0.038* (0.018)
LNUN	-0.052 (0.041)
Short run	
Error correction term	-0.233** (0.079)
ΔLNUNION	0.558* (0.265)
ΔLNY	0.917** (0.273)
ΔLNRES	-0.018 (0.023)
ΔLNUN	-0.013 (0.061)
Constant	8.064** (2.758)
Selected model	ARDL (1,1,1,1)
Number of observations	170
Time period	2001–19

Note: Standard error is in parenthesis.
* $p \leq 0.05$
** $p \leq 0.01$

Results

Table 6 reports our findings from the first pooled mean group (PMG) estimation, where greenhouse gas emissions are used as the dependent variable. In this table, the short-run and long-run results are presented.[61]

In the long-run equation, unionization (represented as LNUNION) is negative and statistically significant at the 1 per cent level. This implies that unionization is negatively associated with greenhouse gas emissions. The magnitude of this coefficient is approximately -3.5. This suggests that a 1 per cent increase in unionization is associated with a 3.5 per cent reduction in GHG. Among

61. An important component of the short-run equation is the error correction term, which explains how much of the deviation from the long-run equilibrium will be corrected in the next forecasting year. A negative and statistically significant error correction will ensure the adequacy of the estimated model. The coefficient of the error correction term is 0.23, and the coefficient is negative and statistically significant at the 1 per cent level. Therefore, approximately 23 per cent of any deviation from the long-run equilibrium is corrected within the first year. In other words, it takes just over four years for the series to converge to the long-run equilibrium. In our analysis, we are mostly interested in the long-run equation since it exhibits the long-run dynamic association between unionization and environment. We used the Schwarz Bayesian criteria to select the appropriate lag lengths.

other variables, real GDP (represented as LNY) is negatively associated with emissions and statistically significant at the 1 per cent level. Thus, an increase in real GDP tends to reduce greenhouse emissions. This may seem counter-intuitive, in that historically and cross-nationally, rising output is associated with increased levels of greenhouse gas pollution.[62] Richard York also finds a positive relationship between per capita GDP and greenhouse gas pollution.[63] Others, however, have found the relationship to be non-linear.[64] Given this, within the confines of the Canadian provinces and the time frame of 2000 to 2019, a negative relationship between GDP and greenhouse gas emissions is reasonable. While GDP rises consistently – with the exception of 2009 – for all provinces over the period, only Alberta and Saskatchewan show fairly consistent increases in greenhouse gas production. For Ontario, Québec, Nova Scotia, New Brunswick, and British Columbia, greenhouse gas emissions decline throughout most of the period. Most of these reductions are on the back of electricity generation and, to a lesser degree, efficiencies in heavy industry.[65] From its peak of 108.9 megatonnes of carbon dioxide equivalent (Mt CO_2e) in 2000, coal-fired electrical generation produced less than half that (42.8 Mt CO_2e) in 2019.[66] The ratio of resource-sector output and total industry output, denoted as LNRES, has a positive association with greenhouse gas emissions. The coefficient of LNRES is statistically significant at the 5 per cent level. The positive coefficient suggests that, as predicted, a larger share of the resource industry (mining, quarrying, and oil and gas) relative to total output is associated with higher amounts of greenhouse gas pollution. Finally, the unemployment rate does not seem to have any significant association with greenhouse gas pollution.

62. Luis F. Sanchez and David I. Stern, "Drivers of Industrial and Non-Industrial Greenhouse Gas Emissions," *Ecological Economics* 124 (April 2016): 17–24; Genovaité Liobikiene and Mindaugus Butkus "Environmental Kuznets Curve of Greenhouse Gas Emissions including Technological Progress and Substitution Effects," *Energy* 135 (September 2017): 237–248.

63. Richard York, "Asymmetric Effects of Economic Growth and Decline on CO2 Emissions," *Nature Climate Change* 2 (October 2012), 762–764.

64. Mahamat Hamit-Haggar, "Greenhouse Gas Emissions, Energy Consumption and Economic Growth: A Panel Cointegration Analysis from Canadian Industrial Sector Perspective," *Energy Economics* 34 (January 2012): 358–364; Alvarez, McGee, and York, "Is Labour Green?"

65. Environment and Climate Change Canada, *Greenhouse Gas Emissions: Canadian Environmental Sustainability Indicators* (Gatineau, QC, 2021), 8, https://www.canada.ca/content/dam/eccc/documents/pdf/cesindicators/ghg-emissions/2023/greenhouse-gas-emissions-en.pdf.

66. Environment and Climate Change Canada, *Greenhouse Gas Emissions*. Anupam Das found a similar national pattern; see Das, "In Search of the Environmental Kuznets Curve in Canada: Where Is the Inverted U Curve?," *International Journal of Global Energy Issues* 41, 5–6 (2018): 289–307.

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Table 7: PMG Long-Run and Error Correction: TPM Equation

Variable	*Coefficient*
Long run	
LNUNION	-1.157* (0.273)
LNY	1.063* (0.156)
LNMFGRES	-0.006 (0.051)
LNUN	-0.029 (0.057)
Short run	
Error correction term	-0.482* (0.126)
ΔLNUNION	-0.562* (0.144)
ΔLNY	-1.033 (0.723)
ΔLNMFGRES	0.267 (0.220)
ΔLNUN	-0.002 (0.102)
Constant	2.672* (0.633)
Selected Model	ARDL (1,1,1,1)
Number of observations	170
Time period	2001–2019

Note: Standard error is in parenthesis.
* $p \leq 0.01$

The second regression examines whether TPM emissions, unionization, and other variables have any statistical association. We present these results in Table 7.[67] Drawing our attention to the long-run equation, we find that unionization exhibits a negative relationship with TPM emissions. Among other variables, real GDP is positively associated with TPM emissions, while there is no evidence of any statistical significance of the ratio of the combined output of the manufacturing and resource sector and total industry output, and the rate of unemployment. Although these models are based on several statistical assumptions, the findings are robust and insensitive to most changes to the specifications of the model.

Discussion and Conclusion

One of the previous studies in this area concluded, "This finding demonstrates that unions are an important part of understanding anthropogenic drivers of CO2 emissions and suggests that unions may have environmentally

67. As before, the error correction term is negative and statistically significant at the 1 per cent level. The size of the coefficient is -0.48, which suggests that approximately half of any deviation from the long-run equation is corrected within the first year.

beneficial effects on production processes."[68] We might be slightly more cautious about concluding that increasing unionization rates would improve environmental indicators. First, it is important to stress that we have established correlation rather than causation. Higher unionization rates are correlated with lower levels of the two pollution measures. We have not established that higher unionization rates cause the reduction in emissions. It might be possible that an unaccounted factor might be driving the changes in both unionization and emissions. For example, a general public sentiment that leans toward "anti-business" or "state intervention" might account for both more active environmental policy and higher unionization rates. However, when we included a political dummy variable, measuring whether the ruling political party had a conservative ideology, in the model, it was insignificant. This does not completely rule out the possibility that a general provincial sentiment is not at play here – only that if we attempt to distinguish between periods when more conservative governments are in power and when they are not, it appears as though there is no impact on the two pollution measures. It is, of course, also possible that some completely different and unanticipated factor might be at play.

However, we have provided suggestive evidence that unions are not the enemy of the environment and that there may not be a "labour" versus "environment" trade-off, at least as far as can be measured by correlations between these two types of emissions and unionization rates. Put in the context of the proliferation of case studies of union environmentalism – which document bargaining provisions, coalition building, lobbying, and policy development – the research provides support for the idea that labour organizing and environmental activism are kindred practices, which tend toward a unified struggle.[69] It also reorients our gaze as we look for obstructions on the path to an ecologically sustainable economy.

If we were to look for an alternative group in society that actively opposes environmental regulation, the business community might be a likely candidate. In Canada, business has been more reliably and publicly opposed to environmental legislation than organized labour has been. It is certainly easy to identify specific business groups, including the Canadian Association of Petroleum Producers, that have been particularly successful in thwarting environmental policies, especially in the area of GHG emissions. Materially, while the business community, like all other stakeholders, relies on the continued health of the environment, specific pro-environmental policies do often negatively impact profits. As our brief history of union environmentalism suggests, corporate actors actively worked to recruit rank-and-file workers into a coalition against environmental protection measures. Making good

68. Alvarez, McGee, and York, "Is Labour Green?"

69. See, for example, the case studies in Räthzel, Stevis, and Uzzell, eds., *Palgrave Handbook of Environmental Labour Studies*; Räthzel and Uzzell, eds., *Trade Unions in the Green Economy*.

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use of employment insecurity generated by economic slowdown, automation, industrial restructuring, and relocation, businesses were able to successfully propagate a jobs-versus-environment narrative that resonated with workers. Economic conditions and the contested work of defining the parameters and drivers of social problems like unemployment have conditioned the possibilities of union environmentalism. In the highly contested fossil fuel industry, this legacy is starkly visible today, as fossil fuel companies engage in coalition politics with some workers and unions to defend the industry against climate activism and government regulation.

Not all workers – or, perhaps, not even most workers – support pro-environmental policies. However, workers' opinions on environmental policy are not exogenous but influenced heavily by the ways that they understand and experience "the environment," political-economic conditions bearing on the stability and security of their livelihood, and the institutions in society from which they get their information. As previous research has shown, the political opinions of workers are influenced by the presence of unions.[70] It may be the case that when unionization rates are higher, and formal working-class organizations are stronger, they provide a counternarrative to the dominant messaging of the business community.

The connection between higher rates of unionization and improvement in environmental indicators does suggest an obvious avenue for subsequent research. As we suggested earlier, unions can have an impact through collective bargaining, intentional political activity, or unintended political consequences, but our analysis does not identify which of these mechanisms might be at play. Some unions in Canada have used the collective bargaining process to negotiate environmental clauses in their contracts.[71] However, given the relatively low rates of unionization in Canada (ranging from a low of just over 20 per cent in Alberta in 2014 to 38 per cent in Newfoundland in 2001) during this period, only a subset of which will have negotiated environmental clauses in their contracts, it would seem unlikely that this mechanism is the driving force behind the connection. At least financially, unions are also fairly small players compared with Canadian business in terms of their direct spending on political activities, whether directly lobbying in the political system or advertising to influence public opinion. Again, given that only a small subset of any union spending in this area would be related to environmental issues, this too would appear an unlikely mechanism.

There are other possibilities. One area where unions have devoted considerable resources and bargaining effort is in workplace safety and health. Most legislated protections, as well as bargained protections, against dangerous or unhealthy work is at least partially, if not wholly, a result of unions. It would be surprising if some of these efforts did not have positive environmental

70. Ahlquist, Clayton, and Levi, "Provoking Preferences."

71. ACW, Green Collective Agreements Database.

spillovers outside the workplace. Marianne P. Brown, for example, shows how California unions won a ban on a specific harmful pollutant, the establishment of workplace toxics research and information centres, and federal right-to-know legislation concerning toxics that covers all US workers.[72] Beth Malinowski, Meredith Minkler, and Laura Stock point out the role of unions in the establishment of monitoring and abatement initiatives for respiratory pollutants in resource extraction, construction, and agriculture.[73]

Additionally, unions argue that social needs are often sacrificed when policy is geared toward maximizing profits. By pointing out that society's resources should be diverted away from business profits to other needs – such as living incomes for workers and environmental sustainability – unions can create space for interventionist government policy. As Craig Slatin puts it, "Workplace injuries and environmental pollution result from deliberate financial practices and organizational priorities that shift resources toward corporate wealth accumulation and away from the optimization of workplace health and safety and environmental protection."[74] Unions point out this fact to the public, to politicians, and to their members, as well as bargaining to protect workers from unprotected exposure. The effectiveness of labour-environmental coalitions that actively attempt to engage in electoral politics to support governments with a slightly more social-democratic ideology might be another causal factor.

Although the precise mechanism or causation should be the subject of further investigation, the evidence presented here suggests that a stronger union movement is not at odds with environmental protection in Canadian provinces and more likely supports it. The conclusion of this research is not that unions are a "magic bullet" that solves environmental problems. Nor is it that all unions are actively engaged in implanting solutions to address the environmental crisis – although some clearly are, and history suggests that the potential for a much stronger union environmentalism is possible. Those working toward this end should be encouraged by the analysis here insofar as it suggests that stronger labour movements in Canadian provinces correspond with better environmental outcomes.

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72. Marianne P. Brown, "Labor's Critical Role in Workplace Health and Safety in California and Beyond – As Labor Shifts Priorities, Where Will Health and Safety Sit?," *New Solutions* 16 (November 2006): 249–265.

73. Beth Malinowski, Meredith Minkler, and Laura Stock, "Labor Unions: A Public Health Institution," *American Journal of Public Health* 105 (February 2015): 261–271.

74. Craig Slatin, *Environmental Unions* (New York: Routledge, 2009).

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Appendix 1

Unit Root Tests

To determine whether the variables are characterized by the unit root process, we apply three different tests: Im, Pesaran and Shin; augmented Dickey-Fuller; and Phillips-Perron. The null hypothesis of all three tests is that the series contains a unit root. Thus, if this hypothesis is not rejected, then we can argue that the chosen variables show unpredictable systemic patterns. Further, if the first difference of the variables does not have any pattern that is unpredictable, then we can use a cointegration technique. We present the unit root results in Table A1. These results suggest that the variables do indeed show unpredictable systemic patterns. However, the first differences of the same variables do not show the same pattern.

Table A1: Unit Root Tests

Variable	*Im, Pesaran, and Shin W-statistic*	*ADF- Fisher χ^2-statistic*	*PP- Fisher χ^2-statistic*
LNGHG	0.869	13.049	11.872
ΔLNGHG	-6.109*	73.563*	100.173*
LNTPM	0.609	16.094	24.617
ΔLNTPM	-7.042*	85.289*	347.889*
LNUNION	0.153	21.044	24.806
ΔLNUNION	-7.254*	87.263*	215.108*
LNY	3.258	8.985	24.613
ΔLNY	-4.785*	60.765*	107.766*
LNRES	-0.952	24.091	26.505
ΔLNRES	-5.537*	66.803*	120.670*
LNMFGRES	0.306	14.393	16.555
ΔLNMFGRES	-4.689*	58.235*	87.403*
LNUN	-0.237	22.840	12.266
ΔLNUN	-4.513*	55.440*	78.977*

Note: The null hypothesis of all three tests is that the series contains a unit root.
* $p \leq 0.01$

Appendix 2

The Pooled Mean Group (PMG) Method

The PMG technique incorporates both non-stationary variables and their first differences and applies an error correction technique to distinguish between long-run relationships and short-run dynamic adjustments. This method has several advantages over conventional cointegration methods such as Pedroni cointegration. Unlike other techniques, the PMG maintains long-run coefficients to be the same across all panels, while allowing for the short-run coefficients to vary. Second, the PMG estimation uses all available information effectively because it estimates the long-run equation by pooling the data from all provinces. The short-run equation is estimated for individual provinces, and then an average is calculated to produce short-run coefficients. Finally, as argued by M. Hashem Pesaran, Yongcheol Shin, and Ron P. Smith, the PMG method works better in the case of extreme values in the panel.[75]

Without loss of generality, if the dependent variable is y for $t = 1,2, \dots, T$ and $i = 1,2, \dots, N$, the unrestricted specification for the autoregressive distributed lags system of equations can be written as follows:

$$y_{it} = \alpha_i y_{i,t-j} + \sum_{j=0}^{1} \beta_{ij} X_{i,t-j} + u_i + \epsilon_{it} \qquad (1)$$

where $X_{i,t-j}$ is an n x k vector of dependent variables for group i; β_{ij} is the n x k vector of coefficients; u_i is the province-specific fixed effects; and ϵ_{it} is the vector of standard errors. Using a vector error correction model framework, the system of equations can be reparametrized in the following manner:

$$\Delta y_{it} = \delta_{1,i}\left(y_{i,t-1} - \gamma_{1,i} X_{i,t-1}\right) + \beta_{1,i} \Delta X_{it} + u_i + \epsilon_{it} \qquad (2)$$

where $\delta_{1,i} = -(1 - \alpha_i)$ and $\gamma_{ij} = \frac{\sum_{j=0}^{1} \beta_{ij}}{1-\alpha_i}$

This model is estimated by maximum likelihood. Parameter estimates are consistent and asymptotically normal for both stationary and non-stationary variables. The error correction term is allowed to vary.

75. Pesaran, Shin, and Smith, "Pooled Mean Group Estimation."

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