

# Climate Adaptation Law: Governing Multi-Level Public Goods Across Borders

Maria L. Banda\*

## ABSTRACT

*The increasingly severe and irreversible effects of climate change around the world make adaptation to a changing climate an immediate and urgent global priority, as the Paris Agreement on Climate Change acknowledged. Yet adaptation investment—to make communities and ecosystems more resilient to climate change—has been slow to materialize. Closing the finance gap and rising to the challenge of adaptation requires two conceptual shifts in how we think about adaptation law and governance. The first is that optimal adaptation is a public good, much like a healthy climate or safe streets. Everyone is better off in a resilient community that can thrive despite climate impacts, whether they contributed to resilience or not. This means adaptation investment will likely continue to be underprovided by the market in the absence of an effective legal regime. The second shift is that adaptation is not merely a local matter, though it is still largely treated as such. In several important scenarios, it will also be an international public good requiring international cooperation. Parties to the Paris Agreement seemingly recognized this when they described adaptation as a “global challenge” with “local, subnational, national, regional and international dimensions.” However, they did not consider what this means in practical terms for law and governance, and the literature is still largely silent on this issue.*

*This Article seeks to move the analysis forward. It makes three principal contributions. First, building on economic analysis of collective action problems, externalities, and public goods, it develops an analytical framework to examine the*

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\* Graham Fellow, University of Toronto Faculty of Law, and Visiting Attorney, Environmental Law Institute. I am grateful to Markus Benzie, Steven Bernstein, Sander Chan, Bruce Chapman, Matthew Hoffmann, Tiffany Morrison, John Robinson, and Michael Trebilcock for their thoughtful comments, as well as the participants of the Stockholm Environment Institute, European Society of International Law, and University of Toronto Environmental Governance Lab workshops, at which early drafts of this Article were discussed. The analysis has benefited from data access and insights from organizations discussed below. I would like to thank in particular Annett Möhner at UNFCCC Secretariat and Paul Glennie at UN Environment–DHI Centre on Water and Environment. Any errors are my own.

*adaptation challenge and similar cross-cutting legal issues. In particular, it reconceptualizes climate adaptation as a multi-level public good (MLPG)—with domestic, transboundary, and global dimensions. Second, it explores the implications of this conceptual shift for institutional and legal design at each level of governance. It considers the efficacy of different market-based mechanisms (Coasean private contracting) and prescriptive regulation in the light of this framework and explores the distinctions between the domestic and the international realms. Third, it proposes a multi-level governance model that could help produce what I call “optimal adaptation” and help optimize legal design. In particular, it identifies three priority areas for institution building in the transboundary setting that pose particular challenges for legal design. This framework will open avenues for more granular and critical study of the legal design and contracting required to rise to the challenge of multi-level public goods.*

## TABLE OF CONTENTS

I. INTRODUCTION .....	1029
II. THE ADAPTATION CHALLENGE .....	1033
A. <i>Optimal Adaptation vs. Maladaptation</i> .....	1033
B. <i>The Problem of Externalities and Coordination</i> .....	1034
C. <i>Multi-Level Public Goods</i> .....	1037
D. <i>Overcoming Externalities</i> .....	1039
III. CURRENT STATE OF CLIMATE ADAPTATION LAW & GOVERNANCE.....	1045
IV. FINDING THE DIVIDING LINE.....	1052
A. <i>Adaptation as a Pure Domestic Public Good</i> .....	1052
B. <i>Adaptation as a Transboundary or a Global Public Good</i> .....	1055
1. Transboundary Public Goods: The Water-Energy-Food Nexus .....	1056
2. Global Public Goods: The Climate-Security Nexus ....	1059
V. THE LAW AND GOVERNANCE OF MULTI-LEVEL CLIMATE ADAPTATION: A PROPOSED FRAMEWORK .....	1062
A. <i>Treaty Regimes</i> .....	1062
B. <i>General International Law</i> .....	1065
C. <i>Enforcement</i> .....	1067
D. <i>Risks of Overreach</i> .....	1069
VI. CONCLUSION .....	1070

## I. INTRODUCTION

The increasingly severe and irreversible effects of climate change around the world make adaptation<sup>1</sup> to a changing climate an immediate and urgent global priority, as the Paris Agreement on Climate Change acknowledged.<sup>2</sup> International action on mitigation remains vital,<sup>3</sup> but even if states were to aggressively reduce their greenhouse gas emissions today, climate impacts—such as record floods and droughts, superstorms, wildfires, falling crop productivity, and coastal erosion—have by now become unavoidable in many regions, as any benefits of new emissions reductions would not be felt for decades.<sup>4</sup> Originally estimated at \$100 billion per year,<sup>5</sup> the cost of climate adaptation in developing countries alone could rise to between \$280 and \$500 billion annually by 2050.<sup>6</sup> Developed countries are not spared either. According to estimates, weather- and climate-related disasters have cost the US economy at least \$240 billion a year over the past decade.<sup>7</sup> In 2017 alone, the United States suffered sixteen

1. Adaptation is defined in this Article as an adjustment in activities to avoid or moderate the expected harm from climate change or its effects. *Cf.* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2014: IMPACTS, ADAPTATION, AND VULNERABILITY 172 (2014) [hereinafter IPCC, CLIMATE CHANGE 2014], [https://www.ipcc.ch/pdf/assessment-report/ar5/wg2/WGIIAR5-IntegrationBrochure\\_FINAL.pdf](https://www.ipcc.ch/pdf/assessment-report/ar5/wg2/WGIIAR5-IntegrationBrochure_FINAL.pdf) [<https://perma.cc/7NSE-HDK9>] (archived Aug. 25, 2018) (Adaptation is “the process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects.”).

2. Paris Agreement, art. 2(b), Dec. 12, 2015, T.I.A.S. No 16-1104 [hereinafter Paris Agreement]. The Paris Agreement is annexed to Decision 1/CP.21 adopted in Paris by Parties to the U.N. Framework Convention on Climate Change (UNFCCC) on Dec. 12, 2015. *See* UNFCCC, Rep. of the Conf. of the Parties on its Twenty-First Session, Adoption of the Paris Agreement (Decision 1/CP.21), U.N. Doc. FCCC/CP/2015/10/Add.1 (Jan. 29, 2016) [hereinafter UNFCCC Decision 1/CP.21]. UNFCCC documents are available at <http://unfccc.int/>.

3. Paris Agreement, *supra* note 2, art. 2(a).

4. U.N. ENV'T PROGRAMME FIN. INITIATIVE CLIMATE CHANGE WORKING GRP., ADAPTATION AND VULNERABILITY TO CLIMATE CHANGE: THE ROLE OF THE FINANCE SECTOR 3 (2006), [http://www.unepfi.org/fileadmin/documents/CEO\\_briefing\\_adaptation\\_vulnerability\\_206.pdf](http://www.unepfi.org/fileadmin/documents/CEO_briefing_adaptation_vulnerability_206.pdf) [<https://perma.cc/LSZ8-B483>] (archived Aug. 25, 2018).

5. WORLD BANK GRP., THE ECONOMICS OF ADAPTATION TO CLIMATE CHANGE: SYNTHESIS REPORT 3 (2010), [https://siteresources.worldbank.org/EXTCC/Resources/EACC\\_FinalSynthesisReport0803\\_2010.pdf](https://siteresources.worldbank.org/EXTCC/Resources/EACC_FinalSynthesisReport0803_2010.pdf) [<https://perma.cc/D96B-XRJX>] (archived Aug. 25, 2018).

6. U.N. ENV'T PROGRAMME, THE ADAPTATION FINANCE GAP REPORT xii (2016), <http://climateanalytics.org/files/agr2016.pdf> [<https://perma.cc/C79X-BUCP>] (archived Sept. 11, 2018).

7. Stephen Leahy, *Hidden Costs of Climate Change Running Hundreds of Billions a Year*, NAT'L GEOGRAPHIC (Sept. 27, 2017), <https://news.nationalgeographic.com/2017/09/climate-change-costs-us-economy-billions-report/> [<https://perma.cc/W9X5-PJNJ>] (archived Aug. 25, 2018).

such disasters with losses exceeding \$1 billion each, causing 362 fatalities and \$306 billion in damages—setting a new US annual record.<sup>8</sup>

A large share of the projected losses can be avoided through preventive adaptation,<sup>9</sup> but investment has been slow to materialize. As this Article explains, the adaptation finance gap is problematic not only for the directly impacted communities, but also for international society as a whole since climate vulnerability in one part of the world could in some cases compromise resilience in the rest of the world.

Part of the implementation challenge is conceptual and requires two shifts in how we think about adaptation law and governance. First, while it is widely accepted that climate *mitigation* is a public good (since one actor's mitigation actions, no matter where or how small, will benefit everyone else<sup>10</sup>), climate *adaptation* is not usually thought of in these terms.<sup>11</sup> However, optimal adaptation, this Article argues, should be treated as a public good—a good that can be enjoyed by many for free, like national defense or clean air. Everyone is better off in a resilient community that can withstand and continue to thrive despite climate impacts, whether they contributed to resilience or not. This encourages free-riding. As such, we would expect that adaptation investment will continue to be underprovided by the market in the absence of an effective legal regime. Meanwhile, poorly designed adaptation could generate negative externalities, which we would expect to be oversupplied.

8. *Billion-Dollar Weather and Climate Disasters: Overview*, NAT'L OCEANIC & ATMOSPHERIC ADMIN., NAT'L CTRS. FOR ENVTL. INFO., <https://www.ncdc.noaa.gov/billions/overview> (last visited Sept. 18, 2018) [<https://perma.cc/B8BU-67G3>] (archived Aug. 25, 2018). The full costs for Hurricanes Harvey, Irma and Maria are still being assessed. See Leahy, *supra* note 7.

9. WORLD ECON. FORUM, CLIMATE ADAPTATION: SEIZING THE CHALLENGE 4 (2014), [http://www3.weforum.org/docs/GAC/2014/WEF\\_GAC\\_ClimateChange\\_AdaptationSeizingChallenge\\_Report\\_2014.pdf](http://www3.weforum.org/docs/GAC/2014/WEF_GAC_ClimateChange_AdaptationSeizingChallenge_Report_2014.pdf) [<https://perma.cc/2VC8-6FSL>] (archived Aug. 26, 2018) (noting that “[u]p to 65% of the increase in the projected losses due to climate change could be averted cost effectively through adaptation investment”).

10. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2001: MITIGATION 607 (Bert Metz et al. eds., 2001) [https://www.ipcc.ch/ipccreports/tar/wg3/pdf/WGIII\\_TAR\\_full\\_report.pdf](https://www.ipcc.ch/ipccreports/tar/wg3/pdf/WGIII_TAR_full_report.pdf) [<https://perma.cc/V697-72BW>] (archived Aug. 26, 2018) [hereinafter IPCC, CLIMATE CHANGE 2001]; cf. NICHOLAS STERN, STERN REVIEW: THE ECONOMICS OF CLIMATE CHANGE 24–25 (2006), [http://mudancasclimaticas.cptec.inpe.br/~rmclima/pdfs/destaques/sternreview\\_report\\_complete.pdf](http://mudancasclimaticas.cptec.inpe.br/~rmclima/pdfs/destaques/sternreview_report_complete.pdf) [<https://perma.cc/UKG5-DNGK>] (archived Aug. 26, 2018) (“In common with many other environmental problems, human-induced climate change is at its most basic level an externality. Those who produce greenhouse-gas emissions are bringing about climate change, thereby imposing costs on the world and on future generations, but they do not face directly, neither via markets nor in other ways, the full consequences of the costs of their actions. . . . The climate is a public good . . .”).

11. But see Emma Tompkins & Hallie Eakin, *Managing Private and Public Adaptation to Climate Change*, 22 GLOBAL ENVTL. CHANGE 3 (2012) (discussing private provision of adaptation public goods); cf. STERN, *supra* note 10, at 37 (ascribing to adaptation some limited public good features).

Second, even though research on climate adaptation and resilience is expanding rapidly across disciplines, adaptation is still largely treated as a *local* matter. Consequently, positive international externalities of optimal adaptation (and negative externalities of maladaptation) are overlooked in the literature.<sup>12</sup> This is an important oversight. While climate adaptation in many cases will be a pure domestic public good (governable by domestic laws), in some scenarios it will also be a transboundary or a global public good requiring international cooperation. Parties to the Paris Agreement recognized this in Article 7(2), where they described adaptation not only as a “global challenge,” but also one that has “local, subnational, national, regional and international dimensions.”<sup>13</sup> However, they did not consider what this means in practical terms for international law and governance.

To date, there has also been little effort in the literature to identify these layers of governance, examine critically their implications for legal design, or explore what role international law and institutions could play in encouraging optimal adaptation across levels. This Article aims to fill those gaps. It provides a preliminary analysis of how a multi-level public good like climate adaptation should be governed to meet the Paris Agreement’s and national adaptation objectives. It contributes to legal literature and policy by reframing the issue, proposing a new analytical framework, and identifying priority areas for institution building. Specifically, it makes four contributions. First, it reconceptualizes climate adaptation as a multi-level public good, comprising domestic, transboundary, and global levels. Second, it explores the implications of this conceptual shift for institutional design and international law. Third, it outlines the contours of a multi-level governance model that could help produce optimal adaptation in a transboundary setting. Finally, it identifies three priority areas for international adaptation law and governance. While this Article is

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12. Even a recent special feature on adaptation governance did not address transboundary risks and governance. See THE GOVERNANCE OF ADAPTATION, ECOLOGY & SOC’Y (David Huitema et al. eds., 2016), <https://www.ecologyandsociety.org/issues/view.php?sf=87> [<https://perma.cc/M98Y-VNCP>] (archived Sept. 11, 2018); see also Declan Conway & Johanna Mustelin, *Strategies for Improving Adaptation Practice in Developing Countries*, 4 NATURE CLIMATE CHANGE 339 (2014); Oliver Schenker & Gunter Stephan, *Give and Take: How the Funding of Adaptation to Climate Change Can Improve the Donor’s Terms-of-Trade*, 106 ECOLOGICAL ECON. 44, 44 (2014) (“[W]hile benefits of mitigation are independent of where emissions are abated, benefits of adaptation are primarily local. In other words, mitigation is a global public good that requires internationally coordinated efforts whereas adaptation is more likely to be implemented locally with sufficient pace and scope . . . [and] without global coordination.”); T. Kato & J. Ellis, *Communicating Progress in National and Global Adaptation to Climate Change* 2, 9, 14 (OECD Climate Change Expert Group Paper No. 2016(1), 2016).

13. Paris Agreement, *supra* note 2, art. 7(2).

primarily concerned with the international legal realm, the same analytical framework could also be employed to engage with the adaptation challenge in the domestic setting—among federal states, counties, and cities.

The remainder of the analysis proceeds as follows. First, the Article develops a new analytical framework to reframe the adaptation challenge and considers the efficacy of market-based mechanisms (private contracting) and prescriptive regulation in the light of this framework (Part II). It introduces the concept of optimal adaptation (a public good), to be distinguished from maladaptation (a public bad), which reduces system resilience. It shows that inadequate provision of adaptation is essentially a public goods problem and that a coherent legal framework is required to restructure economic incentives, enable coordination, and remove barriers to adaptation investment. Further, it develops the concept of *multi-level public goods* and distinguishes between three levels of optimal adaptation: domestic, transboundary, and global. It defines optimal adaptation as a pure *domestic* public good where its provision can be ensured by the domestic legal system or private contracting. Where optimal adaptation cannot be guaranteed by domestic laws, it will require cross-border mechanisms that are able to anticipate and respond to the collective demand for such goods. Adaptation as a *transboundary* public good (which involves a smaller number of often-neighboring states) is conceptually distinct from adaptation as a *global* public good (which affects the international community as a whole) and requires different institutional design. Second, the Article reviews current governance arrangements (Part III). It finds that adaptation governance is already multi-level in the sense that adaptation is being addressed by a number of domestic and international institutions, but these initiatives are largely focused on adaptation's *local* aspects.

Third, it attempts to draw the line between different levels of adaptation in concrete terms (Part IV). It shows that optimal adaptation will most likely be a transboundary public good where domestic water or food security depends on access to shared resources, while it will be a global public good where local climatic impacts can destabilize international peace and security. Fourth, it proposes a multi-level law and governance model to address cross-border externalities (Part V). In particular, it shows that international law can steer state policies towards optimal adaptation; however, many regimes require updating, while others are yet to be built. It concludes by reflecting on the policy implications and the potential risks and pitfalls of overreach.

## II. THE ADAPTATION CHALLENGE

Before turning to current governance arrangements and optimal institutional design, this Part first considers the challenges posed by climate adaptation for legal design and develops a comprehensive analytical framework to examine how this and similar types of public goods can be governed. First, it defines “optimal adaptation,” to be distinguished from maladaptation (Part II.A). Second, it explains why optimal adaptation is a public good and why adaptation measures can give rise to positive or negative externalities (Part II.B). Third, it shows that optimal adaptation, depending on the context, can function as a domestic, transboundary, or a global public good (Part II.C). Finally, it analyzes the tools for dealing with public goods and environmental externalities (such as private contracting and regulation) at each level of governance and identifies particular difficulties encountered in the cross-border setting (Part II.D).

### A. *Optimal Adaptation vs. Maladaptation*

As noted above, “adaptation” means an adjustment in activities to avoid or moderate the expected harm from climate change or its effects.<sup>14</sup> For example, as climate change increases the pressure on water resources, a municipality may decide to adapt by investing in a desalination plant to diversify its water supply and insulate the community from the range of risks associated with water scarcity. But not every adaptive action is *optimal*. In the above example, the municipality’s adaptive measures would not be optimal if the construction and operation degraded the ecosystem or if it increased carbon emissions. By creating negative externalities, such measures would be a form of *maladaptation* (a public bad), which the Intergovernmental Panel on Climate Change (the IPCC) has defined as “[a]ctions that may lead to increased risk of adverse climate-related outcomes, increased vulnerability to climate change, or diminished welfare, now or in the future.”<sup>15</sup> Maladaptation thus has both a spatial and a temporal dimension.

Therefore, optimal adaptation, as understood in this Article, refers to adaptation measures that maximize social welfare by strengthening community and ecosystem resilience and reducing overall vulnerability<sup>16</sup>—without causing negative externalities (such

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14. See IPCC, CLIMATE CHANGE 2014, *supra* note 1.

15. *Id.* at 183; see also IPCC, CLIMATE CHANGE 2001, *supra* note 10; Jon Barnett & Saffron O’Neill, *Maladaptation*, 20 GLOBAL ENVTL. CHANGE 211, 211–12 (2010) (discussing other definitions of maladaptation).

16. Cf. U.N. Framework Convention on Climate Change, Rep. of the Conf. of the Parties on Its Sixteenth Session, ¶ 11, The Cancun Agreements: Outcome of the Work

as pollution or overfishing).<sup>17</sup> Whether adaptation is optimal in any given case is context dependent, but, at a minimum, it assumes there are no adverse local or cross-border spillovers now or in the future.<sup>18</sup> This concept is explored in the next subpart.

### B. *The Problem of Externalities and Coordination*

As with many other issues in environmental, energy, or natural resource law, a key barrier to optimal adaptation is the presence of *externalities*—the costs, or benefits, of an actor's economic activity that do not accrue to that actor but are borne by wider society. Pollution is an example of a negative externality that causes lasting harm to society but is not a cost to the polluter (it is “external” from the polluter's perspective). When the cost of negative externalities (e.g., pollution, loss of habitat, or harm to public health) is not factored into the analysis, the market will tend to focus on the private benefit of a given economic activity, while overlooking its social cost. Accordingly, in the absence of environmental regulation or private contracting, negative externalities will tend to be overproduced. Positive externalities, in contrast, will tend to be underproduced. A beekeeper, for example, may only calculate the cost and revenue of honey production, and not the tremendous value his bees generate for the neighboring orchards and may maintain fewer beehives than is societally optimal. In other words, there is a divergence of economic incentives between the individual actor and the rest of society.<sup>19</sup>

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of the Ad Hoc Working Group on Long-term Cooperative Action Under the Convention (Decision Dec. 1/CP.16), U.N. Doc. FCCC/CP/2010/7/Add.1 (Mar. 15, 2011) (adaptation actions are “aimed at reducing vulnerability and building resilience,” especially in developing countries).

17. Thus, measures where local benefits exceed non-local costs (or future costs) would not be “optimal” (or Pareto-optimal) because they leave nonconsenting third parties worse off. This does not mean there can be no balancing of costs and benefits, but the wronged party would be entitled to compensation in the event of serious harm (similar to Kaldor-Hicks efficiency). *Cf.* Guido Calabresi, *The Pointlessness of Pareto: Carrying Coase Further*, 100 YALE L.J. 1211, 1221, 1223–25 (1991) (discussing compensation); *see also* MICHAEL J. TREBILCOCK, DEALING WITH LOSERS: THE POLITICAL ECONOMY OF POLICY TRANSITIONS 1–2 (2015) (few policy changes make “somebody better off and nobody worse off”).

18. On difficulties of measuring effectiveness, *see generally* SUCCESSFUL ADAPTATION TO CLIMATE CHANGE: LINKING SCIENCE AND POLICY IN A RAPIDLY CHANGING WORLD (S. Moser & M. Boykoff eds., 2013); W. N. Adger et al., *Successful Adaptation to Climate Change Across Scales*, 15 GLOBAL ENVTL. CHANGE (2005) [hereinafter Adger, *Successful Adaptation*]. *See also* Jim W. Hall et al., *Proportionate Adaptation*, 2 NATURE CLIMATE CHANGE 833 (2012), <https://www.nature.com/articles/nclimate1749> [<https://perma.cc/VJF5-PFNF>] (archived Aug. 26, 2018) (applying a cost-benefit approach).

19. *See generally* ARTHUR C. PIGOU, THE ECONOMICS OF WELFARE 134 (4th ed. 1932). *See also* Robert Cooter, *Normative Failure Theory of Law*, 82 CORNELL L. REV. 947, 951 (1997) (describing the Pigovian prescription as “markets for private goods, government for public goods, taxes for externalities”); K. WILLIAM KAPP, THE SOCIAL

This has particular implications for climate adaptation, which is in itself a *public good*, like public safety or street lighting. Public goods can be understood as a special case of positive externalities: in their purest form, public goods offer benefits that cannot be confined to a single person, and, once provided, can be enjoyed by many for free. Public goods are thus characterized by two properties: non-rivalry and non-excludability.<sup>20</sup> Consequently, public goods, like positive externalities, will tend to be underproduced without regulatory intervention or private contracting.

The benefits of optimal adaptation likewise extend beyond the original investor. A homeowner who weatherproofs her home, for example, will enjoy personal security during a storm. But the action could also benefit her neighbors (by reducing the risk of backed-up drains and storm runoff on their property) and the community (by not imposing a cost on the emergency services). Thus, when an actor invests in optimal adaptation, its actions generate not only private benefits, but also benefit society as a whole by strengthening ecosystem and community resilience (e.g., by maintaining a functioning society or operations). Likewise, if an actor fails to take adaptive measures, or takes maladaptive measures, it could expose society to climate risks—from a homeowner who funnels her rain runoff onto her neighbors' property to systemic breakdowns in the food supply or water shortages. Local floods that shut down car and electronics factories in Thailand in 2011, for example, disrupted global supply chains.<sup>21</sup>

Public benefits increase with scale. Everyone is better off in a resilient community that can thrive despite climate change. For example, if a city invests in flood defenses or urban greenbelts, all of its inhabitants will enjoy the benefits of resilience regardless of whether and how much they contributed to those efforts. So will every

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COSTS OF PRIVATE ENTERPRISE 35–41 (2d ed. 1975); MICHAEL J. TREBILCOCK, *THE LIMITS OF FREEDOM OF CONTRACT* 58–77 (1994) (discussing costs to third parties).

20. While *pure* public goods are both nonexcludable and nonrivalrous (e.g., clean air), *common pool resources* (CPRs) are nonexcludable but rivalrous: one actor's use reduces availability for others (e.g., drinking water). For purposes of this Article focusing on MLPGs, this distinction is not material and both types are referred to simply as public goods. To see the evolution of theory of public goods, see Paul A. Samuelson, *The Pure Theory of Public Expenditure*, 36 REV. ECON. & STAT. 387 (1954); Paul A. Samuelson, *Diagrammatic Exposition of a Theory of Public Expenditure*, 37 REV. ECON. & STAT. 350 (1955); MANCUR OLSON, *THE LOGIC OF COLLECTIVE ACTION: PUBLIC GOODS AND THE THEORY OF GROUPS* (1965); Richard A. Musgrave, *Provision for Social Goods*, in *PUBLIC ECONOMICS* (J. Margolis & H. Guitton eds., 1969); Elinor Ostrom & Vincent Ostrom, *Public Economy Organization and Service Delivery* (1978) (Paper for "Financing the Regional City Project" Meeting of the Metropolitan Fund, U. Mich.), <http://dlc.dlib.indiana.edu/dlc/bitstream/handle/10535/732/ostrom01.pdf?sequence=1&isAllowed=y> [<https://perma.cc/844Z-RUR5>] (archived Aug. 26, 2018).

21. Ben Bland & Robin Kwong, *Supply Chain Disruption: Sunken Ambitions*, *FIN. TIMES* (Nov. 3, 2011), <https://www.ft.com/content/6b20d192-0613-11e1-ad0e-00144feabdc0> [<https://perma.cc/S6L5-SAPT>] (archived Aug. 26, 2018).

visitor, who will not have contributed at all. This creates an incentive to free-ride.

What does this mean in practice? A flood barrier, for example, would strengthen the resilience of a city's riverfront and of the neighboring jurisdictions. But since the *positive* externalities of adaptation are not internalized, the city will weigh only its own (private) costs and benefits of construction and will not consider the (external) resilience benefits to its neighbors. Absent coordination and cost-sharing with its neighbors, the city may conclude that the project is too costly and decide against adaptation investment.

Conversely, damming a river might compensate for lower water levels and strengthen the resilience of a county's residents, but would decrease the amount of water available downstream. Here, the *negative* externalities of adaptation are not internalized, which means that, in the absence of coordination or contractual mechanisms between the riparian counties, the upstream county would receive the entire benefit of adaptation, while the downstream county would bear much of the cost (resulting in maladaptation). So long as the adverse impacts of its actions are felt elsewhere, the upstream county will lack incentives to engage in optimal adaptation—unless the affected downstream county is able to impose effective countermeasures or disincentives.

There are additional risks of maladaptation that do not hinge on flawed cost-benefit analysis. For example, even where individual actors find adaptation to be in their self-interest, their (uncoordinated) actions could become maladaptive in the absence of coordination, private contracting, and enforcement mechanisms. Coordination and common standards would also help support adaptation investment by leveling the playing field and ensuring that actors who do implement a long-term adaptation framework are not placed at a competitive disadvantage relative to their peers in the short run (even though they might reap the benefits down the road).

As the foregoing discussion suggests, optimal adaptation will likely be underprovided by the market in the absence of a coherent legal regime that can restructure economic incentives, enable coordination, and help actors internalize the positive externalities of climate adaptation and the negative externalities of maladaptation. We can expect this to be true at *all* levels of governance—domestic, transboundary, and global—but especially where climate adaptation or its impacts cross national boundaries.<sup>22</sup> As shown below, the need for a legal framework is greatest where climate adaptation requires access to shared transboundary resources, where local adaptation measures risk having direct and significant negative transboundary

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22. See *infra* Part IV.B.

externalities, and where individual states, acting in isolation, cannot ensure optimal adaptation.<sup>23</sup>

### C. Multi-Level Public Goods

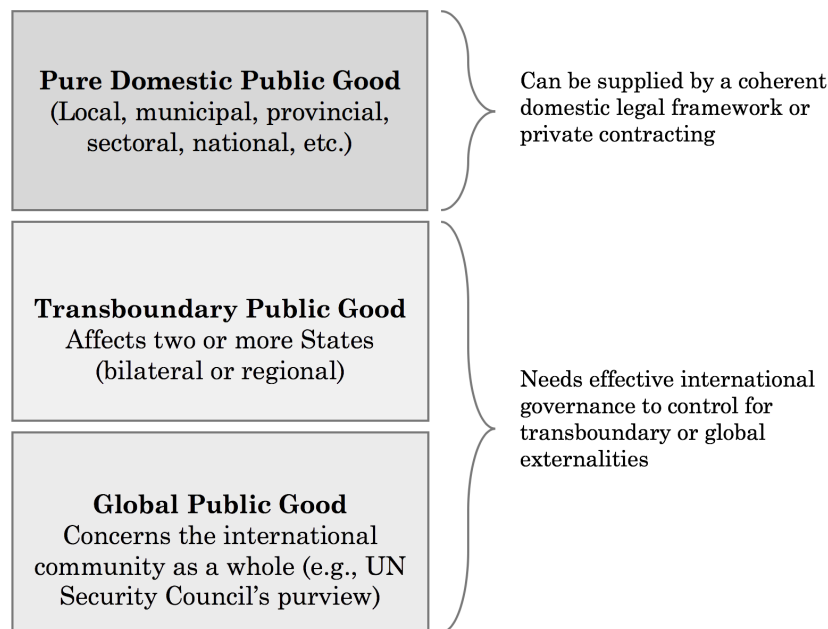
If optimal adaptation is a public good, the next question is *scale*: is adaptation a local, domestic, transboundary, or a global public good? How we answer that question will drive how we set up our institutional and legal design.

Public goods generally can be local (e.g., noise control near an airport), domestic (e.g., control of toxic waste), transboundary (e.g., control of acid rain), or global (e.g., climate mitigation).<sup>24</sup> But some public goods, as this Article shows, are *multi-level*. That is, they do not lose their public goods features as we move spatially up the level of governance (as we zoom out from a large-scale to a small-scale map). For purposes of this Article, the following three levels are most relevant: domestic, transboundary, and global, as shown schematically in Figure 1 below:

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23. See *infra* pp. 1071-72.

24. See MINISTRY OF FOREIGN AFF. & MINISTRY OF ECON., FIN. & INDUSTRY, GOV'T OF FRANCE, GLOBAL PUBLIC GOODS § 2.1 (2002), [http://www.diplomatie.gouv.fr/IMG/pdf/biens\\_publ\\_gb.pdf](http://www.diplomatie.gouv.fr/IMG/pdf/biens_publ_gb.pdf) [<https://perma.cc/Z88M-RXSU>] (archived Aug. 26, 2018). This refers to the spatial or geographic area where the good will be nonrivalrous and nonexcludable, which is distinct from the appropriate level at which the public good should be managed (which could be situated at a higher level of governance). *Id.*



*Figure 1: Multi-Level Public Goods*

As defined in this Article, optimal adaptation will be a pure *domestic public good* where its provision can be ensured by a coherent domestic legal framework (including private contracting) and effectively implemented under the “country-driven” logic of the United Nations Framework Convention on Climate Change (UNFCCC).<sup>25</sup> The term “domestic” encompasses all forms of adaptation that can be undertaken within a given state (i.e., local, municipal, provincial, sectoral, national). Where adaptation is a pure domestic public good, it will make sense for adaptation measures and policy planning to be governed at the level closest to where the impacts of climate change are experienced.<sup>26</sup>

This is not to suggest that domestic adaptation is straightforward. Optimizing adaptation within a state (as opposed to across states) can give rise to complex coordination challenges and externalities between cities, counties, and private actors. For example, individual Londoners’ decisions to pave over their front gardens may have been rational, but in the aggregate “led to a loss of permeable drainage surface equivalent to twenty-two times the size of Hyde Park.”<sup>27</sup> This significantly increased the risk of flash floods, impacting future generations living

25. See *infra* Part III.

26. See *infra* Part IV.A.

27. STERN, *supra* note 10, at 420.

in London.<sup>28</sup> While this Article focuses on transboundary coordination problems, the analytical framework developed here to analyze multi-level public goods can also be used to address questions of legal design in purely domestic cases involving similar multi-level governance challenges.

By contrast, optimal adaptation will be a *transboundary* or a *global public good* where it would be undersupplied by the domestic system alone. *Transboundary* public goods affect two or more states: they can be bilateral or regional.<sup>29</sup> *Global* public goods concern the international community as a whole; as explained below, these are the kinds of issues that might fall within the purview of the UN Security Council.<sup>30</sup> In both cases, optimal adaptation cannot be guaranteed by domestic laws or by delivering on the policies laid out in the individual National Adaptation Plans (NAPs) or Nationally Determined Contributions (NDCs):<sup>31</sup> it will also depend critically on inter-state cooperation and a legal regime that can anticipate and respond to changes in the collective demand for such goods. These concepts are described in more detail below. But, first, the next subpart considers how externalities and public goods are generally governed.

#### D. Overcoming Externalities

In the domestic context, the legal regime capable of redressing the problem of externalities and the kinds of public goods concerns<sup>32</sup> discussed above has generally taken two forms: “command-and-control” regulation and private contracting among market participants. Command-and-control, or prescriptive regulation, aims to either remove or reduce negative externalities directly (by prohibiting particular activities) or indirectly (by imposing Pigovian taxes<sup>33</sup> or liability regimes to induce the market to internalize the costs). The ban on the pesticide DDT and carbon taxes or tradable permits are both examples of these basic regulatory solutions to the problem of environmental externalities.<sup>34</sup>

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28. *See id.*

29. *See infra* Part IV.B.1.

30. *See infra* Part IV.B.2.

31. *See infra* Part V.

32. *See, e.g.,* J. Horowitz & K. McConnell, *A Review of WTA/WTP Studies*, 44 J. ENVTL. ECON. & MGMT. 426, 430 (2002) (discussing examples of environmental public goods).

33. *See generally* PIGOU, *supra* note 19.

34. Both approaches focus on changing the actors’ economic incentives based on the assumption that actors are rational and self-interested. That is not always the case. *See, e.g.,* Rebecca Stone, *Legal Design for the ‘Good Man,’* 102 VA. L. REV. 1767, 1770 (2016) (noting that “[m]any legal subjects are not exclusively motivated by self-interest, and few are perfectly rational”). Actors also often voluntarily supply public goods instead

However, as Ronald Coase has argued, regulatory fiat is not the only way to control externalities.<sup>35</sup> From the Coasean perspective, an environmental problem exists because of a market failure (a failure to fully account for external costs)<sup>36</sup> and can be addressed through private contracting. Assuming zero transaction costs and perfect information, the theory predicts that the market can reach an efficient (Pareto-optimal) outcome through mutually beneficial transactions between the affected parties (e.g., the polluter and its neighbor) that would increase both parties' net benefits without needing government intervention. In other words, depending on the relative gains, either the polluter could compensate its neighbor (buy the "right to pollute"), or the neighbor could pay the polluter not to pollute (buy the right to enjoy its own property). The negotiated outcome could in theory achieve environmental protection more efficiently than regulation.<sup>37</sup> Indeed, private contracting arrangements based on well-defined private property rights (or a market for tradable permits) are common in domestic environmental law, where they have been applied to everything from groundwater licenses and fishing quotas to acid rain abatement.

With more players, transaction costs increase, as does the incentive to free-ride on others' efforts. In such cases, it is widely assumed that, in the absence of prescriptive regulation, a "pumping race" (or a "grazing race") will ensue as each actor tries to extract as much of the common good as possible, come what may. This is the basic premise of Garrett Hardin's "tragedy of the commons,"<sup>38</sup> as well as the intuition behind the Prisoner's Dilemma game, frequently used in law and economics to illustrate the challenge of providing a public good through voluntary actions.<sup>39</sup> However, as Elinor Ostrom and others

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of free-riding. See, e.g., Robert Sugden, *Reciprocity: The Supply of Public Goods through Voluntary Contributions*, 94 ECON. J. 772 (1984). Moreover, actors' preferences are not immutable. A change in social norms, culture, and norm-internalization could change individual preferences—and environmental outcomes. See, e.g., Andrew Green, *You Can't Pay Them Enough: Subsidies, Environmental Law, and Social Norms*, 30 HARV. ENVTL. L. REV. 407 (2009); see also DANIEL BODANSKY, *THE ART AND CRAFT OF INTERNATIONAL ENVIRONMENTAL LAW* 54 (2010) ("Taking [culture] off the table, as economists typically do by treating it as a given, means that we give up one of the potentially most powerful levers to effectuate environmental change."). However, this is a more long-term proposition and is outside the scope of this Article.

35. Ronald H. Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1, 18 (1960) (noting that "direct governmental regulation will not necessarily give better results than leaving the problem to be solved by the market").

36. See generally *id.*

37. See RICHARD LAZARUS, *THE MAKING OF ENVIRONMENTAL LAW* 167, 183–84, 186–87 (2004) (discussing the theory behind market-based solutions).

38. See, e.g., Garrett Hardin, *The Tragedy of the Commons*, 162 SCI. 1243, 1244 (1968) ("Freedom in a commons brings ruin to all."); OLSON, *supra* note 20, at 2 (noting self-interested actors will not protect a common good unless coerced or induced).

39. See Bruce Chapman, *Rational Voluntarism and the Charitable Sector*, in *BETWEEN STATE AND MARKET: ESSAY ON CHARITIES LAW AND POLICY IN CANADA* 130 (Jim Phillips et al. eds., 2001).

have shown, under certain conditions private actors do voluntarily cooperate in the management of shared resources, especially in small communities.<sup>40</sup>

From an economist's perspective, the law's role is to clearly define and assign property rights and minimize transaction costs; the effect of the assignment on net efficiency is supposed to be neutral. In reality, the law retains a critical responsibility for managing adverse impacts of private activity, from assigning the initial property rights to providing credible enforcement.<sup>41</sup> In this sense, market-based schemes are more effective as a *supplement to* rather than a substitute for regulations<sup>42</sup> (as regulations give rise to and enable the use of tradable permits). Put differently, in a world of players with unequal power and imperfect information, private contracting will be viable only because an underlying regulatory regime exists to define its objectives, deter free-riding, and enforce private contracts.

Whatever the merits of private contracting in the domestic setting,<sup>43</sup> there is a separate question of whether, and under what circumstances, a Coasean solution can work once public goods or externalities *cross state boundaries*.<sup>44</sup> As explained below, though basic resources (such as water) are typically governed locally, resources rarely respect national boundaries.<sup>45</sup> If a dispute emerges between two cross-border communities over, say, water usage, the issue is not likely to be handled directly by the parties. It is internationalized: any claims would ultimately be espoused by the affected state against the other state.<sup>46</sup>

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40. ELINOR OSTROM, GOVERNING THE COMMONS: THE EVOLUTION OF INSTITUTIONS FOR COLLECTIVE ACTION 112–14, 137–39 (1990) [hereinafter OSTROM, GOVERNING THE COMMONS]. Ostrom focuses on small-scale CPRs (up to 15,000 users) in a single country. *Id.* at 182; cf. ROBERT C. ELLICKSON, ORDER WITHOUT LAW: HOW NEIGHBORS SETTLE DISPUTES (1993) (small-knit communities resolve disputes using informal rules); Thomas Dietz, Elinor Ostrom & Paul C. Stern, *The Struggle to Govern the Commons*, 302 SCI. 1907, 1908 (2003) (discussing conditions for cooperation).

41. Cf. Horowitz & McConnell, *supra* note 32, at 428 (“[O]ne of the most economically consequential decisions will be the initial establishment of the property rights, especially for environmental and other public amenities for which property rights are unclear.”); Daren Acemoglu, *Why Not a Political Coase Theorem? Social Conflict, Commitment, and Politics*, J. COMP. ECON. 620, 622 (2003) (“Underlying the Coase theorem is the ability to write enforceable contracts . . . any enforcement problem potentially limits the applicability of the Coase theorem.”).

42. LAZARUS, *supra* note 37, at 201–02; cf. OSTROM, GOVERNING THE COMMONS, *supra* note 40, at 121–36).

43. See *infra* Part IV.A.

44. See *infra* Part IV.B.

45. See *infra* pp. 1058–59.

46. This is not to say that subnational governments cannot collaborate, coordinate their actions, and align their legislation relating to shared resources—and they increasingly do so. See, e.g., *About Us*, CONFERENCE OF GREAT LAKES AND ST. LAWRENCE GOVERNORS AND PREMIERS, <http://www.cglslgp.org/about-us/> (last visited

On the surface, little difference may be apparent when moving from the domestic to the international realm, or from domestic to international public goods: bilateral and multilateral environmental treaties are the product of direct bargaining among affected states. In this sense, the inter-state solution to the problem of environmental externalities or market failures is Coasean by definition. This is especially true of transboundary problems involving just two neighboring states—like the management of the Great Lakes by Canada and the United States or the Rio Grande by the United States and Mexico. But states can also control externalities in a multilateral setting, for example, by creating an international market under the Kyoto Protocol.<sup>47</sup>

In practice, the analogy soon begins to break down. The international realm is difficult to reconcile with the Coasean model for several reasons, especially where environmental externalities and public goods are involved.

First, as noted above, the success of private contracting ultimately rests on effective implementation and enforcement.<sup>48</sup> While these are supplied by the domestic legal regime, they are often lacking internationally. This challenge is explored in more detail below.<sup>49</sup>

Second, a greater challenge may be the lack of perfect information. The assumption that animates the entire Coasean model—that private actors will have perfect (and symmetrical) information about the value of environmental goods, the impact of negative externalities, or that they will have a complete understanding of their preferences<sup>50</sup>—is

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Oct. 15, 2018) [<https://perma.cc/DG3R-RKM5>] (archived Aug. 26, 2018). However, where such efforts fail, the ultimate responsibility under international law rests with the State.

47. The Kyoto Protocol created three market-based “flexibility” mechanisms as a “supplement” to domestic measures to reduce emissions: Clean Development Mechanism (CDM), Joint Implementation (JI), and Emissions Trading (ET). See *Mechanisms Under the Kyoto Protocol*, U.N. FRAMEWORK CONVENTION ON CLIMATE CHANGE, [http://unfccc.int/kyoto\\_protocol/mechanisms/items/1673.php](http://unfccc.int/kyoto_protocol/mechanisms/items/1673.php) (last visited Oct. 15, 2018) [<https://perma.cc/VDH6-VHAJ>] (archived Aug. 26, 2018). CDM enables industrialized countries with an emissions reductions requirement (“Annex I” countries) to invest in projects in developing countries (“non-Annex I” countries) as an alternative to more expensive emissions reductions at home. Meanwhile, JI enables industrialized countries to meet part of their required emissions reductions by paying for projects in other industrialized countries. Participants in the EU Emissions Trading System can use international credits from CDM and JI towards fulfilling part of their obligations until 2020. *Use of International Credits*, EUR. COMM’N, [https://ec.europa.eu/clima/policies/ets/credits\\_en](https://ec.europa.eu/clima/policies/ets/credits_en) (last visited Oct. 15, 2018) [<https://perma.cc/A3RY-9EAC>] (archived Aug. 26, 2018).

48. See sources cited *supra* notes 41–42 and accompanying text.

49. See *infra* pp. 1068–70.

50. Behavioral economics has problematized the notion of preferences. See, e.g., Daniel Kahneman & Amos Tversky, *Prospect Theory: An Analysis of Decision Under Risk*, 47 *ECONOMETRICA* 263 (1979); Daniel Kahneman & Amos Tversky, *The Psychology of Preference*, 246 *SCI. AM.* 160 (1982); Richard Thaler, *Anomalies: Saving, Fungibility, and Mental Accounts*, 4 *J. ECON. PERSP.* 193 (1990); Daniel Kahneman, *Maps of Bounded Rationality: Psychology for Behavioral Economics*, 93 *AM. ECON. REV.* 1449 (2003).

questionable even in the domestic setting. It is especially doubtful in the international arena populated by diverse states. Nor is it evident that environmental goods can be adequately priced given their intrinsic, intertemporal, and often *sui generis* nature.<sup>51</sup>

Third, Coasean contracting for transboundary adaptation poses additional normative concerns. The model assumes that private actors are indifferent between engaging in a particular activity (e.g., ranching, farming) and receiving monetary compensation.<sup>52</sup> But states and nonstate actors are unlikely to be indifferent between different adaptation outcomes. Can one state sacrifice its citizens' resilience in exchange for payment from another state and still comply with its human rights or constitutional duties? Is it fair for the nonoffending state to pay the offending state to prevent maladaptation? It is not clear that resilience is the kind of a public good that can have a well-defined marketplace (i.e., that it is possible to "trade" investment in climate (mal)adaptation for increased payments to the adversely affected states). As explained below, trading in maladaptation would upend a number of established international norms, including the duty not to cause transboundary harm, human rights obligations, and the polluter-pays principle. The optimal adaptation regime would thus need to protect *both* states' resilience.

The need for coherence and predictability is magnified by the power asymmetries in the international system. State-to-state bargains, especially in a bilateral situation, would favor the more powerful party.<sup>53</sup> In the absence of an international equivalent of judicial review, it is not clear that a Coasean approach would actually maximize net welfare. If there are distributional consequences across states, the international system is not well equipped to address them.

In addition, as mentioned above, maladaptation can result in negative externalities either now or *in the future*. When externalities take place in the future, the bargain to be struck is not likely to be effective, or fair, since the key affected parties are not represented at the bargaining table. In other words, the negotiations, without more,

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51. See, e.g., DAVID HARVEY, A BRIEF HISTORY OF NEOLIBERALISM 165 (2009) ("To presume that markets and market signals can best determine all allocative decisions is to presume that everything can in principle be treated as a commodity."). Any bargain would also need to accommodate changing conceptions of environmental public goods over time (such as the benefits provided by ecosystem services).

52. As such, maximization of net benefits can animate a private bargain between a cattle rancher and a farmer, where both parties' interests are in theory economic and quantifiable.

53. Power asymmetry is also present in decentralized polycentric governance. See, e.g., Tiffany Morrison et al., *Mitigation and Adaptation in Polycentric Systems: Sources of Power in the Pursuit of Collective Goals*, 8 WIREs CLIMATE CHANGE Sept.–Oct. 2017, at 1.

cannot protect the interests of the nonconsenting future generations that may bear the majority of the cost.

Finally, it is widely accepted that Coasean bargaining is least applicable in situations involving a large number of parties (and potential free-riders) and high transaction costs.<sup>54</sup> We can expect this to be the case for global public goods (such as climate change mitigation), as well as for transboundary public goods that are regional in nature (such as multi-state aquifers).<sup>55</sup> In such circumstances, domestically, an external arbiter is needed to help actors coordinate their actions, protect their interests, and reduce the burden of externalities.

But in the international realm, there is no higher power to impose regulation. When states suffer the adverse effects of externalities, they can try to induce changes in their neighbors' activities through bilateral persuasion, institutions, or, in extreme cases, through force. If states engage in self-interested behavior, there is very little to stop them, as the US withdrawal from the Paris Agreement in 2017 or Canada's abandonment of the Kyoto Protocol six years earlier shows. However, as explained below, this does not mean that transboundary and global public goods are ungovernable.<sup>56</sup> States bargain against the backdrop of pre-existing treaty and customary rules defining their rights and responsibilities. This legal context is equally useful in building governance mechanisms and designing institutions capable of producing optimal adaptation.

With this analytical framework in place, we can now turn to how climate adaptation, with all its complexity, is currently governed.

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54. As Coase himself observed, "there is no reason why, on occasion, such governmental administrative regulation should not lead to an improvement in economic efficiency. This would seem particularly likely when, as is normally the case with the smoke nuisance, a large number of people is involved and when therefore the costs of handling the problem through the market or the firm may be high." Coase, *supra* note 35, at 18.

55. Cf. SCOTT BARRETT, ENVIRONMENT & STATECRAFT: THE STRATEGY OF ENVIRONMENTAL TREATY-MAKING 355 (2003) ("Regional or minilateral environmental problems are easier to remedy than global environmental problems.").

56. See *infra* Part V.

### III. CURRENT STATE OF CLIMATE ADAPTATION LAW & GOVERNANCE

Climate adaptation has been on the global climate agenda since the signing of the UNFCCC in 1992,<sup>57</sup> but its importance has increased exponentially in recent years as harmful impacts of climate change have continued to mount.<sup>58</sup> Adaptation was assigned the same level of priority as mitigation in the Cancun Adaptation Framework, adopted at the Cancun Climate Change Conference in 2010.<sup>59</sup> To promote enhanced action on adaptation, the Cancun summit also established an Adaptation Committee<sup>60</sup> and created a process for the formulation and implementation of National Adaptation Plans (NAPs), whose main objective was to help Least Developed Country (LDC) Parties identify their medium- to long-term climate risks and develop strategies to reduce their vulnerability to climate change.<sup>61</sup> In 2014, the Lima summit invited all Parties to communicate their adaptation undertakings or address adaptation in their Intended Nationally Determined Contributions (INDCs).<sup>62</sup>

The importance of adaptation—and adaptation finance—was reaffirmed in the 2015 Paris Agreement. The new climate treaty established the global adaptation goal “of enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change.”<sup>63</sup> The Agreement does not require Parties to adopt any specific adaptation targets. Instead, it calls on them to engage in adaptation planning and implementation<sup>64</sup> and to submit and update

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57. See, e.g., U.N. Framework Convention on Climate Change arts. 2, 4.1, 4.4, May 9, 1992, S. Treaty Doc. No. 102-38, 1771 U.N.T.S. 107 [hereinafter UNFCCC].

58. See, e.g., U.N. Framework Convention on Climate Change, *Rep. of the Conf. of the Parties on its Thirteenth Session*, ¶ 1(c), Bali Action Plan (Decision 1/CP.13), U.N. Doc. FCCC/CP/2007/6/Add.1\* (Mar. 14, 2008).

59. See U.N. Framework Convention on Climate Change, *Rep. of the Conf. of the Parties on its Sixteenth Session*, ¶¶ 2, 11–35, The Cancun Agreements: Outcome of the Work of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention (Decision 1/CP.16), U.N. Doc. FCCC/CP/2010/7/Add.1 (Mar. 15, 2011) [hereinafter UNFCCC Decision 1/CP.16].

60. *Id.* ¶ 20.

61. *Id.* ¶ 15; U.N. Framework Convention on Climate Change, *Rep. of the Conf. of the Parties on its Seventeenth Session*, ¶ 1, National Adaptation Plan (Decision 5/CP.17), U.N. Doc. FCCC/CP/2011/9/Add.1 (Dec. 11, 2011).

62. U.N. Framework Convention on Climate Change, *Rep. of the Conf. of the Parties on its Twentieth Session*, ¶ 12, Lima Call for Climate Action (Decision 1/CP.20), U.N. Doc. FCCC/CP/2014/10/Add.1 (Dec. 14, 2014).

63. Paris Agreement, *supra* note 2, art. 7(1) (“Parties hereby establish the global goal on adaptation of enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change, with a view to contributing to sustainable development and ensuring an adequate adaptation response in the context of the temperature goal referred to in Article 2.”); see also *id.* arts. 2(1)(b) & 7.

64. *Id.* art. 7(9).

their “adaptation communications.”<sup>65</sup> Unlike mitigation, adaptation reporting is voluntary.<sup>66</sup>

The UNFCCC approach to adaptation, as with mitigation, is “country-driven.”<sup>67</sup> Adaptation communications and the Nationally Determined Contributions (NDCs) (communications setting out each country’s climate vision and mitigation policies<sup>68</sup>) are *nationally* determined by design. This logic has shaped the work of the Adaptation Committee<sup>69</sup> and other bodies.<sup>70</sup> This means that each country decides

65. *Id.* art. 7(10).

66. *Id.*

67. *Id.* arts. 7(5), 7(9). See also UNFCCC, *Rep. of the Conf. of the Parties on its Twentieth Session*, ¶ 7(a), Long-Term Climate Finance (Decision 7/CP.22), U.N. Doc. FCCC/CP/2016/10/Add.1 (Nov. 14, 2014); UNFCCC Decision 1/CP.16, *supra* note 59, at ¶¶ 12, 20(a), 30, 32; U.N. Framework Convention on Climate Change, *Rep. of the Conf. of the Parties on its Twenty-First Session*, Report of the Adaptation Committee (Decision 3/CP.21), U.N. Doc. FCCC/CP/2015/10/Add.2 (Jan. 29, 2016); U.N. Framework Convention on Climate Change, *Rep. of the Conf. of the Parties on its Twenty-First Session*, ¶ 7(a), National Adaptation Plans (Decision 4/CP.21), U.N. Doc. FCCC/CP/2016/10/Add.1 (Jan. 29, 2016).

68. The Paris Agreement does not require Parties to discuss adaptation in their NDCs. Instead, it gives them the option of submitting their adaptation communications as a component of or in conjunction with other documents, including their NAPs or NDCs. See Paris Agreement, *supra* note 2, art. 7(11). While developed countries generally see NDCs as focusing primarily on mitigation, many developing countries take the view that NDCs should also address adaptation and support. For the former perspective, see, for example, ENV’T & CLIMATE CHANGE CAN., CANADA’S SUBMISSION ON APA ITEM 3: FEATURES, UP-FRONT INFORMATION & ACCOUNTING FOR NATIONALLY DETERMINED CONTRIBUTIONS (NDCs) (2017), [http://www4.unfccc.int/Submissions/Lists/OSPSubmissionUpload/175\\_356\\_131502373272845803-APA%201.3%20Item%203%20-%20Mitigation%20NDC\\_EN.pdf](http://www4.unfccc.int/Submissions/Lists/OSPSubmissionUpload/175_356_131502373272845803-APA%201.3%20Item%203%20-%20Mitigation%20NDC_EN.pdf) [<https://perma.cc/WT3U-F2MV>] (archived Aug. 27, 2018).

69. See, e.g., Adaptation Comm., *Rep. of the Adaptation Comm. for the Period 2016–2018*, U.N. Doc. FCCC/SB/2015/2 (Oct. 20, 2015) (emphasizing adaptation at household/community and national/regional levels); Adaptation Comm., *Draft Outline of a Report on Various Approaches to Adaptation, such as Community-Based Adaptation and Ecosystem-Based Adaptation, Taking into Account Livelihoods and Economic Diversification*, U.N. Doc. AC/2017/6 (Mar. 1, 2017), [https://unfccc.int/sites/default/files/ac11\\_8b\\_approaches.pdf](https://unfccc.int/sites/default/files/ac11_8b_approaches.pdf) [<https://perma.cc/K35Y-5MQP>] (archived Sept. 19, 2018); Adaptation Comm., *Technical Paper on Long-Term Adaptation Planning*, U.N. Doc. AC/2018/4 (Feb. 20, 2018) (discussing country-driven nature of adaptation planning, [https://unfccc.int/sites/default/files/resource/ac13\\_7b\\_longterm\\_adaptation.pdf](https://unfccc.int/sites/default/files/resource/ac13_7b_longterm_adaptation.pdf) [<https://perma.cc/5CMB-9KS7>] (archived Oct. 24, 2018)).

70. See, e.g., UNFCCC LEAST DEVELOPED COUNTRIES EXPERT GRP. (LEG), *BEST PRACTICES AND LESSONS LEARNED IN ADDRESSING ADAPTATION IN LEAST DEVELOPED COUNTRIES 15* (2015), [http://www4.unfccc.int/nap/Documents%20NAP/50301\\_LEG\\_UNFCCC\\_BPLL\\_vol3.pdf](http://www4.unfccc.int/nap/Documents%20NAP/50301_LEG_UNFCCC_BPLL_vol3.pdf) [<https://perma.cc/KF96-AB2K>] (archived Sept. 12, 2018) (adopting a country-driven approach); *About the Adaptation Fund*, ADAPTATION FUND, <https://www.adaptation-fund.org/about> (last visited Sept. 19, 2018) [<https://perma.cc/CM2M-NRDN>] (archived Aug. 27, 2018); *Climate Change Adaptation*, U.N. DEV’T PROGRAMME, <http://www.adaptation-undp.org/about> (last visited Aug. 27, 2018) [<https://perma.cc/3APE-R8SG>] (archived Aug. 27, 2018) (applying a “community-driven approach”); *Projects Table View*, ADAPTATION FUND, <https://www.adaptation-fund.org/projects-programmes/project-information/projects-table-view> (last visited Aug. 29, 2018) [<https://perma.cc/B57Y-HAMQ>] (archived Aug. 29, 2018) (financing projects on a community- or country-basis).

for itself what adaptation “priorities, implementation and support needs, plans and actions” (Art. 7(10)) it wants to focus on—without necessarily taking into account the impact of its actions on its neighbors or the effectiveness of its unilateral measures.<sup>71</sup> As explained below, this is a significant design flaw.

At the same time, the growing international focus on adaptation has spurred considerable domestic action. After Finland published its national adaptation strategy in 2005, the first country in the Organisation for Economic Co-operation and Development (OECD) to do so,<sup>72</sup> some twenty-four developed countries issued their strategies, while seven are in the process of developing them.<sup>73</sup> In April 2016, 137 out of 161 INDCs (covering 189 Parties, or 83 percent of all INDCs) included an adaptation component.<sup>74</sup> As of October 2018, 129 out of 177 NDCs submitted (or 73 percent) contained an adaptation component.<sup>75</sup> Moreover, by October 2018, eleven developing countries had finalized their NAPs,<sup>76</sup> while over eighty others were laying the groundwork.<sup>77</sup>

In parallel, subnational and city-level adaptation planning has steadily expanded, aided by transnational organizations and networks

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71. The Paris Agreement’s “bottom-up” design is matched with “top-down” transparency, review, and reporting processes, whose purpose is to generate momentum and increase ambition over time by informing the periodic global stock take. Paris Agreement, *supra* note 2, arts. 7(14)(a), 7(14)(d), 13(5), 14.

72. Michael Mullan et al., *National Adaptation Planning: Lessons from OECD Countries* 13 (Org. for Econ. Coop. & Dev., Env’t Working Paper No. 54, 2013).

73. ORG. FOR ECON. COOP. & DEV., NATIONAL CLIMATE CHANGE ADAPTATION: EMERGING PRACTICES IN MONITORING AND EVALUATION 14 (2015) [hereinafter OECD, NATIONAL CLIMATE CHANGE], [https://read.oecd-ilibrary.org/environment/national-climate-change-adaptation\\_9789264229679-en#page1](https://read.oecd-ilibrary.org/environment/national-climate-change-adaptation_9789264229679-en#page1) [<https://perma.cc/3EWS-Q5TE>] (archived Aug. 28, 2018).

74. This includes INDCs submitted by 46 LDC Parties. U.N. Framework Convention on Climate Change, Aggregate Effect of the Intended Nationally Determined Contributions: An Update (Synthesis Report), ¶¶ 7, 59, 252, U.N. Doc. FCCC/CP/2016/2 (May 2, 2016) [hereinafter UNFCCC, Aggregate Effect].

75. UNFCCC Secretariat data on file with the author. Compare U.N. Framework Convention on Climate Change, Adaptation-Related Information Included in Nationally Determined Contributions, National Adaptation Plans and Recent National Communication (Technical Paper by the Secretariat), at 3, U.N. Doc. FCCC/TP/2017/7 (Oct. 2, 2017) [<https://perma.cc/M8M9-XEAP>] (archived Sept. 2, 2018) (showing that, as of October 2017, 108 out of 160 NDCs submitted (or 68 percent) contained an adaptation component).

76. UNFCCC Secretariat data on file with the author. Cf. *National Adaptation Plans: NAPs from Developing Countries*, U.N. FRAMEWORK CONVENTION ON CLIMATE CHANGE, <http://www4.unfccc.int/nap/Pages/national-adaptation-plans.aspx> (last visited Aug. 28, 2018) [<https://perma.cc/KX4X-V4EY>] (archived Aug. 28, 2018).

77. U.N. Framework Convention on Climate Change, Progress in the Process to Formulate and Implement National Adaptation Plans (Note by the Secretariat), ¶ 13, U.N. Doc. FCCC/SBI/2017/INF.12 (Nov. 2, 2017), <https://unfccc.int/sites/default/files/resource/docs/2017/sbi/eng/inf12.pdf?download> [<https://perma.cc/Q4HN-RGQP>] (archived Aug. 29, 2018).

like the C40 network of the world's megacities, the International Council for Local Economic Initiatives (ICLEI), and the World Mayors Council on Climate Change.<sup>78</sup>

As these developments indicate, the governance of climate adaptation is already *multi-level* in the sense that the issue is being addressed, to varying degrees, by institutions at all levels.<sup>79</sup> However, the current architecture is decidedly *mono-scalar* in terms of its geographic or spatial focus: most of the initiatives are concerned with domestic measures (i.e., local or national) even though climate adaptation has “local, subnational, national, regional and international dimensions”<sup>80</sup> and requires “international cooperation.”<sup>81</sup>

This Article thus draws a distinction between multi-level governance in terms of the *institutional* structure (which is an apt descriptor of the current framework) and multi-level governance in terms of the *policy focus* (which is the direction in which, this Article argues, adaptation needs to evolve).<sup>82</sup> Figure 2 below visualizes the difference between these two concepts:

78. ORG. FOR ECON. COOP. & DEV., ADAPTING TO THE IMPACTS OF CLIMATE CHANGE 5 (2015), <http://www.oecd.org/environment/cc/Adapting-to-the-impacts-of-climate-change-2015-Policy-Perspectives-27.10.15%20WEB.pdf> [<https://perma.cc/H2VX-LYXA>] (archived Aug. 29, 2018). While private actors and transnational networks also participate in adaptation, this Article is primarily concerned with states given its focus on transboundary issues requiring inter-state coordination.

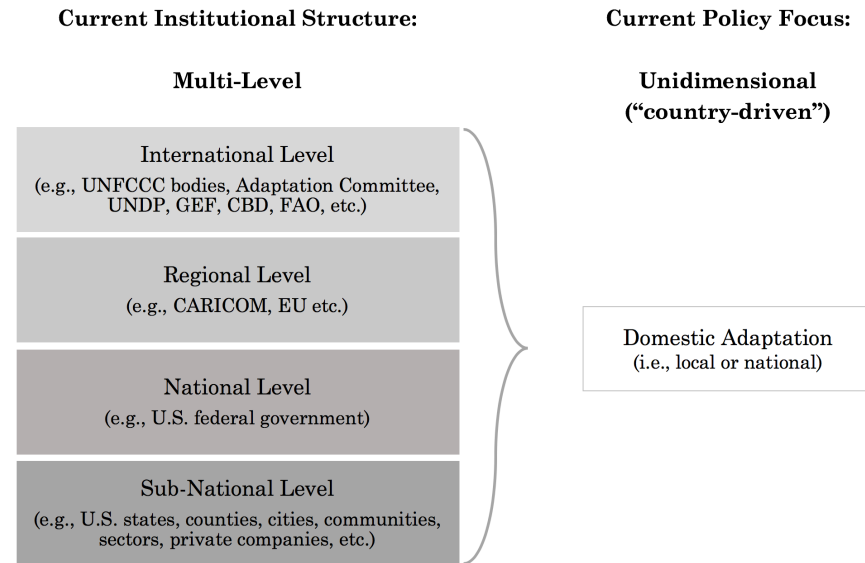
79. At the international level, the Adaptation Committee is charged with adaptation, but there is “significant” overlap in the functions performed by other institutions. See Adaptation Comm., Review of the Work of Adaptation-Related Institutional Arrangements under the Convention in 2017 (Background Note), ¶ 10, U.N. Doc. AC/2017/3 (Mar. 2, 2017) [hereinafter Adaptation Comm., Review of the Work]. Though crowded, the current institutional landscape is still largely focused on domestic adaptation. See also Adaptation Comm. & Least Developed Countries Expert Grp., Draft Options for the Adaptation Committee and the Least Developed Countries Expert Group to Address Decision 1/CP.21, paragraphs 41 and 45, ¶ 18, U.N. Doc. AC-LEG/2017/1 (Mar. 3, 2017).

Other notable governance issues at the international level—such as lack of agreed methodology to identify/track adaptation indicators, progress, or needs; lack of developing country capacity to track indicators and integrate strategies at the national/cross-sectoral level; and difficulties with monitoring and evaluation—are beyond the scope of this Article. See OECD, NATIONAL CLIMATE CHANGE, *supra* note 73, at 6, 9, 15; FOOD & AGRIC. ORG. OF THE U.N., THE AGRICULTURAL SECTORS IN NATIONALLY DETERMINED CONTRIBUTIONS (NDCS): PRIORITY AREAS FOR INTERNATIONAL SUPPORT 11 (2016), <http://www.fao.org/3/a-i6400e.pdf> [<https://perma.cc/5C5M-S3H4>] (archived Sept. 12, 2018); Kato & Ellis, *supra* note 12, at 9–11.

80. See Paris Agreement, *supra* note 2, art. 7(2) (“adaptation is a global challenge faced by all with local, subnational, national, regional and international dimensions”); see also UNFCCC, *supra* note 57, ¶¶ 14(f), 18.

81. Paris Agreement, *supra* note 2, art. 7(6); UNFCCC, *supra* note 57, ¶ 13.

82. In discussing multi-level governance (or scales), the literature typically focuses only on the former. See, e.g., Adger, *Successful Adaptation*, *supra* note 18, at 77–79. Multi-level (institutional) governance as defined in this Article differs from polycentric governance, which is defined in the literature as many centers of decision-making that are formally independent of each other, but are nested within a larger



*Figure 2: Current Governance: Institutional Structure vs. Policy Focus*

There are signs that new thinking may slowly be emerging. For example, in its 2012 NAP guidance document, the Least Developed Countries Expert Group (LEG) noted that regional cooperation could enhance the effectiveness and longer-term impact of adaptation, including by helping to “[a]void negative transboundary impacts, especially on shared river basins or other ecosystems.”<sup>83</sup> Funding and implementing bodies like the Global Environment Facility (GEF) have also begun considering transboundary factors.<sup>84</sup> Disaster risk

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system. See Vincent Ostrom et al., *The Organization of Government in Metropolitan Areas: A Theoretical Inquiry*, 55 AM. POL. SCI. REV. 831, 831–32 (1961). Here, as this Article shows, certain issues (e.g., transboundary externalities) are falling through the institutional cracks and are not a focus of polycentric governance—in contrast to local adaptation, which might be.

83. UNFCCC LEAST DEVELOPED COUNTRIES EXPERT GRP. (LEG), NATIONAL ADAPTATION PLANS: TECHNICAL GUIDELINES FOR THE NATIONAL ADAPTATION PLAN PROCESS 102 (2012) [hereinafter UNFCCC LEG NATIONAL ADAPTATION PLANS], [https://unfccc.int/files/adaptation/cancun\\_adaptation\\_framework/national\\_adaptation\\_plans/application/pdf/naptechguidelines\\_eng\\_low\\_res.pdf](https://unfccc.int/files/adaptation/cancun_adaptation_framework/national_adaptation_plans/application/pdf/naptechguidelines_eng_low_res.pdf) [https://perma.cc/Y26G-SAWC] (archived Aug. 28, 2018).

84. See, e.g., *Protection of Transboundary Surface and Groundwaters*, U.N. DEV. PROGRAMME, <http://www.adaptation-undp.org/protection-transboundary-surface-and-groundwaters> (last visited Aug. 29, 2018) [https://perma.cc/6XHD-TRTF] (archived Aug. 29, 2018); *Sustainable Management of Oceans in a Changing Climate*, U.N. DEV. PROGRAMME, <http://www.adaptation-undp.org/sustainable-management-oceans-chang>

reduction efforts, which are intrinsically connected with climate adaptation, are evolving in a similar direction.<sup>85</sup> The Adaptation Fund recently endorsed several “concepts” or “pre-concepts” with a transboundary dimension,<sup>86</sup> including ecosystem-based management or risk reduction plans in the Sahel, Lake Victoria Basin, Central Asia, and along the Ecuador-Colombia border.<sup>87</sup> Similarly, the UNFCCC Secretariat recently acknowledged that avoiding maladaptation could in some cases require “a metropolitan, regionally integrated and/or watershed-oriented approach, which may be transboundary in nature.”<sup>88</sup>

The same concerns are increasingly echoed by the Parties in their submissions to the UNFCCC Secretariat. For example, some Parties have adverted to the need to focus on “sectoral issues,” such as water, forests, ecosystems, and “eco-regions,” and to “develop[] approaches that are transboundary in nature for issues that cut across national borders.”<sup>89</sup> Others have suggested that assessments of impacts,

ing-climate (last visited Aug. 29, 2018) [<https://perma.cc/YK6Z-59E2>] (archived Aug. 29, 2018). Indeed, some of these initiatives focusing on the need for an ecosystem-based approach (e.g., by looking at shared watersheds or transboundary waters) predate the Paris Agreement. The GEF, in particular, has funded regional adaptation projects on this basis. See, e.g., Glob. Env’t. Facility, Evaluation of the GEF Strategic Priority for Adaptation, U.N. Doc. GEF/ME/C.39/4 (Oct. 22, 2010); GLOB. ENV’T. FACILITY, GEF PROGRAMMING STRATEGY ON ADAPTATION TO CLIMATE CHANGE—LEAST DEVELOPED COUNTRIES FUND SPECIAL CLIMATE CHANGE FUND (2014) [https://www.thegef.org/sites/default/files/publications/GEF\\_AdaptClimateChange\\_CRA\\_0.pdf](https://www.thegef.org/sites/default/files/publications/GEF_AdaptClimateChange_CRA_0.pdf) [<https://perma.cc/K4G2-T9WT>] (archived Aug. 29, 2018).

85. See, e.g., U.N. OFFICE FOR DISASTER RISK REDUCTION, REGIONAL ACTION PLAN FOR THE IMPLEMENTATION OF THE SENDAI FRAMEWORK FOR DISASTER RISK REDUCTION 2015–2030 IN THE AMERICAS (2017), [https://www.preventionweb.net/files/52286\\_americasregionalactionplaneng.pdf](https://www.preventionweb.net/files/52286_americasregionalactionplaneng.pdf) [<https://perma.cc/4RPT-TEZH>] (archived Aug. 29, 2018).

86. See *Endorsed Concepts*, ADAPTATION FUND, <https://www.adaptation-fund.org/projects-programmes/endorsed-concepts/> (last visited Aug. 28, 2018) [<https://perma.cc/Y2XG-J3WF>] (archived Aug. 28, 2018) [hereinafter *Endorsed Concepts*]; *Proposals & Concepts Currently Under Review*, ADAPTATION FUND, <https://www.adaptation-fund.org/projects-programmes/proposals-concepts-under-review> (last visited Aug. 29, 2018) [<https://perma.cc/E6FM-AB4E>] (archived Aug. 29, 2018).

87. *Endorsed Concepts*, *supra* note 86.

88. U.N. Framework Convention on Climate Change, Adaptation in Human Settlements: Key Findings and Way Forward (Report by the Secretariat), ¶ 31(a), U.N. Doc. FCCC/SBSTA/2018/3 (Feb. 19, 2018), <https://unfccc.int/sites/default/files/resource/docs/2018/sbsta/eng/03.pdf?download> [<https://perma.cc/VYZ4-CTNX>] (archived Aug. 29, 2018). The EU, for example, already supports its member states with transboundary issues by facilitating regional adaptation strategies, as in the Baltic Sea region. *Id.* ¶ 57.

89. Adaptation Comm., Review of the Work, *supra* note 79, ¶¶ 19; see also Adaptation Comm., Synthesis of Submissions from Parties and Other Stakeholders, and Next Steps for Developing Recommendations on Methodologies for Assessing Adaptation Needs, 12, U.N. Doc. AC/2017/4 (Mar. 4, 2017) (recommending that the Adaptation Committee consider transnational climate impacts at the regional scales); *Adaptation Committee: Fostering engagement of the agri-food sector in resilience to climate change*, U.N. CLIMATE CHANGE, <https://unfccc.int/event/adaptation-committee-fostering->

vulnerability, risk, and resilience also cover transboundary aspects. For instance, one West African country whose territory includes four major rivers (all of which are threatened by climate change) noted that it could become a destination for nomadic pastoralists from neighboring countries, which would further increase the pressure on its already vulnerable river basins.<sup>90</sup> Meanwhile, two major food-exporting countries reported that the climate-vulnerability of their agriculture and livestock sectors could translate into a global risk.<sup>91</sup> The Adaptation Committee, however, has not yet formally agreed to take the discussion of these issues forward.

These initiatives reflect the growing recognition that the present focus on unilateral, country-driven adaptation measures will be futile, if not harmful, in some cases. However, discussions of transboundary dimensions of climate adaptation remain an exception and do not go far enough in ensuring optimal adaptation, while the international community has yet to engage meaningfully with the global dimension of climate adaptation (which, as explained below, implicates international peace and security).<sup>92</sup> Similarly, while it is increasingly clear that climate adaptation needs to strengthen the resilience of both communities and ecosystems, ecosystem-based adaptation remains difficult due to both data gaps and low awareness among stakeholders.<sup>93</sup> If Figure 2 (above) shows the current unidimensional state of adaptation governance, Figure 3 illustrates what optimal institutional design might look like:

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engagement-of-the-agri-food-sector-in-resilience-to-climate-change (last visited Oct. 24, 2018) [<https://perma.cc/6TTE-GYKD>] (archived Oct. 24, 2018) (advertising a workshop that took place in October 2018, discussing links between food security, trade, and adaptation needs).

90. UNFCCC, Aggregate Effect, *supra* note 74, ¶ 281.

91. *Id.* ¶¶ 281, 305; *see also* Adaptation Comm., Progress Report by the Adaptation Committee's Working Group on the Technical Examination Process on Adaptation, ¶ 10, U.N. Doc. AC/2017/5 (Mar. 1, 2017) (raising the issue of the water-energy-food nexus and transboundary adaptation in delta countries).

92. *Cf.* IPCC, CLIMATE CHANGE 2014, *supra* note 1, at 1227 ("Regional policies and strategies for adaptation [in Africa], as well as transboundary adaptation, are still in their infancy.").

93. U.N. Framework Convention on Climate Change, Outcomes of Work under the Nairobi Work Programme on Impacts, Vulnerability and Adaptation to Climate Change Since May 2016 (Synthesis Report by the Secretariat), ¶¶ 29–30, UN Doc. FCCC/SBSTA/2018/2 (Mar. 26, 2018), [https://unfccc.int/sites/default/files/resource/02\\_1.pdf?download](https://unfccc.int/sites/default/files/resource/02_1.pdf?download) [<https://perma.cc/7CP6-ZUF8>] (archived Aug. 28, 2018). *See generally* U.N. Framework Convention on Climate Change, Adaptation Planning, Implementation and Evaluation Addressing Ecosystems and Areas such as Water Resources (Synthesis Report by the Secretariat), U.N. Doc. FCCC/SBSTA/2017/3 (Mar. 27, 2017), <http://undocs.org/en/FCCC/SBSTA/2017/3> [<https://perma.cc/5C29-DDS2>] (archived Aug. 29, 2018) (defining ecosystem-based adaptation).

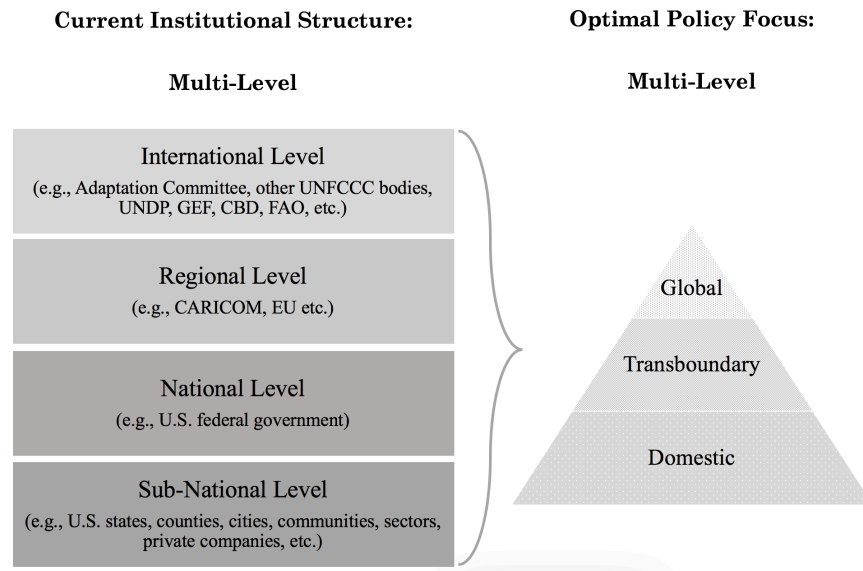


Figure 3: Optimal Institutional Design for Climate Adaptation

#### IV. FINDING THE DIVIDING LINE

With this framework in place, this Part seeks to differentiate between adaptation as a domestic, a transboundary, and a global public good (Parts IV.A–IV.B) before turning in the next Part to how such goods should be governed.

##### A. Adaptation as a Pure Domestic Public Good

In most cases, the appropriate regulatory measures for adaptation will be *highly localized* and *sector-specific*, because the underlying climate risks and impacts are also highly localized and sector-specific. Floods, droughts, and wildfires are all experienced locally and require a local response. As the Adaptation Committee noted in 2014, “[t]here needs to be a prioritization of support of local action, where adaptation will happen.”<sup>94</sup>

This makes sense in many instances. Crafting a single global adaptation goal in the Paris Agreement would not have been realistic, nor would states have accepted a top-down adaptation mandate. There is a great diversity of the Parties’ national circumstances and vulnerabilities to climate change owing to their particular geographic

94. Adaptation Comm., Letter to Co-Chairs of Board of Green Climate Fund, Ref. No. YN/OP/AM (Mar. 13, 2014); *see also* INTERAGENCY CLIMATE CHANGE ADAPTATION TASK FORCE, FEDERAL ACTIONS FOR A CLIMATE RESILIENT NATION: PROGRESS REPORT iv (2011).

characteristics (e.g., length of coastline, elevation, biodiversity, forest coverage, groundwater resources), population dynamics, and socioeconomic situation—factors that are reflected in the wide range of adaptation needs and priorities outlined in the individual INDCs.<sup>95</sup> Moreover, even where states adopt an adaptation policy to comply with their UNFCCC obligations, they still enjoy wide discretion with respect to domestic implementation.

As discussed above, domestic public goods generally can be managed, and externalities controlled, in two basic ways: through prescriptive regulation or private contracting.<sup>96</sup> Adaptation, however, even at the most local level, will rarely involve just two private parties. More often, it will require city- or region-wide solutions since climate change affects natural ecosystems, built environments, human health, and existing social, institutional, and legal arrangements.<sup>97</sup> Optimal adaptation at all levels of domestic governance, from city districts to the federal government, requires planning for a wide range of impacts and their interlinkages, such as heat stress, floods, wildfires, and blackouts, affecting large numbers of actors. The complexity and diversity of issues and institutions involved means that domestic adaptation will not lend itself easily to contractual bargains between neighbors or affected community members.<sup>98</sup> It will require a regulatory strategy to factor climate risks in a growing range of decisions, from coastal development, zoning, and agricultural policies, to freshwater conservation and endangered species protection. For example, building codes and landscaping ordinances will need to be updated to conserve water supplies, reduce susceptibility to heat stress, and improve protection against extreme events.<sup>99</sup>

Domestic legislation can aid optimal local adaptation by extending the government's planning horizons, factoring in long-term climate risks,<sup>100</sup> internalizing externalities, and promoting coordination among different levels of domestic governance. In addition, to prevent local maladaptation, domestic authorities would need to avoid market

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95. UNFCCC, Aggregate Effect, *supra* note 74, ¶¶ 63, 255–57.

96. *See supra* Part II.D.

97. *See* Rosina Bierbaum et al., *Adaptation*, in CLIMATE CHANGE IMPACTS IN THE UNITED STATES: THE THIRD NATIONAL CLIMATE ASSESSMENT 671 (J. Melillo et al. eds., 2014); STERN, *supra* note 10, at 422.

98. *Cf.* DON DEWEES, DAVID DUFF & MICHAEL TREBILCOCK, EXPLORING THE DOMAIN OF ACCIDENT LAW: TAKING THE FACTS SERIOUSLY 270 (1996) (“[W]here there are large numbers of victims, Coasian bargaining cannot take place.”). *See also* LAZARUS, *supra* note 37, at 40.

99. Bierbaum et al., *supra* note 97.

100. For example, South Australia's development planning policy calls for consideration of sea-level rise in the first 100 years of a project's life. *See Northcape Props. Pty Ltd. v. District Council of Yorke Peninsula* [2008] SASC 57 (Austl.) (upholding planning authority's decision to refuse development permits for failure to account for receding coastline under projected sea-level rise).

distortions, such as keeping in place or adopting new regulatory regimes for infrastructure that deter investment in resilience (such as direct or indirect fossil-fuel subsidies); public insurance or planning policies that encourage development in vulnerable areas (such as coverage for flood-prone homes); and measures that underprice natural resources.<sup>101</sup> They would also need to consider indirect risks, such as climate-related risks to financial stability.<sup>102</sup>

Domestic planning decisions are generally subject to judicial review, which means that local courts can play an important role in ensuring that such decisions are optimal from a public goods perspective. While courts are not competent to promulgate a national adaptation policy, they can provide a check on government decisions, as they do in other areas of environmental and administrative law.<sup>103</sup> Indeed, though it is early days, courts have successfully prevented maladaptation in a number of recent cases in different jurisdictions.<sup>104</sup>

For example, judicial review of zoning decisions by Australian courts has aided optimal adaptation by limiting development in coastal regions and flood-prone zones, where negative externalities from maladaptive development would be felt in the future (a form of *inter-temporal maladaptation*).<sup>105</sup> Similarly, judicial review can help ensure that local authorities consider climate risks to other types of infrastructure, including roads, sewage systems, and energy installations.<sup>106</sup> Courts can also help protect the availability of freshwater resources by mandating governments to consider climate impacts in a range of decisions, including groundwater extraction<sup>107</sup>

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101. Cf. ORG. FOR ECON. COOP. & DEV ET AL., ALIGNING POLICIES FOR A LOW-CARBON ECONOMY 54–56, 144 (2015), <http://dx.doi.org/10.1787/9789264233294-en> [<https://perma.cc/8353-QP78>] (archived Aug. 29, 2018); STERN, *supra* note 10, at 355.

102. See Maria L. Banda, *The Bottom-Up Alternative: The Mitigation Potential of Private Climate Governance After the Paris Agreement*, 42 HARV. ENVTL. L. REV. 325, 356 (2018).

103. This assumes that courts are neither usurping political powers nor abdicating their duties of judicial and administrative review through excessive deference. Cf. *Gutierrez-Brizuela v. Lynch*, 834 F.3d 1142, 1149 (10th Cir. 2016) (Gorsuch C.J., concurring) (“[W]hatever the *agency* may be doing under *Chevron*, the problem remains that *courts* are not fulfilling their duty to interpret the law and declare invalid agency actions inconsistent with those interpretations in the cases and controversies that come before them.”) (emphasis in original).

104. See generally Maria L. Banda & Scott Fulton, *Litigating Climate Change in National Courts: Recent Trends and Developments in Global Climate Law*, 47 ENVTL. L. REP. 10121 (2017).

105. See, e.g., *Gippsland Coastal Bd. v. South Gippsland SC & Ors*, [2008] VCAT 1545 (Vict. Civ. & Admin. Trib.) (Austl.); *Taip v. East Gippsland Shire Council*, [2010] VCAT 1222 (Austl.); *Rainbow Shores Pty Ltd. v. Gympie Reg’l Council*, [2013] QPEC 26 (Queensl. Plan. & Env’t Ct.) (Austl.).

106. Complaint in Intervention, *United States v. Miami-Dade County, Fla.*, No. 12-24400-FAM (S.D. Fla. June 25, 2013) (arguing that county’s plan to retrofit sewage treatment system in Biscayne Bay failed to address the risk of sea-level rise).

107. *Alanvale Pty Ltd. v. Southern Rural Water* [2010] VCAT 480 (Vict. Civ. & Admin. Trib.) (Austl.) (upholding local water authority’s denial of groundwater

and economic development, in challenges to environmental impact assessment or constitutional rights. For example, Colombia's Constitutional Court invalidated legislation permitting oil, gas, and mining operations in the nation's *páramo* partly because of the nexus between climate change, water, and biodiversity in this fragile high-altitude ecosystem.<sup>108</sup> As the Court found, though the *páramo* covers only 2 percent of Colombia's territory, it provides drinking water to 70 percent of Colombia's residents and plays a key role in climate mitigation.<sup>109</sup> Judicial enforcement of habitat protections for endangered species can also indirectly support optimal adaptation by encouraging ecosystem-based adaptation.<sup>110</sup>

As this emerging jurisprudence suggests, domestic governance is more likely to minimize negative externalities and result in optimal adaptation (or, at least, prevent maladaptation) if it is backstopped by judicial review. The scope of judicial review varies across jurisdictions and depends significantly on the courts' underlying powers and implementing legislation. However, domestic administrative and constitutional law generally supplies some of the basic building blocks to support optimal local adaptation, including evidentiary rules that consider scientific data (such as long-term climate risks), interpretative principles (such as the precautionary principle), and procedural rights (such as the right to access to information and public participation).

### *B. Adaptation as a Transboundary or a Global Public Good*

As the foregoing discussion shows, in many (if not most) cases, climate adaptation will be a pure domestic public good governable by domestic laws. Many local adaptation measures are just that—*local*: a housing development on an Australian beach is unlikely to produce

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extraction licenses where, applying the precautionary principle, additional exploitation of groundwater would not be sustainable given the likely long-term effects of climate change on rainfall and aquifer ability to recharge).

108. Corte Constitucional [C.C.] [Constitutional Court], Sala Plena, febrero 8, 2016, Gloria Stella Ortiz Delgado, Sentencia C-035/16 (Colom.).

109. *Id.* ¶¶ 141–43, 149–50, 156, 160.

110. Nat'l Wildlife Fed'n v. Nat'l Marine Fisheries Serv., No. 3:01-CV-00640-SI, 2016 WL 2353647, at \*7 (D. Or. May 4, 2016) (rejecting federal plan for the management of the Federal Columbia River Power System, having found, in part, that the latest biological opinion ignores current climate science); Defs. of Wildlife v. Jewell, No. 14-247-M-DLC, 2016 WL 1363865, at \*29 (D. Mont. Apr. 4, 2016) (holding that federal decision against listing the wolverine as threatened is arbitrary and capricious, in part because it ignored the effects of climate change on the species' survival); see also Alaska Oil & Gas Ass'n v. Jewell, 815 F.3d 544, 550 (9th Cir. 2016) (rejecting challenge by oil and gas trade associations, Alaska Native corporations and villages, and the state of Alaska against federal designation of critical habitat for polar bears and recognizing the future impact of climate change as relevant in the designation).

negative transboundary externalities, even if it is maladaptive, and would not justify superimposing a layer of international governance. However, the country-driven approach will fail to deliver optimal adaptation if it cannot control significant transboundary or global externalities or if adaptive capacity depends on international coordination due to cross-scale or cross-border linkages. This Article identifies two areas where this will likely be the case: those involving (1) the *water-energy-food nexus* and (2) the *climate-security nexus*. Each is explored below before turning to the legal framework.

### 1. Transboundary Public Goods: The Water-Energy-Food Nexus

A key challenge to optimal adaptation is how to protect freshwater resources, food production, and energy supply from climate change, especially in view of demographic growth in many vulnerable regions. Freshwater resources and food security are at particular risk from climate-induced change, such as extreme droughts.<sup>111</sup> In Africa, for example, between 350 and 600 million people may be at risk of increased water stress by 2050, while crop yields from rain-fed agriculture in some countries could be cut by up to 50 percent by 2020.<sup>112</sup> A number of regions are already feeling the impacts of water scarcity. Starting in 1998, Syria experienced its worst drought in 900 years.<sup>113</sup> China, the world's second-largest wheat producer, suffered a once-in-a-century drought in 2010–2011.<sup>114</sup> California's record-breaking drought that began in 2011 decimated the state's agriculture and ecosystems.<sup>115</sup> To be optimal, adaptation in these

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111. See IPCC, CLIMATE CHANGE 2014, *supra* note 1, at 14–15, 18; see also generally Carlo Fezzi et al., *The Environmental Impact of Climate Change Adaptation on Land Use and Water Quality*, 5 NATURE CLIMATE CHANGE 255 (2015) (addressing the impacts of agricultural adaptation on ecosystems); D. Lobell et al., *Climate Trends and Global Crop Production Since 1980*, 333 SCI. 616 (2011) (discussing climate risks to agriculture).

112. Michel Boko et al., Intergovernmental Panel on Climate Change, *Africa*, in CLIMATE CHANGE 2007: IMPACTS, ADAPTATION AND VULNERABILITY 434–35 (Martin Parry et al. eds., 2007).

113. NASA Finds Drought in Eastern Mediterranean Worst of Past 900 Years, NASA (Mar. 1, 2016), <https://www.nasa.gov/feature/goddard/2016/nasa-finds-drought-in-eastern-mediterranean-worst-of-past-900-years> [https://perma.cc/J8WB-WBFM] (archived Aug. 28, 2018).

114. See Stephane Dion, Minister of Foreign Affairs of Canada, Keynote Address at the Climate Change and Security: Fragile States Conference, The Security Implications of Climate Change in Fragile States (Mar. 30, 2016), <https://www.climate-diplomacy.org/news/keynote-security-implications-climate-change-fragile-states> [https://perma.cc/7PMY-S28Z] (archived Aug. 27, 2018); Thomas L. Friedman, *The Scary Hidden Stressor*, N.Y. TIMES (Mar. 2, 2013), <https://www.nytimes.com/2013/03/03/opinion/sunday/friedman-the-scary-hidden-stressor.html> [https://perma.cc/4CTM-TXNX] (archived Aug. 28, 2018).

115. See, e.g., JOSUÉ MEDELLÍN-AZUARA ET AL., ECONOMIC ANALYSIS OF THE 2016 CALIFORNIA DROUGHT ON AGRICULTURE (2016), <https://watershed.ucdavis.edu/files/Dro>

circumstances requires an understanding of climate impacts and ecosystem interlinkages inherent in the water-energy-food nexus concept.<sup>116</sup>

The risk of maladaptation is made more acute by the fact that while water and food governance tend to be primarily local, many communities depend on access to water and food resources that do not track state boundaries and are not amenable to local regulation. Globally, there are 286 watersheds and 300 aquifers that cross the boundaries of two or more states.<sup>117</sup> Shared waters represent about 45 percent of the earth's land surface and support 40 percent of the global population, but are under threat from pollution, mismanagement, and climate change.<sup>118</sup> As discussed below, they can also become a source of local or regional conflict.<sup>119</sup> Similarly, global food production is concentrated in a small number of states: just five countries will account for at least 70 percent of total exports of key agricultural commodities in 2025.<sup>120</sup> Considering future population growth, up to 5.2 billion people will be dependent on external water and land resources (and international trade) for their food security, while up to 1.3 billion people in low-income economies (mainly in Africa) may face long-term food insecurity in 2050.<sup>121</sup>

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ughtReport\_20160812.pdf [https://perma.cc/95G4-QGJH] (archived Sept. 12, 2018); Press Release, U.S. Dep't of Agric., New Aerial Survey Identifies More Than 100 Million Dead Trees in California (Nov. 18, 2016), <https://www.usda.gov/media/press-releases/2016/11/18/new-aerial-survey-identifies-more-100-million-dead-trees-california> [https://perma.cc/LA5T-2X8Y] (archived Aug. 28, 2018). The federal government maintains a drought portal to monitor local and global drought impacts. *See Drought*, NAT'L INTEGRATED DROUGHT INFO. SYS., <https://www.drought.gov/drought/> (last visited Aug. 28, 2018) [https://perma.cc/RE75-N3FT] (archived Aug. 28, 2018).

116. The water-energy-food nexus construct is also becoming increasingly critical in the domestic setting, which is often characterized by complex regulatory regimes for water, energy, and food that have historically evolved in isolation and display a considerable degree of rigidity.

117. *See* UNEP-DHI & UNEP, TRANSBOUNDARY RIVER BASINS: STATUS AND TRENDS 1–2 (2016); *Transboundary Waters*, FOOD & AGRIC. ORG. OF THE U.N., <http://www.fao.org/land-water/water/water-management/transboundary-water-management/en/> (last visited Jan. 30, 2018) [https://perma.cc/T6BW-C4Z3] (archived Sept. 2, 2018).

118. *Transboundary Waters supra* note 117. In Africa, 90 percent of all surface freshwater resources are shared between two or more states. *See* M. Goulden et al., *Adaptation to Climate Change in International River Basins in Africa: A Review*, 54 HYDROLOGICAL SCI. J. 805, 805 (2009); *see also* Declan Conway, *From Headwater Tributaries to International River: Observing and Adapting to Climate Variability and Change in the Nile Basin*, 15 GLOBAL ENVTL. CHANGE 99, 107 (2005).

119. *See infra* Part IV.B.2.

120. ORG. FOR ECON. COOP. & DEV. & FOOD & AGRIC. ORG. OF THE U.N., AGRICULTURAL OUTLOOK 2016–2025 at 45–46 (2016) [hereinafter OECD-FAO AGRICULTURAL OUTLOOK].

121. Marianela Fader et al., *Spatial Decoupling of Agricultural Production and Consumption: Quantifying Dependences of Countries on Food Imports Due to Domestic Land and Water Constraints*, 8 ENV'TL. RES. LETTERS 1, 7 (2013). Actual vulnerability is

In these circumstances, one state's unilateral attempts to adapt could generate significant negative externalities and make others *less* resilient. Increased irrigation by one state, for example, could jeopardize another state's water and food security. Similarly, one state's efforts to geoengineer its way out of climate impacts (for example, by trying to alter the local hydrological or meteorological cycle) could harm its neighbors. Adaptation studies, however, rarely consider these transboundary spillovers.<sup>122</sup>

Even though the Parties to the Paris Agreement were aware that adaptation policies might conflict and "threaten food production" (Article 2), they opted to follow a "country-driven" approach to adaptation and have yet to consider—let alone agree on—principles to align adaptation policies across state boundaries.<sup>123</sup> Transboundary governance—similar to the role played by domestic legal frameworks—could help avert maladaptation across national borders by internalizing externalities and ensuring coordination of unilateral state actions.

As the foregoing analysis suggests, climate adaptation should be treated as a transboundary public good where water or food security (or both)—which are integrally related to a community's ability to adapt to a changing climate—depend on access to shared resources. This includes both instances where one state's measures could generate negative externalities for its neighbors, or where neither state acting alone can attain optimal adaptation.

It is important to note, however, that the underlying drivers of water and food insecurity also include *non-climatic factors*, such as population growth and changes in per capita or agricultural water demand.<sup>124</sup> In fact, in many cases, demographically-driven growth in demand for freshwater *outweighs* the climate-induced changes.<sup>125</sup> Where such additional factors are present, climate change will likely exacerbate existing challenges and make cooperative adaptation frameworks all the more necessary. The confluence of climatic and non-climatic factors is a challenge not only for adaptation law and governance, but also for the climate finance provisions of the Paris

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likely greater in view of recent upward revision of projected population growth. See U.N. DEP'T. OF ECON. & SOC. AFF., WORLD POPULATION PROSPECTS: THE 2017 REVISION (2017), [https://esa.un.org/unpd/wpp/publications/files/wpp2017\\_keyfindings.pdf](https://esa.un.org/unpd/wpp/publications/files/wpp2017_keyfindings.pdf) [perma.cc/5UEF-8NE8] (archived Sept. 19, 2018).

122. See, e.g., Akemi Tanaka et al., *Adaptation Pathways of Global Wheat Production: Importance of Strategic Adaptation to Climate Change*, 5 SCI. REP. 1 (2015) (examining expanded irrigation capacity in wheat-producing countries to maintain yields).

123. See *supra* pp. 1046-47.

124. Goulden, *supra* note 118, at 812, 823.

125. *Id.*; see also IPCC, CLIMATE CHANGE 2014, *supra* note 1, at 17, 154, 239-40, 251, 381, 386, 505, 513, 552, 679, 714, 718, 740-42, 1067, 1072, 1123.

Agreement and the fraught discussions over “loss-and-damage” associated with the adverse effects of climate change.<sup>126</sup>

## 2. Global Public Goods: The Climate-Security Nexus

In select cases, transboundary impacts of climate change or maladaptation could be sufficiently widespread to acquire a global character. As defined in this Article, climate adaptation should be treated as a global public good where it contributes to the maintenance of international peace and security.

It is increasingly recognized that climate change makes violent conflict more likely, especially in fragile or failing states.<sup>127</sup> It can undermine international peace and security in a number of ways, including by:

1. Increasing scarcity and intensifying local competition over food, water, and energy (for example, due to drought and crop failures), which could turn violent and have cross-border spillovers;
2. Engendering competition over increasingly scarce transboundary resources (e.g., the Indus or the Nile);

126. See Paris Agreement, *supra* note 2, art. 8.; see also UNFCCC Decision 1/CP.21, *supra* note 2, ¶¶ 47–51.

127. For U.N. documents, see, for example, Press Release, Security Council, Security Council Holds First-Ever Debate on Impact of Climate Change on Peace, Security, Hearing Over 50 Speakers, U.N. Press Release SC/9000 (Apr. 17, 2007) [hereinafter 2007 UNSC Press Release]; Press Release, Security Council, Maintenance of International Peace and Security: Impact of Climate Change, U.N. Press Release SC/10332 (July 20, 2011) [hereinafter 2011 UNSC Press Release]; U.N. Secretary-General, Prevention of Armed Conflict, ¶¶ 37, 114–15, U.N. Doc. A/55/985–S/2001/574 (June 7, 2001); U.N. Secretary-General, The Relationship Between the United Nations and Regional Organizations, in Particular the African Union, in the Maintenance of International Peace and Security, ¶ 67, U.N. Doc. S/2008/186\*\* (Apr. 8, 2009); U.N. Secretary-General, Enhancing Mediation and Its Support Activities, ¶ 63, U.N. Doc. S/2009/189 (Apr. 8, 2009). For IPCC discussion, see, for example, IPCC, CLIMATE CHANGE 2014, *supra* note 1, at 20, 65, 94 & Ch. 12.5.

For country statements, see, for example, U.S. DEP’T OF DEF., 2014 CLIMATE CHANGE ADAPTATION ROADMAP (2014) [hereinafter 2014 DOD REPORT]; U.S. DEP’T OF DEF., NATIONAL SECURITY IMPLICATIONS OF CLIMATE-RELATED RISKS AND A CHANGING CLIMATE (2015); Dion, *supra* note 114.

See also CTR. FOR CLIMATE & SEC., EPICENTERS OF CLIMATE AND SECURITY: THE NEW GEOSTRATEGIC LANDSCAPE OF THE ANTHROPOCENE (Caitlin E. Werrell & Francesco Femia, eds., 2017) [hereinafter CFCS EPICENTERS]; L. RÜTTINGER ET AL., A NEW CLIMATE FOR PEACE: TAKING ACTION ON CLIMATE AND FRAGILITY RISKS, AN INDEPENDENT REPORT COMMISSIONED BY THE G7 MEMBERS (Adelphi, Int’l Alert, The Wilson Ctr., & Eur. Union Inst. for Security Stud. eds., 2015).

3. Submerging coastlines and triggering new disputes over altered maritime boundaries, territorial seas, sea lanes, and ocean resources;
4. Unleashing natural disasters, which may destabilize fragile and conflict-affected states;
5. Triggering unprecedented mass-migrations due to flooding, disease, desertification, war, and famine, generating additional conflict; and
6. Weakening the capacity of states to absorb shocks and resolve conflicts peacefully.<sup>128</sup>

Over the past decade, international organizations and governments have increasingly acknowledged the climate-security nexus. The UN Security Council placed the issue on its agenda in 2007.<sup>129</sup> A number of countries, including in the Sahel, have recognized the security implications of climate change and natural resource conflicts in their UNFCCC communications.<sup>130</sup> Several developed and developing countries have included these risks in their national defense plans.<sup>131</sup> The US military, for example, treats climate change as a significant strategic threat that could cause “instability in other countries by impairing access to food and water, damaging infrastructure, spreading disease, uprooting and displacing large numbers of people, compelling mass migration, interrupting commercial activity, or restricting electricity availability.”<sup>132</sup> The Pentagon also fears such disruptions could foster terrorism.<sup>133</sup>

Climate-induced competition over scarce natural resources has already been a key driver of violent conflict, especially in Africa.<sup>134</sup> Water scarcity, in particular, has been at the heart of the deadly conflicts in Darfur, Syria, and the Sahel.<sup>135</sup> In addition to the human

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128. See sources cited *supra* note 127 and accompanying text.

129. 2007 UNSC Press Release, *supra* note 127.

130. 2011 UNSC Press Release, *supra* note 127; UNFCCC, Aggregate Effect, *supra* note 74, ¶¶ 60, 261.

131. 2011 UNSC Press Release, *supra* note 127.

132. 2014 DOD REPORT, *supra* note 127, at 4.

133. *Id.*

134. See 2011 UNSC Press Release, *supra* note 127.

135. See, e.g., *id.*; U.N. ENV'T PROGRAMME, ENVIRONMENTAL GOVERNANCE IN SUDAN: AN EXPERT REVIEW (2012); Craig Welch, *Climate Change Helped Spark Syrian War, Study Says*, NAT'L GEOGRAPHIC (Mar. 2, 2015), <https://news.nationalgeographic.com/news/2015/03/150302-syria-war-climate-change-drought/> [https://perma.cc/N55A-5YSH] (archived Sept. 12, 2018); Naziru Mikailu, *Making Sense of Nigeria's Fulani-Farmer Conflict*, BBC NEWS (May 5, 2016), <https://www.bbc.com/news/world-africa-36139388> [https://perma.cc/X6T3-VWU2] (archived Sept. 12, 2018).

costs, there are also costs to the international community in the form of migration, arms flows, humanitarian aid, and spreading instability. In 2011, as many as ten UN Security Council-mandated peacekeeping operations costing \$35 billion—half of the global peacekeeping budget—were deployed to countries where natural resources had played a key role in conflict.<sup>136</sup>

As such, the need for a supra-national layer of climate adaptation governance will depend in part on whether international involvement in local adaptation (and community resilience) would help remove the underlying drivers of violent conflict and thereby contribute to international peace and security.

It should be noted that it is not possible to establish *causation* between climate change and conflict: these crises might have erupted at some point anyway due to non-climactic factors,<sup>137</sup> and, in many cases, climatic disturbances will not result in conflict. However, it is clear that (a) ecological crises can trigger conflicts and (b) climate change is almost certain to cause many more ecological crises in the future. While many societies are relatively resilient and can withstand some climate-induced shocks, this is not true of fragile or failing states. As former UN Secretary-General Ban Ki-moon noted, climate risks are heightened in vulnerable regions that face multiple stresses, such as pre-existing conflict, poverty, weak institutions, or food insecurity.<sup>138</sup> Almost half of the countries at high risk of water shortages in the coming decades are in the Middle East and North Africa—a region that is already under considerable stress.<sup>139</sup>

Optimal adaptation in these circumstances—measures that can help societies adjust to the effects of climate change and reduce the likelihood of violent conflict—is thus a global public good, which requires international support and governance frameworks. As noted above, we would expect lack of coordination and free-riding to be more likely here than in a simple two-state problem, which would result in even more suboptimal investment in global resilience.

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136. See 2011 UNSC Press Release, *supra* note 127, at UNEP Statement.

137. See *supra* pp. 1059–60.

138. 2007 UNSC Press Release, *supra* note 127.

139. Andrew Maddocks et al., *Ranking the World's Most Water-Stressed Countries in 2040*, WORLD RES. INST. (Aug. 26, 2015), <http://www.wri.org/blog/2015/08/ranking-world%E2%80%99s-most-water-stressed-countries-2040> [https://perma.cc/A4CU-SQWE] (archived Sept. 2, 2018).

## V. THE LAW AND GOVERNANCE OF MULTI-LEVEL CLIMATE ADAPTATION: A PROPOSED FRAMEWORK

The foregoing discussion has identified several major gaps in the prevailing approach to adaptation governance. However, governing a multi-level public good does not necessarily require inventing new international institutions or legal frameworks. As explained below, in many cases, existing principles and institutions can help states coordinate their efforts, reduce negative externalities, and avoid competition over diminishing resources. This Part, first, shows how treaty-based mechanisms and general international law could supply a framework for international climate adaptation (Parts V.A–V.B). Second, it addresses enforcement concerns (Part V.C). Finally, it identifies three priority areas for international law and institution-building (Part V.D).

### A. *Treaty Regimes*

As discussed above, neighboring states have historically negotiated treaties to resolve disputes over negative cross-border externalities (e.g., acid rain) or to peacefully use and manage their shared resources (e.g., transboundary lakes). Nowadays, a large number of bilateral or multilateral regimes are in place to govern and conserve shared transboundary resources, such as river basins.<sup>140</sup>

These treaty regimes are the product of inter-state bargaining (effectively, a Coasean-style solution), and each reflects the affected states' particular circumstances and interests. However, they have not emerged in a vacuum: they are informed by and negotiated against the background of foundational principles of international law, such as the no-harm principle and the equitable use principle. These principles define rights and assign consequences when state actions produce negative cross-border externalities, as explained in the next subpart.<sup>141</sup>

These existing governance structures provide an obvious starting point to address the transboundary dimensions of climate adaptation in a given “neighborhood” (such as the 1964 Columbia River Treaty between Canada and the United States). Treaty regimes and institutions can transform the structure of state incentives.<sup>142</sup> As climate change puts increasing pressure on shared resources, many agreements will require updating to expressly address climate risks

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140. Following thirty-seven acute transboundary water disputes in the last fifty years, 150 treaties have been signed to make international water-related relationships more stable and predictable. *See Transboundary Waters*, *supra* note 117.

141. *See infra* Part V.B.

142. *Cf.* OSTROM, GOVERNING THE COMMONS, *supra* note 40, at 137.

and align cross-border adaptation policies.<sup>143</sup> Few studies, however, currently address climate adaptation in international river basins.<sup>144</sup>

In addition to changing state incentives, these treaty regimes provide a template for neighborhoods where no treaties exist. As many as 158 (or 55 percent) of the world's 286 transboundary river basins presently lack a framework for cooperative management.<sup>145</sup> Given the potential for negative cross-border externalities, these areas should be the focus of international efforts to develop new cooperative, ecosystem-based adaptation governance, using best practices from other regions.

The 1997 Watercourses Convention also embodies a number of customary law principles relating to equitable use, significant harm avoidance, environmental protection, dispute resolution, as well as procedural rights, which could be used to elaborate new bilateral or multilateral arrangements.<sup>146</sup> However, the drafters of the Convention (who commenced their work in the 1960s) did not anticipate the scale of climatic and non-climatic stressors; today, far greater emphasis should be placed on precaution and harm avoidance.<sup>147</sup>

143. See COLUMBIA BASIN REGIONAL ADVISORY COMM., MEETING SUMMARY (2017), <https://engage.gov.bc.ca/app/uploads/sites/6/2017/07/2017-06-20-CBRAC-Meeting-Summary-2.pdf> [<https://perma.cc/9VGY-MNA2>] (archived Sept. 12, 2018) (discussing climate impacts on the river as part of treaty review process).

144. Goulden, *supra* note 118, at 816.

145. *Transboundary Waters* *supra* note 117; *The Legal Architecture for Transboundary Waters*, U.N. WATERCOURSES CONVENTION, <http://www.unwatercoursesconvention.org/importance/the-legal-architecture-for-transboundary-waters> (last visited Sept. 2, 2018) [<https://perma.cc/2ZJY-MNTE>] (archived Sept. 2, 2018); see also UNEP-DHI & UNEP, *supra* note 117, at 115 (identifying sixty-two basins and 106 basins as “high” and “very high” risk, respectively, based on whether they are governed by a modern legal framework); *Sustainable Development Goal (SDG) Indicators: Metadata Repository*, U.N. STATISTICS DIV., <https://unstats.un.org/sdgs/metadata> (last visited Oct. 15, 2018) [<https://perma.cc/Z7CQ-8T5Z>] (archived Oct. 15, 2018) (defining SDG Indicator 6.5.2 (Proportion of Transboundary Basin Area with an Operational Arrangement for Water Cooperation) as “the proportion of transboundary basins area within a country with an operational arrangement for water cooperation,” and finding that “cooperation is in most cases not advanced”).

146. Convention on the Non-Navigational Uses of International Watercourses arts. 8, 9, 12, May 21, 1997, 36 I.L.M. 700 (entered into force Aug. 17, 2014); see also Convention on the Protection and Use of Transboundary Watercourses and International Lakes, Mar. 17, 1992, 1936 U.N.T.S. 269 [hereinafter UNECE Water Convention]. On transboundary aquifers, see The Law of Transboundary Aquifers, G.A. Res. 66/104, U.N. Doc. A/RES/66/104 (Dec. 9, 2011) (encouraging states, *inter alia*, “to make appropriate bilateral or regional arrangements for the proper management of their transboundary aquifers”); G.A. Res. 63/124, U.N. Doc. A/RES/63/124 (Dec. 11, 2008) (taking note of 2008 Draft Articles on the Law of Transboundary Aquifers).

147. Cf. K. Conca et al., *Global Regime Formation or Complex Institution Building? The Principled Content of International River Agreements*, 50 INT'L STUD. Q.

Even modern agreements do not always necessarily reflect the needs of climate adaptation. For example, the Zambezi Watercourse Commission Agreement, concluded in 2004 to promote equitable and reasonable use of water resources and sustainable development of the Zambezi basin (one of the most vulnerable basins in Africa), does not fully consider the risks associated with more extreme floods and droughts due to the changing climate.<sup>148</sup> In addition, economic assessments of hydropower and irrigation projects are yet to factor in the full value of ecosystem goods and services.<sup>149</sup> In this sense, climate adaptation highlights the need for convergence between international environmental and water law—two congruent regimes<sup>150</sup> that have for too long evolved in silos.

Beyond shared freshwater resources, which have seen significant efforts at transboundary coordination, new bilateral or regional agreements could also contribute to sustainable management of other aquatic and terrestrial ecosystems (a) where one state's adaptation measures would have knock-on effects on another state's resilience (negative externalities), or, (b) where neither state's measures, taken in isolation, are likely to produce optimal adaptation (positive externalities). Forest ecosystems are one area where greater transboundary coordination may be needed not only with respect to climate mitigation,<sup>151</sup> but also water management.<sup>152</sup> Regional seas, like the Caribbean, and regional fish stocks are other candidate areas.<sup>153</sup> There is thus scope for both institutional change and institution building.

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263, 267 (2006) (noting tension between “no significant harm” and “equitable use” principles).

148. U.N. FRAMEWORK CONVENTION ON CLIMATE CHANGE, OPPORTUNITIES AND OPTIONS FOR ENHANCING ADAPTATION ACTIONS AND SUPPORTING THEIR IMPLEMENTATION: REDUCING VULNERABILITY AND MAINSTREAMING ADAPTATION (TECHNICAL PAPER) ¶ 19 (2016), [http://unfccc.int/files/adaptation/groups\\_committees/adaptation\\_committee/application/pdf/tp\\_adaptation\\_2016.pdf](http://unfccc.int/files/adaptation/groups_committees/adaptation_committee/application/pdf/tp_adaptation_2016.pdf) [<https://perma.cc/BBY8-2FJV>] (archived Sept. 2, 2018).

149. *Id.*

150. See generally Maria L. Banda, *Regime Congruence: Rethinking the Scope of State Responsibility for Transboundary Environmental Harm*, 103 MINN. L. REV. (forthcoming 2019) [hereinafter Banda, *Regime Congruence*].

151. See also Paris Agreement, *supra* note 2, art. 5(2) (encouraging “alternative policy approaches, such as joint mitigation and adaptation approaches for the integral and sustainable management of forests”).

152. Almost one-third of the world's watersheds have lost more than 75 percent of their forest cover. Conca, *supra* note 147, at 264.

153. Many regional seas are governed by treaties. See, e.g., Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (Cartagena Convention), Mar. 24, 1983, 1506 U.N.T.S. 157. However, as with freshwater regimes, these treaties require updating and greater enforcement capacity.

### B. General International Law

In many cases, no treaty-based transboundary resource-sharing regimes exist, and they are also not likely to be negotiated soon—due to high transaction costs, a large number of parties, concerns about free-riding, or other political barriers or populist concerns. However, a lack of formal institutions such as those described in the preceding subpart does not mean there is a legal vacuum. General international law can still aid optimal adaptation, though it might not always supply clear answers.

As noted above, general international law defines rights (e.g., to sovereign territory), imposes liability (for exceeding those rights and encroaching on another's sovereignty), and thus limits the range of appropriate state conduct.<sup>154</sup> As relevant in this context, it does not permit states to conduct or allow activities within their territory, or in common spaces, without regard for the rights of other states or for the protection of the general environment.<sup>155</sup> This principle translates into two related duties—to prevent, reduce, and control transboundary environmental harm, and to cooperate in mitigating risks of such harm. These duties inform the content of treaty regimes and also offer guidance in the formulation of new adaptation policies. In a sense, they define the range of acceptable bargains and set the direction in which compensation should flow (i.e., from the wrongdoer to the wronged party).<sup>156</sup>

The no-harm principle is a foundational element of international law. As the tribunal in the seminal *Trail Smelter* arbitration between the United States and Canada—the first sovereign dispute over air pollution—famously ruled, no state has the right to use or permit the use of its territory in such a manner as to cause injury by fumes in or to the territory of another or the properties or persons therein, when the case is of serious consequence and the injury is established by clear and convincing evidence.<sup>157</sup>

The duty to prevent transboundary environmental harm has since been reaffirmed in numerous decisions and become firmly entrenched in the corpus of customary international law.<sup>158</sup> It is also a core feature

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154. Cf. BARRETT, *supra* note 55, at 132 (“Many of the rules of any particular cooperation game are determined by the metagame of customary law.”).

155. See generally PATRICIA BIRNIE ET AL., *INTERNATIONAL LAW AND THE ENVIRONMENT* 137 (3d ed. 2009).

156. Cf. BARRETT, *supra* note 55, at 122 (noting Coase’s argument that the direction of an externality depends on the initial allocation of rights).

157. *Trail Smelter Case* (U.S. v. Can.), Award, 3 R.I.A.A. 1905, 1965 (Mar. 11, 1941).

158. See, e.g., *Legality of Threat or Use of Nuclear Weapons*, Advisory Opinion, 1996 I.C.J. 226, 241–42 (July 8) (“The existence of the general obligation of States to ensure that activities within their jurisdiction and control respect the environment of

of many multilateral environmental regimes, including the United Nations Convention on the Law of the Sea and the Convention on Biological Diversity.<sup>159</sup> Generally, states incur responsibility for transboundary harm if they are objectively at fault (i.e., if they failed to act with due care or diligence, if they acted in breach of a treaty, or if they committed a prohibited act).<sup>160</sup>

These principles apply with equal force to transboundary adaptation. Where a state knows, or should reasonably know or foresee, that its planned adaptation measures could cause serious harm to another state's environment (for example, by depleting natural resources or aggravating climate change), that state has a duty to prevent, reduce, and control the potential harm. A failure to honor that duty could attract international responsibility under customary law (and any applicable treaty law)—the consequences of which are discussed in Part V.C below.

Second, the duty to prevent transboundary environmental harm entails a concomitant duty to cooperate with the potentially affected states.<sup>161</sup> As the World Court stated, "by co-operating . . . the States concerned can manage the risks of damage to the environment that might be created by the plans initiated by one or [the] other of them, so as to prevent the damage in question."<sup>162</sup> Related to this duty are procedural obligations relating to notification, consultation, and risk assessment. Thus, where the risk of transboundary harm exists due to the state's activities or lack of action, the state would be required to undertake an environmental impact assessment in cooperation with the potentially affected state(s). A failure to do so could give rise to international responsibility.<sup>163</sup>

Applied to the adaptation context, this means that a state contemplating certain measures (e.g., building a hydroelectric dam, syphoning off freshwater) has a duty to assess the transboundary environmental impact of its project in cooperation with the downstream states. Under customary international law, the

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other States or of areas beyond national control is now part of the corpus of international law relating to the environment."); *see also* Gabčíkovo-Nagymaros Project (Hung/Slovk), 1997 I.C.J. 7, 67, 77–78 (Sept. 25); Pulp Mills on River Uruguay (Arg. v. Uru.), 2010 I.C.J. 14, ¶ 101 (Apr. 20); Certain Activities Carried out by Nicaragua in Border Area (Costa Rica v. Nicar.) / Construction of Road in Costa Rica Along San Juan River (Nicar. v. Costa Rica), 2015 I.C.J. 1, ¶ 104 (Dec. 16).

159. *See also* South China Sea Arbitration (Phil. v. China), PCA Case No. 2013-19, Award, ¶¶ 941, 944, 959 (Perm. Ct. Arb. 2016).

160. Alan Boyle, *Globalising Environmental Liability: The Interplay of National and International Law*, 17 J. ENVTL. L. 3, 3–5 (2005).

161. *See, e.g.*, South China Sea, PCA Case No. 2013-19, ¶ 985 n.1181.

162. Pulp Mills, 2010 I.C.J. 14, ¶ 77.

163. *See infra* Part V.C.

downstream states do not have the right to veto the project but would be entitled to reparations if they suffer significant injury.<sup>164</sup>

In a real-world dispute, obligations under other legal regimes could be triggered, such as human rights law, if one state's measures threatened another's citizens—an issue I explore elsewhere.<sup>165</sup> To avoid normative conflict, optimal adaptation will also require that these principles be mainstreamed in other legal regimes. International trade and investment law, for example, could act as a potential source of policy incoherence by reducing the scope of state discretion over adaptation (as certain regulatory measures could give rise to investment or trade claims).<sup>166</sup>

A different approach, however, would apply in those cases involving the climate-security nexus where the potential source of instability is entirely domestic. There, treaty regimes and general international law do not impose a *duty* on the international community to act: their interest is moral or political. However, in such matters, collective self-interest may counsel concerted international action—even in the absence of immediate transboundary effects or legal duties—to help communities address climate-related root causes of conflict and prevent externalities.

### C. Enforcement

International law thus provides a coherent framework to guide state efforts on adaptation in the context of transboundary or global public goods, but can it make a difference? It could be objected that international law lacks enforcement capacity. As noted, this is a major distinction between the domestic and the international legal realm that complicates public goods provision.<sup>167</sup> Moreover, even where such enforcement mechanisms exist and rights are in theory clearly defined, in practice states rarely bring inter-state claims in environmental matters.<sup>168</sup> Most disputes are resolved politically.

But this does not mean that investment in developing legal institutions and regimes is pointless. If disputes are generally resolved politically, whether through carrots (e.g., distributional incentives) or sticks (e.g., economic or reputational consequences), this is so in part because institutions, rules, and principles exist that can steer the

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164. See Lake Lanoux Arbitration (Fr. v. Spain), 12 R.I.A.A. 281, ¶ 11 (Perm. Ct. Arb. 1957); see also *infra* Part V.C.

165. See Banda, *Regime Congruence*, *supra* note 150.

166. See, e.g., MICHAEL TREBILCOCK ET AL., *THE REGULATION OF INTERNATIONAL TRADE* 684–86 (4th ed. 2013) (discussing potential trade linkages); see also *infra* note 176.

167. See *supra* pp. 1042, 1044.

168. See Banda, *Regime Congruence*, *supra* note 150.

dispute towards a particular outcome. Legal regimes and norms define the range of appropriate behavior. To the extent that states respond to the “logic of appropriateness”<sup>169</sup> (i.e., to a common standard of what constitutes internationally responsible behavior), we would expect them to refrain from taking actions that would invite international opprobrium.

But even if states respond predominantly to the “logic of consequences,”<sup>170</sup> a less charitable view, we would still expect them to seek a negotiated settlement. States face multiple equilibria in a dynamic multi-stage game, not a simple Prisoner’s Dilemma. They will rarely face the same set of players, or the same unidirectional externalities. There are multiple iterations involving multiple parties and multiple externalities, such that the wrongdoing state in one iteration may be wronged in another. Through practice, states create precedents, and bad precedents can harm their future interests. This creates an intrinsic interest in rule compliance.<sup>171</sup> Thus, though there is no higher authority to impose order from above, and despite difficulties with implementation and enforcement, a degree of restraint and respect for legal norms is embedded in the international system by virtue of self-interest.<sup>172</sup> (This is another distinction between interstate bargaining and the Coasean model involving private parties in the domestic context, which does not work via self-policing or precedent.)

However, for self-policing to work, states have to be conscious not only of the risk of cross-border externalities, but also of the applicability of particular legal norms. Currently, it is not clear that they are aware of either.<sup>173</sup> Existing institutions, such as the UNFCCC, could fill an important function by raising awareness of adaptation co-benefits, coordinating state actions, and broadcasting and reaffirming the relevance of common rules. This is particularly

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169. See generally JAMES G. MARCH & JOHAN P. OLSEN, REDISCOVERING INSTITUTIONS (1989) [hereinafter MARCH & OLSEN, REDISCOVERING INSTITUTIONS]; James G. March & Johan P. Olsen, *The Institutional Dynamics of International Political Orders*, 52 INT’L ORG. 943 (1998). For similar thinking, see Harold Hongju Koh, *Why Do Nations Obey International Law?* 106 YALE L.J. 2599 (1997).

170. See MARCH & OLSEN, REDISCOVERING INSTITUTIONS, *supra* note 169.

171. Cf. THOMAS C. SCHELLING, THE STRATEGY OF CONFLICT (1960) (advancing the theory that in games with multiple equilibria, “focal points,” such as environmental, cultural, or historical factors and precedent, can focus the players’ attention on one equilibrium and lead them to expect it, influencing subsequent behavior). Legal rules can have the focal-point effect. See, e.g., Richard H. McAdams, *Beyond the Prisoners Dilemma: Coordination, Game Theory, and Law*, 82 S. CAL. L. REV. 209, 234 (2009) (“Legal actors can influence behavior merely by creating self-fulfilling expectations that the legally obligatory behavior will occur.”). But see Jack L. Goldsmith & Eric A. Posner, *A Theory of Customary International Law*, 66 U. CHI. L. REV. 1113 (1999) (explaining customary international law solely as a reflection of state self-interest).

172. The Montreal Protocol’s stabilization of ozone-depleting substances is a commonly-cited success story.

173. See *supra* Part III.

important since actors might refuse to cooperate without assurances that others will do the same.<sup>174</sup> If states believe they will receive benefits (which can include carrots in the form of financing or side payments), they will be more likely to cooperate. And cooperation can beget cooperation through reciprocity.<sup>175</sup> Moreover, while the climate regime (and most resource-focused treaty regimes) does not provide for coercion, other regimes, such as trade, do. Those adjacent institutions, or bilateral relationships, could be leveraged as a stick to help enforce principles on climate adaptation much in the same way as they are used in other environmental disputes.<sup>176</sup>

#### D. *Risks of Overreach*

That said, not every transboundary impact calls for transboundary governance. In an interconnected world, the ripple effects of many domestic policies will be felt across the border, but that does not by itself justify superimposing an extra layer of governance.

As the above discussion suggests, the case for transboundary governance is strongest in the following three situations: *first*, where climate adaptation requires access to shared transboundary resources (which will often already be governed by treaty regime); *second*, where local adaptation measures risk having direct and significant negative transboundary externalities; and, *third*, where individual states, acting in isolation, cannot ensure optimal adaptation. This is particularly true of the use and management of shared water resources, such as aquifers, lakes, basins, or deltas, but also cross-

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174. See, e.g., Amartya K. Sen, *Isolation, Assurance and the Social Rate of Discount*, 81 Q.J. ECON. 112, 114 (1967) (In “assurance games,” expectations about other people’s behavior affect strategy: “If everyone has implicit faith in everyone else doing the ‘right’ thing..., then it will be in everyone’s interest to do the right thing . . . . [If] each individual has complete assurance that the other will do B, there is no problem of compulsory enforcement.”); cf. Chapman, *supra* note 39, at 147 (in “conditional co-operation,” players will contribute more as they are assured of fellow players’ cooperation, on whose behavior their own is conditional).

175. See, e.g., Robert Sugden, *The Supply of Public Goods Through Voluntary Contributions*, 94 ECON. J. 772, 783 (1984) (reciprocity theory predicts that each person tends to contribute more as others contribute more to public goods and charitable activities); cf. Joyce Berg et al., *Trust, Reciprocity, and Social History*, 10 GAMES & ECON. BEHAV. 122 (1995).

176. See, e.g., UNFCCC, *supra* note 57, art. 3(5) (contemplating the use of “unilateral” measures to combat climate change). Clarifying the interaction between the climate regime and the trade and investment regimes is outside the scope of the present analysis. On effectiveness of environmentally-based trade sanctions and border tax adjustments, see generally DANIEL BODANSKY ET AL., *INTERNATIONAL CLIMATE CHANGE LAW* 327–49 (2017); MICHAEL TREBILCOCK ET AL., *THE REGULATION OF INTERNATIONAL TRADE* 658–60, 686–91 (4th ed. 2013). On investment law, see, for example, Jorge E. Viñuales, *Foreign Investment and the Environment in International Law: An Ambiguous Relationship*, 80 BRIT. Y.B. INT’L L. 244 (2010).

border forests, terrestrial ecosystems, and ocean resources that are essential to local food security. As discussed above, international law offers the basic principles that could be used to address these situations and align adaptation efforts across state boundaries.

The argument for transboundary governance is less strong where the transboundary impact of local adaptation measures is indirect or not otherwise governed by international law. For example, if a country decides to protect its food security by restricting grain exports, its trade policies could increase food prices in import-dependent countries.<sup>177</sup> The affected state's degree of dependence on food imports—and vulnerability to these indirect effects—will be a function of many variables, including its demographic growth, governance, resource management, and agricultural and economic policy.<sup>178</sup> In this scenario, it would be difficult to argue that the exporting state's domestic food policy should be subject to international control, though a case for international cooperation could be made.<sup>179</sup> The same is true of access to water or energy resources. For example, to meet its local adaptation needs, a country could reasonably decide to restrict the right of foreign companies to bottle and export its freshwater resources or to use its arable land (though, as noted above, this could have repercussions under investment law).

## VI. CONCLUSION

How to ensure the provision of public goods has posed a significant challenge for our legal and political institutions. This is especially true of public goods that cross multiple jurisdictional lines and lie beyond

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177. A number of countries resorted to these measures during the 2007–08 and 2010–11 food crises. See, e.g., ORG. FOR ECON. COOP. & DEV., *Impact of Agricultural Export Restrictions on Prices in Importing Countries*, Joint Working Party on Agric. & Trade, OECD Doc. TAD/TC/CA/WP(2017)1/FINAL (2017) (noting “varying effectiveness” of export restrictions in stabilizing domestic prices and finding variable long-term impact on trading partners). For a discussion of indirect transnational risks, see also W. N. Adger et al., *Nested and Teleconnected Vulnerabilities to Environmental Change*, 7 FRONTIERS ECOLOGY & ENV'T 150 (2009) (applying concept of “nested and teleconnected vulnerability” to describe vulnerabilities of social-ecological systems that are linked across different localities and scales); Schenker & Stephan, *supra* note 12, at 45 (proposing adaptation as a strategy to offset climate-induced terms-of-trade effects transferred via integrated markets); Magnus Benzie et al., *Introducing the Transnational Climate Impacts Index: Indicators of Country-Level Exposure* (Stockholm Env't Inst. Working Paper No. 2016-07, 2016) (finance and trade “pathways” can transmit climate risks across markets and supply chains).

178. See *supra* pp. 1052–53, 1059–60; see also UNFCCC LEG, NATIONAL ADAPTATION PLANS, *supra* note 83, at 71.

179. But see Michael Trebilcock & Kristen Pue, *The Puzzle of Agricultural Exceptionalism in International Trade Policy*, 18 J. INT'L ECON. L. 233, 237, 247–50 (2015) (arguing that trade measures, including export restrictions, are “blunt instruments for dealing with price volatility” and can “undermine global welfare by inducing beggar-thy-neighbour policies”).

the control of any particular layer of government, such as high-seas fisheries, biodiversity, or a stable climate. As this Article has sought to illustrate using the case of climate adaptation, it is possible to optimize legal design for the provision of such multi-level public goods once we recognize their true nature and identify the basic barriers to cooperation. With this analytical framework in place, it will be possible to study the institutional design and/or forms of private contracting required to ensure the optimal provision of other multi-level public goods at the intersection of domestic and international law.

The recognition that climate adaptation is a multi-level public good, as this Article has argued, also has specific policy implications for how adaptation is governed and financed. The provision of an important transboundary, or global, public good cannot be left to unilateral efforts of individual states; it requires international legal and governance frameworks and more coherent, targeted adaptation finance. It further suggests that a one-size-fit-all approach to adaptation will not work. Legal design will have to accommodate multi-level risks and externalities, while recognizing the need for local implementation and community involvement.<sup>180</sup> While adaptation planning will largely remain a locally-owned and country-driven process, as reflected in the UNFCCC regime's philosophy, the strong transboundary dimensions of the water-energy-food nexus and the global dimensions of the climate-security nexus, especially in vulnerable regions, require a rethinking of adaptation law and governance. The management of climate adaptation in shared watersheds, forests, or navigation pathways is unimaginable without cross-border coordination, as individual states, left to their own devices, are unlikely to produce optimal adaptation. This Article has identified three priority areas where this is the case.<sup>181</sup>

As the foregoing discussion shows, multi-level adaptation governance will not necessarily require the creation of new governance institutions, as existing treaty regimes and general international law already provide considerable guidance. The first step is to reaffirm and remind states that—in the adaptation context, as elsewhere—they have a duty to prevent transboundary environmental harm to other states and to engage in international cooperation where their actions risk having significant transboundary impacts.

Thus far, UNFCCC bodies have not called on Parties to coordinate their adaptation plans or to take steps to ensure that their adaptation activities do not result in transboundary harm, and only “[a] few Parties” have planned to address transboundary issues in their

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180. Cf. Dietz et al., *supra* note 40, at 1910 (advocating institutions that are “complex, redundant, and nested in many layers” to manage global commons).

181. See *supra* p. 1070.

communications.<sup>182</sup> Parties will have a chance to decide whether they wish to include some form of regional cooperation in a future guidance document on adaptation<sup>183</sup> and whether they wish to entrust the Adaptation Committee with carrying out that mandate.<sup>184</sup> In particular, the Parties should signal a change of direction, including at the upcoming 24th Conference of the Parties in Katowice, Poland (COP24), by emphasizing the importance of transboundary adaptation measures and promoting integrated, ecosystem-based, and cooperative approaches to shared climate risk- and resource-management.

Second, with respect to adaptation finance, the recognition that country-driven adaptation measures may result in maladaptation and generate negative externalities (through market failures, environmental degradation, mass migration, and conflict) could make the Parties more willing to mobilize funds and help vulnerable countries build resilience to climate shocks before the worst projections materialize. In some cases, international cooperation on adaptation is

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182. UNFCCC, *supra* note 57, ¶ 65; *see also* U.N. Framework Convention on Climate Change, Adaptation-Related Information Included in Nationally Determined Contributions, National Adaptation Plans and Recent National Communication, ¶ 28, U.N. Doc. FCCC/TP/2017/7 (Oct. 2 2017) (noting that some Parties have highlighted their intended efforts to “cooperat[e] on transboundary waters”) [<https://perma.cc/M8M9-XEAP> archived 9/2/2018].

183. *See* Ad Hoc Working Grp. on the Paris Agreement, Draft Elements for APA Agenda Item 4 (Further Guidance in Relation to the Adaptation Communication, Including, *inter alia*, as a Component of NDCs, Referred to in Article 7, Paragraphs 10 and 11, of the Paris Agreement), Informal Note by the Co-Facilitators—Final Iteration (May 9, 2018), [https://unfccc.int/sites/default/files/resource/APA1-5\\_IN\\_i4\\_3.pdf?download](https://unfccc.int/sites/default/files/resource/APA1-5_IN_i4_3.pdf?download) [<https://perma.cc/ZAK7-4GKF>] (archived Sept. 2, 2018).

184. The Adaptation Committee’s mandate is limited by the Parties’ Agreement. In 2015, it was requested to develop methodologies for reviewing the adequacy and effectiveness of adaptation and support. *See* UNFCCC Decision 1/CP.21, *supra* note 2, ¶¶ 41, 42, 45, 130. The Adaptation Committee presented its recommendations on this subject in 2017. *See* U.N. Framework Convention on Climate Change, Report of the Subsidiary Body for Implementation on its Forty-Seventh Session, ¶¶ 77–78, U.N. Doc. FCCC/SBI/2017/19 (Jan. 31, 2018), <https://unfccc.int/sites/default/files/resource/docs/2017/sbi/eng/19.pdf> [<https://perma.cc/AFT7-LDRP>] (archived Oct. 15, 2018) (discussing Adaptation Committee’s technical work and recommendations). At this point, it is up to the Parties, acting with the UNFCCC subsidiary bodies, to decide whether to extend or expand the Adaptation Committee’s mandate via a new request issued at COP24. *See id.* ¶ 80. The draft negotiating documents discussing the Adaptation Committee’s mandate do not presently disclose an intention to move in this direction. *See, e.g.*, U.N. Framework Convention on Climate Change, Elements of Draft Text Under SBI Agenda Item 12 and SBSTA Agenda Item 4, ‘Report of the Adaptation Committee’ Revised Informal Note by the Co-Facilitators (Nov. 14, 2017), [http://unfccc.int/files/meetings/bonn\\_nov\\_2017/in-session/application/pdf/sb47\\_isbi12\\_isbst4\\_ainformal\\_note\\_ac\\_.pdf](http://unfccc.int/files/meetings/bonn_nov_2017/in-session/application/pdf/sb47_isbi12_isbst4_ainformal_note_ac_.pdf) [<https://perma.cc/UET4-QS3Y>] (archived Oct. 15, 2018) (summarizing views expressed by some of the Parties during informal consultations and recommendations prepared by the Adaptation Committee); *see also* U.N. Framework Convention on Climate Change, Draft Decision Text on Matters Referred to in Paragraphs 41, 42 and 45 of Decision 1/CP.21 (Sept. 8, 2018), [https://unfccc.int/sites/default/files/resource/DT\\_AC\\_LDCs\\_v8Sep.pdf](https://unfccc.int/sites/default/files/resource/DT_AC_LDCs_v8Sep.pdf) [<https://perma.cc/E65Z-W2GK>] (archived Oct. 15, 2018) (outlining current state of negotiations on different mandates). The Adaptation Committee is developing its new workplan.

a (self-interested) investment in international peace and security. Likewise, the recognition that positive externalities of adaptation may be undervalued in the absence of transboundary cooperation may support better cost-and-benefit-sharing agreements.

International governance mechanisms, however, need to be placed on a sounder, evidence-based methodological footing if they are to result in optimal adaptation.<sup>185</sup> For example, Parties should be required to address transboundary dimensions of adaptation in their adaptation communications under the Paris Agreement or requests for adaptation funding, including: (a) shared natural resources and shared climate risks; (b) potential adverse impacts of domestic adaptation measures on other states; and (c) potential adverse domestic impacts of other states' adaptation measures.

This data—while likely controversial among some countries—would help the funding bodies, the Adaptation Committee, and the affected regions and countries plan for and preempt climate risks and direct international support and finance to where they are most needed. To encourage compliance, access to adaptation finance could additionally be conditioned on a party's willingness to cooperate with other potentially affected states and to respect international law. Though grounded in basic norms of international law, appending such criteria to funding would also likely prove controversial in view of current practices.<sup>186</sup>

In addition, it will be important to develop a methodology to disaggregate climatic from non-climatic factors that can reduce a society's resilience, such as bad governance or demographic growth, as non-climatic factors may require a different policy approach and different financing channels.<sup>187</sup>

In grappling with the transboundary and global dimensions of climate change, however, the international community needs to guard against the risks of overreach (i.e., of extending the scope of transboundary governance mechanisms too far into the local realm). As this Article has argued, many adaptation measures are purely local and do not warrant international supervision. Identifying the

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185. See *supra* note 79.

186. That said, some funding bodies already do consider transboundary impacts in their funding criteria. See, e.g., GREEN CLIMATE FUND, ENVIRONMENTAL AND SOCIAL POLICY ¶ 8(b) (2018), [https://www.greenclimate.fund/documents/20182/574763/GCF\\_policy\\_Environmental\\_and\\_Social\\_Policy.pdf/aa092a12-2775-4813-a009-6e6564bad87c](https://www.greenclimate.fund/documents/20182/574763/GCF_policy_Environmental_and_Social_Policy.pdf/aa092a12-2775-4813-a009-6e6564bad87c) [https://perma.cc/2FEZ-DEVW] (archived Oct. 15, 2018) (in case of potential transboundary impacts of GCF-funded projects, committing to undertake "all necessary consultations and due diligence processes, including prior notification and consultations with the relevant stakeholders, including addressing their comments"); see also *id.* ¶¶ 2, 68bis (committing to develop modalities to resolve neighboring countries' concerns about "potential transboundary environmental and social impacts").

187. On the interplay between climatic and non-climatic factors, see *supra* pp. 1059–60.

circumstances in which local actions can have unforeseen transboundary or global impacts<sup>188</sup>—and designing legal mechanisms to encourage state cooperation in different contexts—is thus a key research and policy priority.

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188. Cf. Oran R. Young et al., *The Globalization of Socio-Ecological Systems: An Agenda for Scientific Research*, 16 GLOBAL ENVTL. CHANGE 304, 313 (2006).