

THE PARCHED EARTH OF COOPERATION: HOW TO SOLVE THE TRAGEDY OF THE COMMONS IN INTERNATIONAL ENVIRONMENTAL GOVERNANCE

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ABSTRACT

This article proposes a way to strengthen international environmental agreements, such as the Paris Agreement and the Kyoto Protocol. Multilateral environmental agreements such as these are extremely fragile. At the heart of the problem is what is known as the tragedy of the commons—a unique dynamic that viciously sabotages cooperation. The cause of this tragedy is that no one can trust that other actors will conserve the common resource, which triggers a race to the bottom—a race to deplete. Global warming and our inability to halt it is perhaps the ultimate example of a tragedy of the commons on a truly massive scale. On a domestic level, the tragedy of the commons is easily solved through regulation. However, on a supranational level, where there is no overarching authority, governance mechanisms tend to collapse. The hard truth is that without robust enforcement of some kind, international cooperation is extremely difficult to maintain. This article proposes the following idea: governments joining (or already party to) an agreement, contribute an upfront deposit to an international regulatory body (the Commons Management Fund (“CMF”)) with the understanding that their contribution will be forfeited if they fail to honor their treaty commitments. The idea, while ostensibly simple, is deceptively complex. The focus is not the penalty, but rather the ability of governments to credibly signal commitment. In game theory, credible signaling can prevent a tragedy of the commons by generating confidence

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that everyone will stick to their commitments. The CMF is designed to exploit this effect. Now, more than ever, a solution to the tragedy of the commons on a supranational level is desperately needed—the CMF is such a solution.

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I. INTRODUCTION

International environmental governance remains shockingly anemic. While there is now global consensus regarding the magnitude of the threat posed by the ecological crisis before us, our ability to take meaningful action to halt or at least slow its advance is profoundly constrained. The problem is that the basic architecture of the international system is anarchic: “[n]one is entitled to command; none is required to obey.”¹ The international community lacks a central authority capable of enforcing cooperation. In the absence of such enforcement, uncertainty between states as to the strength

1. KENNETH N. WALTZ, *THEORY OF INTERNATIONAL POLITICS* 88 (1979).

of each other's commitment reliably undermines attempts at collective action. The hard truth is that without enforcement of some kind, robust international cooperation will remain elusive.

Consider the recent Paris Agreement on climate change. The agreement was a remarkable achievement in international diplomacy. Nearly every state in the world—from North Korea to the United States—pledged to reduce their greenhouse gas emissions.² Yet governments face no consequences if they fall short of their commitments under the agreement. The agreement thus stands enfeebled upon the shaky edifice of verbal commitments and good will. Consensus of this kind is extremely fragile. Even a trickle of states exiting the agreement will, in all likelihood, trigger the withdrawal of more governments and bring about the total collapse of the agreement. Multilateral environmental agreements are uniquely susceptible to this pattern of failure.³ This is because for an environmental treaty to work effectively, everyone needs to be onboard and everyone needs to stay onboard.

The inability to manage a common resource in the absence of an overarching authority is by no means a new or unrecognized problem—it has been understood for centuries.⁴ The inability to effectively coordinate the use of an open-access resource and the disastrous consequences that may flow from failing to do so is known as the *tragedy of the commons*.⁵ A tragedy of the commons exists where a group of actors behaving rationally and in-line with their self-interests depletes a common resource, undermining the entire group's long-term interests (along with their own), yet the prevailing equilibrium forces precisely this outcome. The cause of this tragedy is that no one can trust that their partners will not overexploit the resource, which invariably triggers a destructive race to the bottom. The true 'tragedy' in the tragedy of the commons is that actors otherwise willing to husband a resource are forced by rational self-interest to 'grab what they can.' Global warming and our inability to halt it is perhaps the ultimate example of a

2. Joby Warrick & Chris Mooney, *196 Countries Approve Historic Climate Agreement*, WASH. POST (Dec. 12, 2015), <https://www.washingtonpost.com/news/energy-environment/wp/2015/12/12/proposed-historic-climate-pact-nears-final-vote/> [<https://perma.cc/Y2GA-KREG>].

3. Bilateral environmental agreements (where the agreement is between two nation states) are also vulnerable to this model of collapse. However, because the dynamic involves only two players, the pattern plays out in a less obvious sequential fashion and may be easier to forestall.

4. See Amy Sinden, *The Tragedy of the Commons and the Myth of a Private Property Solution*, 78 U. COLO. L. REV. 533, 534–35 (2007).

5. The concept was first formulated in a rigorous way by Garrett Hardin. See Garret Hardin, *The Tragedy of the Commons*, 162 SCI. 1243, 1248 (1968). Other terminology used to describe this social dilemma or aspects thereof include: resource dilemma, take-some dilemma, and common-pool resource. For a good overview of these descriptors and some of the structural conditions that make up the dilemma, see MARGARET FODDY, ET AL., *RESOLVING SOCIAL DILEMMAS: DYNAMIC, STRUCTURAL, AND INTERGROUP ASPECTS* 9 (2013).

tragedy of the commons on a truly massive scale. On a domestic level, the tragedy of the commons is easily solved through regulation. On a supranational level, however, preventing a tragedy of the commons is extremely tricky. Because there is no authority able to coordinate the behavior of the relevant stakeholders, governance mechanisms tend to collapse.

According to neoclassical welfare economics, there are two solutions to the tragedy of the commons. The first is top-down regulation, and the second is privatization of the resource.⁶ However, both solutions falter on the international level. The fragmented structure of the international community precludes solving the tragedy of the commons using regulation as it is deployed in the domestic realm. The second solution, privatization, is a radical concept fraught with serious logistical and normative challenges. This article proposes the following idea: governments joining (or already party to) an agreement contribute an upfront deposit to an international regulatory body (the *Commons Management Fund* (“CMF”)) with the understanding that their contribution will be forfeited if they fail to honor their treaty commitments. The idea, while ostensibly simple, is in fact deceptively complex. The focus is not the penalty, but rather the ability of governments to credibly signal commitment. In game theory, credible signaling between actors can prevent a tragedy of the commons from forming by generating confidence that everyone will stick to their commitments. There is a sizeable literature on signaling in both economics and political science, as well as other disciplines.⁷ The proposal is designed to exploit this effect. The model is particularly well-suited for treaties exhibiting a tragedy-of-the-commons dynamic because the problem in such cases is primarily one of perception, and this model targets perceptions more effectively than alternative compliance mechanisms.

6. Hardin proposes “mutual coercion, mutually agreed upon” i.e. state regulation. Hardin, *supra* note 5, at 1247. Alternatively, Hardin suggests that the commons may be sold off as private property. *Id.* at 1245. Note, however, that Hardin also postulates that common ownership pools may also solve the dilemma. *See id.* at 1245–46; *see also* ELINOR OSTROM, GOVERNING THE COMMONS: THE EVOLUTION OF INSTITUTIONS FOR COLLECTIVE ACTION 37–46 (James E. Alt & Douglass C. North eds., 1990) (arguing that common-pool problems may be solved by voluntary organizations rather than by a coercive state or privatization); Robert C. Ellickson, *Property in Land*, 102 YALE L.J. 1315, 1388–91 (1993) (observing that close-knit social groups often develop strategies that can prevent the tragedy of the commons). Unfortunately, the international community is the very antithesis of a close-knit social group.

7. For example, costly signaling has been proposed in the IR literature as a method for solving the security dilemma, the situation in which states, seeking only to strengthen their own military security, escalate tensions and increase the likelihood of conflict, although neither side desire it. *See generally* Evan Braden Montgomery, *Breaking out of the Security Dilemma*, 31 INTERNATIONAL SECURITY 151 (2006). Costly signaling theory is also found in evolutionary biology. *See infra* note 98 and accompanying text.

The discussion that follows focuses primarily on the resource of water. The global, unconfined nature of water makes it an ideal case study through which to examine commons management on a supranational level. The reader should note, however, that the model may be applied to any common-pool resource. The proposal can, in principle, solve the tragedy of the commons across the board. With the continuing destruction of the *global commons*,⁸ the international community desperately needs a mechanism to strengthen international environmental governance. If the tragedy of the commons cannot be brought to heel, the collective prosperity and perhaps even the very survival of our species is threatened. Yet given the current political and legal fragmentation of the world, the task of sustaining coordinated action on such a massive scale is formidable. This difficulty, however, does not impugn its possibility; it merely speaks to the inadequacy of our current governance structures. The supranational nature of the global commons requires a new way to maintain the agreements we make. It is the aim of this article to lay out the broad strokes of such an approach.

My argument unfolds in three parts. Part II explains the tragedy of the commons and analyzes it in terms of the prisoner's dilemma. Part III examines the standard solutions to the tragedy of the commons—top-down regulation and privatization—and explains how both approaches fail on the supranational level. I then propose a solution to the tragedy of the commons on the international level—the Commons Management Fund. Part IV explains the theoretical underpinnings of the proposal, how the approach differs from standard compliance mechanisms employed in treaties, and how, given the peculiar dynamics of multilateral environmental agreements, the model is uniquely crafted to diffuse a tragedy of the commons. Part V concludes.

II. THE PROBLEM UNPACKED: THE TRAGEDY IN THE TRAGEDY OF THE COMMONS

A. Hardin's Hungry Cattle

In a tragedy of the commons, agents' inability to reliably coordinate gives rise to a social dilemma with grossly inefficient outcomes.⁹ The

8. The term 'global commons' traditionally describes international and supranational resource domains, such as Antarctica, the world's oceans and seabed, the atmosphere and space. *See, e.g.*, SUSAN J. BUCK, *THE GLOBAL COMMONS: AN INTRODUCTION* 1 (2012). I use the term here and throughout the discussion, however, more loosely to refer to any common-pool resource that necessitates the collective action of two or more states.

9. The definition of a social dilemma is any situation in which "the reward or payoff to each individual for a selfish choice is higher than that for a cooperative one, regardless of what other people do; yet all individuals in the group receive a lower payoff if all defect than if all cooperate." FODDY, ET

tragedy of the commons, also referred to as the *common-pool resource problem*,¹⁰ is particularly pernicious in situations in which there is no centralized enforcement, and thus the stakeholders' ability to diffuse the dilemma is severely impoverished. Even where it is in the collective interests of all parties to coordinate, each party, driven by rational self-interest, will generate a behavioral equilibrium that is, tragically, far worse for all the stakeholders. Economic rationality thus produces a sub-optimal use of the resource, often leading to complete destruction of a shared resource. Examples abound. The canonical example, however, is a group of farmers overgrazing a common range until it can no longer be grazed (this is the example used by Garrett Hardin in his famous essay formally describing the dilemma).¹¹ Each farmer strives to maximize her personal gain by continuing to add additional cattle onto the grazing land. This gives rise to an externality problem. While each farmer gleans the full benefit of using the grazing land, each bears only a portion of the cost of its overuse. Collectively, however, the farmers bear the complete cost of the overgrazing. Private decision-makers do not fully internalize the social benefits or costs that flow from their actions.¹² Under these conditions, each farmer will, driven by economic rationality, continue to introduce additional cattle until the resource—the grazing land—is completely decimated.¹³ The expectation that other agents will behave in the same manner triggers a rush to exploit the resource. In a tragedy of the commons situation, nothing incentivizes collective action to avoid resource depletion. Instead, actors have every incentive to deplete the resource. The tragic irony is that, even where all stakeholders wish to cooperate because of the threat of free riding, the entire system is nonetheless driven to eventual collapse. Each actor is compelled by rational self-interest

AL., *supra* note 5, at 1–2.

10. I use the terms common-pool resource problem and the tragedy of the commons interchangeably going forward.

11. See Hardin, *supra* note 5, at 1244–45. Hardin, however, was not the first to recognize the problem; see generally H. Scott Gordon, *The Economic Theory of a Common Property Resource: The Fishery*, 62 J. POL. ECON. 124 (1954); Anthony Scott, *The Fishery: The Objectives of Sole Ownership*, 63 J. POL. ECON. 116 (1955). There are even earlier references to the social dilemma. See Jens Warming, *Om 'Grundrente' af Fiskegrunde*, NATIONALOKONOMISK TIDSSKRIFT 495 (1911), *reprinted and translated in* Peder Andersen, *'On Rent of Fishing Grounds': A Translation of Jens Warming's 1911 Article, with an Introduction*, 15 HIST. POL. ECON. 391, 392–96 (1983) (discussing the problem in relation to open-access fisheries). Indeed, the problem can be found in the work of Aristotle. See ARISTOTLE, *POLITICS* 32–33 (n.d.), *reprinted in* ARISTOTLE, *THE BASIC WORKS OF ARISTOTLE* 1148 (Richard McKeon ed. & Benjamin Jowett trans., 1941) (“[T]hat which is common to the greatest number has the least care bestowed upon it.”).

12. See generally R. H. Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1 (1960); Carl J. Dahlman, *The Problem of Externality*, 22 J.L. & ECON. 141 (1979).

13. As Hardin points out, “[f]reedom in a commons brings ruin to all.” Hardin, *supra* note 5, at 1244.

to deplete the resource to every actor's disadvantage. The dilemma can be summed up concisely, if colloquially: a "get it while you can" mindset prevails, producing devastating consequences.

The problem extends from the constituent nature of the good in question: the grazing land is rivalrous and non-excludable. That is, its use by one consumer prevents consumption by other consumers, and it is not possible to prevent people from consuming the resource. In his original analysis, however, Hardin failed to distinguish between common ownership regimes (where group members jointly hold property rights in the resource) and open access regimes (where no one holds property rights).¹⁴ While the tragedy of the commons is notorious with respect to open access regimes, the problem can surface in relation to any "natural or man-made resource system that is sufficiently large to make it costly (but not impossible) to exclude potential beneficiaries from obtaining benefits from its use."¹⁵ While a wide variety of things may be understood as the "commons," the model is particularly consequential with respect to environmental issues of sustainability, such as clean air, forest management, non-renewable energy sources such as oil and coal, grazing lands, desertification, and—pertinent to the present discussion—water resources.

B. Lake Tanganyika and the Prisoner's Dilemma

Common resources that exist on a supranational level are particularly vulnerable to the tragedy of the commons. This is often the case with water reserves. Water has little respect for political boundaries or legal jurisdictions. Indeed, large bodies of water often serve as natural boundaries upon which political divisions are based. Consider, for example, Lake Tanganyika in East Africa. Lake Tanganyika is a trans-boundary water body divided among four countries: Tanzania, Burundi, the Democratic Republic of the Congo, and Zambia.¹⁶ It is resource rich. Lake Tanganyika is the third largest freshwater lake in the world by volume and the second deepest.¹⁷ The lake provides up to forty-percent of the protein in the diets of one million people living in the lake basin¹⁸ and is a critical source of food, income, water, and transport to approximately ten million people—a population

14. See Ellickson, *supra* note 6, at 1381 ("All analysts now agree that it is important to distinguish, as Hardin did not, between open-access territories that anyone may enter and tracts that are accessible only to the members of a limited populace and their licensees.")

15. OSTROM, *supra* note 6, at 30.

16. THOMAS M. LEONARD, *ENCYCLOPEDIA OF THE DEVELOPING WORLD* 499 (2013).

17. MYRON ECHENBERG, *AFRICA IN THE TIME OF CHOLERA: A HISTORY OF PANDEMICS FROM 1817 TO THE PRESENT* 128 (2011).

18. *Id.*

roughly twice the size of Norway.¹⁹ Lake Tanganyika, however, is now facing profound resource decimation due to extensive overfishing, oil and mineral exploration, excessive soil erosion, industrial and urban pollution, and intensive fishing with unsuitable methods.²⁰ Owing to the supranational character of the resource, conservation efforts are proving largely ineffective. As the resource is further depleted, the pace of overexploitation is accelerating as its users compete for dwindling remains. Lake Tanganyika is witnessing a tragedy of the commons on a massive, transnational scale—one that the stakeholders are powerless to prevent.

The tragedy of the commons is captured formally in game theory as a multi-player prisoner's dilemma. As the number of stakeholders increases, the predicament worsens because the threat of free riding looms ever larger. The dynamic becomes even more unstable in a multi-person prisoner's dilemma:²¹ suspicion of just one defector can cause cooperation to completely unravel because no party wishes to be the 'sucker.' However, even in the case of just two players, the dilemma emerges.

Figure 1. Below is the tragedy of the commons modeled as a two-person prisoner's dilemma involving Tanzania and the Democratic Republic of Congo ("DRC"), two of the four states that share access to Lake Tanganyika.

		Tanzania	
		Conserve	Don't conserve
DRC	Conserve	<div style="display: flex; justify-content: space-around;"> 3 3 </div>	<div style="display: flex; justify-content: space-around;"> 5 0 </div>
	Don't conserve	<div style="display: flex; justify-content: space-around;"> 5 0 </div>	<div style="display: flex; justify-content: space-around;"> 1 1 </div>

19. ANDREW HUDSON, UNITED NATIONS DEV. FUND, GLOBAL ENVIRONMENTAL FINANCE, INTERNATIONAL WATERS PROGRAMME 16 (2009).

20. *Id.*

21. That is, games that involve more than two players—'N-person prisoner's dilemmas' as they are termed. For a more detailed discussion of such games, see RUSSELL HARDIN, COLLECTIVE ACTION 169 (1982).

Figure 1 models the dilemma facing Lake Tanganyika as a two-person prisoner's dilemma. In the game matrix, the players are Tanzania and the Democratic Republic of Congo ("DRC"). The states can choose either to conserve or not to conserve the waters of Lake Tanganyika (cooperate or not cooperate). If Tanzania and the DRC both choose to conserve, both players will receive three points—a good outcome (in that it is a sustainable one). However, if either party chooses to cooperate while the other party does not, the result will be disastrous for the cooperating party. The non-cooperating party will receive five points, but the cooperating party will receive zero points. This creates a powerful temptation for both Tanzania and the DRC to not cooperate in that they can gain greater advantage by doing so. However, because this logic holds for both the DRC and Tanzania, and this is known to both governments, both countries fear that the other party will free ride, thus rendering noncooperation the dominant strategy. While cooperating (i.e. conservation) provides mutual benefit regardless of the other player's actions, the selfish choice of noncooperation is always the smartest move.²² If the other player does not betray you, you gain the most by betraying them; if the other player does betray you, then you can mitigate this by also betraying them. Either way, noncooperation is the dominant strategy, producing the worst possible outcome for both Tanzania and the DRC—both states receive only one point (the eventual depletion of the resource). The sinister element of the prisoner's dilemma is that the player's logic is their own worst enemy because it drives them to the worst possible outcome. Although conserving the resource is in both countries' long-term interests, each country doubts that the other party has sufficiently long time horizons to stick to its obligations. The tragedy is that the initial good-faith intentions of Tanzania and the DRC are irrelevant: the countries are driven to deplete the resource. Even where both parties wish to cooperate, by the diktat of rationality, they cannot.²³ The situation devolves into a race to betray the other person first—a race to the bottom.²⁴

22. Robert Axelrod & William D. Hamilton, *The Evolution of Cooperation*, 211 SCI. 1390, 1391 (1981) ("[T]wo individuals can each either cooperate or defect . . . No matter what the other does, the selfish choice of defection yields a higher payoff than cooperation.").

23. Much of this explanation of the prisoner's dilemma draws from an earlier description of the prisoner's dilemma I provide elsewhere. See Bryan Druzin, *Opening the Machinery of Private Order: Public International Law as a Form of Private Ordering*, 58 ST. LOUIS U. L.J. 423, 432–33 (2014).

24. As Axelrod and Hamilton write, "[W]ith two individuals destined never to meet again, the only strategy that can be called a solution to the game is to defect always despite the seemingly paradoxical outcome that both do worse than they could have had they cooperated." Axelrod & Hamilton, *supra* note 22, at 1391.

C. Why the Dilemma is Uniquely Pernicious on the Supranational Level

In the quagmire of a prisoner's dilemma, even angels are forced to become devils. The situation is such that it compels the parties to cheat for fear of being the 'sucker.'²⁵ They cannot trust one another and so, in their attempt to win, both parties lose. The prisoner's dilemma is a formidable obstacle to cooperation in situations lacking third-party enforcement. The ever-present specter of the other side cheating undermines governance structures. Without external enforcement mechanisms, it is difficult for the parties to trust one another and, as a result, cooperative structures typically collapse. The lack of trust underlying the prisoner's dilemma is easily resolved with third-party enforcement. The guarantee of sanctions for non-compliance instills a sufficient degree of confidence in all players that their fellow-players will 'play nice.' Because sanctions for cheating negate any short-term advantage a player may glean from defection, "trust" is created, and the prisoner's dilemma is solved. However, in situations lacking third-party enforcement where there are no clear sanctions for non-compliance, alternative mechanisms are required to solve the prisoner's dilemma. In such situations, the dilemma is far more robust and difficult to forestall.

The common-pool resource problem is uniquely pernicious on the supranational level, because no centralized coercive authority exists to instill confidence between stakeholders and prevent a downward spiral into noncooperation. The problem is by no means exclusive to water. The term global commons refers to any commons lying beyond the political and legal reach of any one state. These are natural resources upon which the fates of billions of people—if not of all humanity—depends. Examples include the global climate system, the ozone shield, Antarctica, the deep seabed minerals of the world's oceans, and the atmosphere.²⁶ These resources are non-renewable on human timescales. Traditionally, these resources remained untouched by legal jurisdiction because accessing them was not technologically cost-effective, and the value of the resource was insufficient to justify acquisition efforts.²⁷ Yet as technology grows more sophisticated and populations balloon, this economic calculation is changing. As the environmental impact of our behavior as a species becomes clearer, the need

25. The Prisoner's Dilemma dynamic is in fact the reason that plea bargaining is forbidden in many jurisdictions, as it can potentially compel innocent parties to confess to crimes they did not commit. For a good discussion of this, see generally Oren Bar-Gill & Omri Ben-Shahar, *The Prisoners' (Plea Bargain) Dilemma*, 1 J. LEGAL ANAL. 737 (2009).

26. See MICHAEL GOLDMAN, *PRIVATIZING NATURE: POLITICAL STRUGGLES FOR THE GLOBAL COMMONS* IX–X (1998); ORAN R. YOUNG, *INTERNATIONAL GOVERNANCE: PROTECTING THE ENVIRONMENT IN A STATELESS SOCIETY* 20 (1994).

27. See BUCK, *supra* note 8, at 1 (noting that the technological ability to exploit these resources "has now caught up with desire").

to prevent a tragedy of a commons from emerging on a supranational level is assuming a degree of alarming urgency. Management of the global commons requires international and supranational legal regimes capable of sustaining compliance in the face of mutual distrust.

III. REGULATION, PRIVATIZATION, AND THE PROPOSED SOLUTION

The tragedy of the commons can be conceptualized as a form of market failure. Where there are externalities—specifically, where “some of the costs (or benefits) of an activity are not borne by the decision maker engaging in that activity—the market will fail to produce an optimal result.”²⁸ The market will produce either overproduction (where the cost is not completely borne by the actor) or underproduction (where the benefit is not completely borne by the actor).²⁹ In a common resource problem, external costs are not borne entirely by the decision maker. As such, overproduction ensues, typically leading to resource depletion. The received wisdom of welfare economics offers two potential solutions to the tragedy of the commons: top-down regulation or privatization.³⁰ A third approach, what we may call *voluntary small group cooperation*, has been explored by the political economist Elinor Ostrom (for which she won a Nobel prize).³¹ As Ostrom demonstrated, rules and institutions can emerge within close-knit communities to ensure shared management of resources.³² Ostrom’s approach, however, is simply not viable on the international level. By definition, it does not pertain to global actors. The international community is the antithesis of a close-knit community able to develop strong norms of conservation.³³ The present discussion, therefore, focuses exclusively on the first two approaches—top-down regulation and privatization. However, these two approaches do not fare any better when transposed onto the transnational level of decentralized governance. As we will see, both the regulatory and privatization approaches face significant challenges with respect to global commons.

28. Sinden, *supra* note 4, at 545; *see also* TOM TIETENBERG, ENVIRONMENTAL AND NATURAL RESOURCE ECONOMICS 51–54 (1992).

29. Sinden, *supra* note 4, at 545.

30. *See id.* at 535. However, it should be noted that where conditions allow for it, “common ownership regimes . . . offer a third way out of the tragedy that resists categorization as either a government regulation or a private property/market regime.” *Id.* at 548.

31. *See* OSTROM, *supra* note 6 (arguing that common-pool problems may be solved by voluntary organizations rather than by a coercive state or privatization).

32. *Id.*

33. Although, given a sufficiently high degree of repeated interaction, it is not inconceivable that the international community may demonstrate some of the traits of a small community.

A. The Regulatory Approach

Most mainstream neo-classical and Keynesian economists believe regulatory intervention is needed to correct market inefficiencies.³⁴ As applied to the commons, we may call this tack the *regulatory approach*. The regulatory approach takes a variety of forms. However, attempts to regulate our way out of the tragedy of the commons generally fall into two broad camps. The first is command and control regulation, where an administrative authority directs the behavior of private parties—for instance, legislation requiring private vehicles to pass an emissions test or requiring homeowners to install energy-saving light bulbs.³⁵ The second method is arguably less intrusive and relies on the creation of economic incentives. Examples of this approach include pollution taxes and environmental trading markets (“ETMs”).³⁶ One popular example of an ETM is the introduction of tradable carbon emission permits to control pollution patterns (commonly known as “cap-and-trade”). Cap-and-trade can be understood as a light-touch, market-based form of regulation. It artificially creates a market, but then steps back and allows the market to self-order in relation to larger market forces. While many place ETMs squarely on the privatization side of the ledger, the approach is more properly conceptualized as a regulatory solution—it is not privatization in its most pure sense.³⁷

Classic examples of the command and control approach are anti-poaching laws and whaling bans. In both cases, the actions of private parties are directly controlled by the force of law and the threat of sanctions. In certain instances, light-touch forms of top-down regulation are employed in lieu of outright bans. The creation of hunting seasons is a good example. Similar forms of regulatory tack can be seen in the case of logging where denuding is restricted in designated areas and allowed to resume after a fixed number of years in order to avoid permanent deforestation. A more familiar example of the regulatory approach is the regulation of open-water fishing to prevent depletion of fishing stock. A common regulatory strategy is to

34. See GREGORY N. MANKIW, *PRINCIPLES OF MACROECONOMICS* 11–12 (2009) (discussing market failure). *But see* the concept of “government failure.” For a fantastic overview of the concept, see generally GORDON TULLOCK, ET AL., *GOVERNMENT FAILURE: A PRIMER IN PUBLIC CHOICE* (2002).

35. An example of such a scheme is the recently defunct “AirCare” vehicle emissions testing program in the province of British Columbia, Canada.

36. See Sinden, *supra* note 4, at 549 (arguing that environmental trading markets should be conceptualized as merely a more minimalist form of regulation in that even with respect to ETMs, an administrator still decides where to set the cap on overall resource use).

37. See *id.* at 549–55; see also Jody Freeman & Daniel A. Farber, *Modular Environmental Regulation*, 54 *DUKE L.J.* 795, 819–20 (2005); see generally David M. Driesen, *Is Emissions Trading an Economic Incentive Program?: Replacing the Command and Control/Economic Incentive Dichotomy*, 55 *WASH. & LEE L. REV.* 289 (1998).

impose quotas that limit species-specific total catch within a given fishery. Licensing schemes and regulations that prohibit certain kinds of nets, mesh sizes, or place limits on fish traps are also commonly employed. In some cases, the threat of the tragedy of the commons is so pernicious that exceedingly invasive regulation may be imposed. China provided the ultimate example of such an approach. The country's one-child policy, which constrained reproductive freedom for "the common good," was an effort to prevent the emergence of a tragedy of commons on a truly massive scale by directly limiting potential users of the commons.³⁸ Indeed, population control was precisely the solution that Hardin proposed to solve the tragedy of the commons.³⁹

While the regulatory approach may solve the dilemma, it is difficult to implement on the supranational level. The problem is that the global community is a polycentric mosaic of legal authorities lacking a centralized authority with coercive strength. International administrative law is nascent at best and the legal complexity of regulating waterways, lakes, and oceans that span multiple jurisdictions is enormous.⁴⁰ With respect to global commons, the only recourse is international agreements in the form of environmental treaties and protocols. The international community only began to recognize in earnest the magnitude of transnational environmental challenges during the 1960s,⁴¹ with international environmental agreements proliferating significantly following the 1972 Stockholm Intergovernmental Conference (The United Nations Conference on the Human Environment).⁴² Such understandings are, in the words of Hardin, "mutual coercion, mutually agreed upon."⁴³ However, the ability of such agreements to successfully address the tragedy of the commons on a supranational level remains troublingly deficient, as was so patently illustrated by the failure of the Kyoto Protocol.⁴⁴ Moreover, international environmental agreements remain

38. China began to formally phase out its one-child policy beginning in 2015. See Chris Buckley, *China Ends One-Child Policy, Allowing Families Two Children*, N.Y. TIMES (Oct. 29, 2015), <http://nyti.ms/1kVjnep> [<https://perma.cc/G8AJ-JZVF>]; see generally ESTHER GOH, CHINA'S ONE-CHILD POLICY AND MULTIPLE CAREGIVING: RAISING LITTLE SUNS IN XIAMEN (2011) (examining the sociological impact of China's one child policy).

39. See Hardin, *supra* note 5.

40. See William W. Buzbee, *Recognizing the Regulatory Commons: A Theory of Regulatory Gaps*, 89 IOWA L. REV. 1, 25 (2003–2004).

41. PETER M. HAAS ET AL., INSTITUTIONS FOR THE EARTH: SOURCES OF EFFECTIVE INTERNATIONAL ENVIRONMENTAL PROTECTION 6 (1993).

42. Michael Zürn, *The Rise of International Environmental Politics: A Review of Current Research*, 50 WORLD POL. 617, 623 (1998).

43. Buzbee, *supra* note 40, at 19.

44. For a good examination of why the Kyoto Protocol failed, see generally GERALD KUTNEY, CARBON POLITICS AND THE FAILURE OF THE KYOTO PROTOCOL (2014) (detailing the political evolution

insufficient in number to adequately address the ecological challenges we face. With respect to water management, there are 263 transboundary water basins globally; however, only 158 of these possess any cooperative management framework.⁴⁵ There is no coherent legal regime in place to manage water resources.⁴⁶ The international governance that does exist is based upon a disjointed patchwork of environmental treaties that are highly susceptible to collapse.⁴⁷ Again, it should be borne in mind that this problem applies to environmental governance more broadly and is not restricted merely to conservation of global water commons.

B. The Privatization Approach

While many theorists advocate the regulatory approach in response to the tragedy of the commons, others fiercely debate the necessity (and effectiveness) of this approach, pointing to the dangers implicit in regulation. These voices argue that privatization is a more efficient, effective, and elegant solution to the problem.⁴⁸ We may term this approach the *privatization approach*. Since the close of the last century and the defeat of communism at the hands of free market capitalism, the privatization approach has gained increasing intellectual ascendancy—particularly in the United States—where the market has “all but swept away command and control as a device for managing resources.”⁴⁹ There has been a rise in “free-market environmentalism,” which holds that the enforcement of private

of Kyoto Protocol negotiations and examining its subsequent failure).

45. UNESCO, THE UNITED NATIONS WORLD WATER DEVELOPMENT REPORT 2015: WATER FOR A SUSTAINABLE WORLD 11 (2015).

46. MATTHEW ZENTNER, DESIGN AND IMPACT OF WATER TREATIES: MANAGING CLIMATE CHANGE 2 (2012) (“The closest to a universal mechanism is the 1997 UN Watercourses Convention. . . .”). The UN Watercourses Convention (UNWC) articulates a global legal framework that “establishes basic standards and rules for cooperation between watercourse states on the use, management, and protection of international watercourses.” FLAVIA LOURES, ET AL., EVERYTHING YOU NEED TO KNOW ABOUT THE U.N. WATERCOURSES CONVENTION 1 (2014). However, the UNWC only entered into force in August 2014 and is limited in scope. It does not provide a meaningful basis for comprehensive water management. Indeed, the UNWC has been criticized as largely failing to advance sustainable water use or regulate the discretionary powers of riparian states. See PHILIPPE CULLET, ET AL., WATER LAW FOR THE TWENTY-FIRST CENTURY: NATIONAL AND INTERNATIONAL ASPECTS OF WATER LAW REFORM IN INDIA 38–40 (2009).

47. These mostly come in the form of multilateral environmental agreements (MEAs), such as the Kyoto Protocol.

48. With reference to the tragedy of the commons, see generally, e.g., Robert Smith, *Resolving the Tragedy of the Commons by Creating Private Property Rights in Wildlife*, 1 CATO J. 439 (1981). Important here is the famed Coase theorem and the idea of private ordering through market forces (where transaction costs are zero); see generally R. H. Coase, *The Problem of Social Cost*, 3 J. LAW & ECON. 1 (1960); R. H. Coase, *The Nature of the Firm*, 4 ECONOMICA 386 (1937).

49. Carol M. Rose, *The Several Futures of Property: Of Cyberspace and Folk Tales, Emission Trades and Ecosystems*, 83 MINN. L. REV. 129, 130 (1998–99).

property rights within the free market is sufficient to solve the common resource problem.⁵⁰ Common examples of privatization are water markets,⁵¹ transferable fishing quotas, and carbon emission trading schemes.⁵² Although the privatization approach may take a variety of forms, the basic premise is as follows: converting non-property into private property forces resource owners to internalize the costs of overexploitation thereby creating an incentive to preserve the resource.⁵³ The heart of the problem is that without some kind of property rights regime, a valuable open-access resource will invariably be overexploited. If a resource is privatized, the argument goes, the resource owner's "private cost-benefit analysis would yield a result that was optimal for society as well as for her. All externalities would be internalized and the tragedy of the commons would be solved."⁵⁴ Privatization solves the problem without the need for top-down regulation because decision makers bear the full costs and benefits of their actions. The privatization approach is the second solution Hardin discusses, suggesting that the commons may be sold off as private property.⁵⁵

The privatization approach, however, has not proven workable on the supranational level. Three central problems emerge (from among many). The first is normative. The second relates to actors' time horizons with respect to the resource, and the third concerns the profound logistical challenges of privatizing commons on a supranational level. Let us examine each of these in turn.

1. Normative Issues

First, on a basic visceral level, the privatization of water resources is a radical concept fraught with normative challenges. All living things depend upon water for their very existence. The proposition that something so essential to human survival, such as access to water, should be parceled up and privatized, perhaps allowing for monopoly control of the resource, may give many profound caution. Indeed, "[u]nlike almost every other form of property, which we allow to be entirely privatized, water has always been viewed as something in which the community has a stake and which no one

50. See, e.g., TERRY L. ANDERSON & DONALD R. LEAL, *FREE MARKET ENVIRONMENTALISM* 27–35 (2001).

51. This is also known as 'water trading'—the buying and selling of water access entitlements. The concept is similar in function to ETMs.

52. Sinden, *supra* note 4, at 537–38. The extent that this can be conceptualized as privatization is, however, debatable.

53. Daniel H. Cole, *Clearing the Air: Four Propositions about Property Rights and Environmental Protection*, 10 *DUKE ENVTL. L. & POL'Y F.* 103, 106 (1999–2000).

54. Sinden, *supra* note 4, at 556.

55. Hardin, *supra* note 5, at 1245.

can fully own.”⁵⁶ For example, the poor may be priced out of the resource and underprivileged communities may be bypassed altogether in terms of access to the resource.⁵⁷ Because water quality is not readily detectable by end-users, a privatized market will create incentives to provide the minimum quality of water in order to maximize profits. Additionally, private water sectors may engage in political bargaining to block environmental conservation efforts, giving rise to the danger of regulatory capture on the domestic level. Yet there are other even more serious concerns. Should a privatized water market become non-competitive with a few key players or a single player dominating the global market, the ability to manipulate the price of such a precious resource could produce catastrophic consequences of a truly dystopian quality. The power of a global ‘water cartel’ would dwarf that of the Organization of the Petroleum Exporting Countries (OPEC) and its influence over world oil prices. The implications of such a concentration of power are a very serious cause for concern. Yet, normative reservations aside, there are other, more technical problems to the privatization approach.

2. No Guarantee of Long Time Horizons

A core problem with privatization is that it may not necessarily yield an equilibrium that promotes conservation. The core assumption of the privatization approach is that the market will provide incentives to adopt a long-term view—a view that government administrators, whose time horizons often stretch no further than their next career move, may lack.⁵⁸ A private owner will have the low discount rate and long time horizon necessary to conserve a resource. There are, however, several problems with this assumption—indeed it is not nearly as airtight as many free market environmentalists would have us believe. If private owner’s time horizons collapse, so too will the resource. There is empirical work that challenges this supposition. For instance, a study of the economics of whaling shows that the “extermination of the entire [whale] population may appear as the most attractive policy, even to an individual resource owner,” where “(a) the discount (or time preference) rate sufficiently exceeds the maximum reproductive potential of the population, and (b) an immediate profit can be

56. Joseph L. Sax, *Understanding Transfers: Community Rights and the Privatization of Water*, 1 W.N.W. 13, 13 (1994).

57. See SHARON BEDER, ENVIRONMENTAL PRINCIPLES AND POLICIES: AN INTERDISCIPLINARY INTRODUCTION 143–45 (2006) (discussing how free-market environmentalism can reinforce existing inequalities).

58. Cole, *supra* note 53, at 122. See, e.g., Richard L. Stroup & Sandra L. Goodman, *Property Rights, Environmental Resources, and the Future*, 15 HARV. J.L. & PUB. POL’Y 427, 431–32 (1992) (arguing that the “ability to capitalize future value into an asset’s present value induces property owners to consider the long-term implications of their asset-use decisions”).

made from harvesting the last remaining animals”⁵⁹ As another example, the pressure of market competition combined with ignorance of dryland farming methods drove private farmers in the 1930s to engage in deep plowing of the virgin topsoil of the United States’ Great Plains, eventually causing the environmental catastrophe of the Dust Bowl.⁶⁰

Indeed, many commentators have pointed out that “claims that ‘privatization’ is a necessary and sufficient condition for optimal environmental protection are inherently implausible, under-supported by economic theory, and under-determined by the available empirical evidence.”⁶¹ There is no guarantee that private resource owners will always possess sufficiently high time horizons. For instance, uncertainty regarding the future value of a resource may drive private owners to overexploit the resource while prices are high. What would be the fate of the world’s petroleum reserves if a new energy source capable of wholly replacing the world’s dependency on oil suddenly became imminent? What would happen to the pace of logging if a technological substitute for all uses of timber suddenly appeared on the near horizon? Moreover, the problem of high discount rates may be particularly pernicious if the resource owner is a public company with a fiduciary duty to maximize annual profits for short-term investors who may not “be in it for the long haul.”

3. Logistical Challenges

Perhaps the most fundamental problem with the privatization approach on the supranational level, however, is that it is often logistically impossible to divide up and privatize a commons. This is particularly true in the case of water. Supranational water reserves cannot be privatized. Water flows freely across multiple jurisdictions, making it impossible to parcel it off under private ownership. Indeed, water “is a resource that is hard to pin down within fixed property boundaries and is, thus, particularly vulnerable to the tragedy of the commons.”⁶² The physical dimensions of Lake Tanganyika, for instance, cannot be effectively privatized by creating property boundaries. This difficulty is even more salient with respect to the world’s international waterways, seas, and oceans that do not fall under any

59. Colin W. Clark, *Profit Maximization and the Extinction of Animal Species*, 81 J. POL. ECON. 950, 950–51 (1973); see also Colin W. Clark, *The Economics of Overexploitation*, 181 SCI. 630, 630 (1973); Edella Schlager & Elinor Ostrom, *Property-Rights Regimes and Natural Resources: A Conceptual Analysis*, 68 LAND ECON. 249, 256 (1992).

60. DANIEL W. BROMLEY, ENVIRONMENT AND ECONOMY: PROPERTY RIGHTS AND PUBLIC POLICY 171 (1991). See generally DONALD WORSTER, DUST BOWL: THE SOUTHERN PLAINS IN THE 1930S (2004).

61. Cole, *supra* note 53, at 105.

62. Sinden, *supra* note 4, at 576.

jurisdiction. The problem is that water “flows across boundaries, seeps under the earth, evaporates into the air, and fluctuates drastically in quantity depending on random and unpredictable weather patterns. As such, water is not amenable to the imposition of full ownership rights in the nature of a fee simple interest in land.”⁶³ While some free market environmentalists have actually proposed that we privatize the ocean, or at least portions of it, arguing that the ocean floor may be allocated to private property owners,⁶⁴ there remain insurmountable logistical hurdles to such an approach.⁶⁵

Unlike land, the resources of value found in water—like the water itself—are not tethered to the ocean floor, but rather are suspended in the water and flow freely around.⁶⁶ Indeed, Hardin pointed out that privatization may often be impossible to implement given that certain commons, such as the earth’s air and water, are logistically impossible to privatize: “the air and waters surrounding us cannot readily be fenced, and so the tragedy of the commons as a cesspool must be prevented by different means. . . .”⁶⁷ Hardin’s solution lies in administrative law.⁶⁸ The non-fixed nature of water resources renders effective privatization of large-scale water reserves (or even small-scale) impracticable. Large bodies of water typically consist of a myriad of sweeping complex and overlapping ecosystems.⁶⁹

Related to this is the problem of what we may call “leaky externalities.” The precise meaning of externalities is difficult to pinpoint—it is difficult even to delineate what precisely a “commons” is in that the environment is so interconnected. As such, it is unclear what exactly should be privatized. The idea that we can parcel off discrete sections of the environment exposes a profound ignorance of how interconnected the natural environment actually is. The privatization approach becomes ever more difficult to accept on a conceptual level as “we become increasingly aware of the vast web of connections that link species and ecosystems to each other . . . and the extent to which human activities that disrupt ecosystems can have ripple effects that extend over vast areas. . . .”⁷⁰ The problem of “leaky externalities” also

63. *Id.* at 578.

64. *See, e.g.*, Walter Block, *Environmental Problems, Private Property Rights Solutions*, in *ECONOMICS AND THE ENVIRONMENT: A RECONCILIATION* 281, 292–93 (Walter Block ed., 1990); ANDERSON & LEAL, *supra* note 50, at 116.

65. Although, some argue that technology may eventually render such an approach feasible. *See, e.g.*, Jonathan H. Adler, *Legal Obstacles to Private Ordering in Marine Fisheries*, 8 *ROGER WILLIAMS U. L. REV.* 9, 21 (2002).

66. Sinden, *supra* note 4, at 601.

67. Hardin, *supra* note 5, at 1245.

68. *Id.*

69. Sinden, *supra* note 4, at 601.

70. *Id.* at 588.

applies to the regulatory approach, but it is particularly relevant to privatization because of the need to clearly divide the commons between an array of private actors.

While the privatization approach may be an effective tool to promote conservation and prevent the tragedy of the commons in some situations, this is not always the case. It is particularly difficult to implement on the supranational level. On the supranational level, the privatization approach fares no better than the regulatory approach (and it arguably fares worse). The key problem remains: how can the tragedy of the commons be diffused in situations of decentralized governance where actors do not answer to an overarching authority? Privatization does not change this equation in any way. While regulating or privatizing our way out of the dilemma represents divergent solutions to the problem, the two approaches are the same in the sense that they both rely ultimately on enforcement. In the case of the regulatory approach, this is obvious: regulation requires the enforcement of sanctions for plundering the commons. With respect to privatization, the need for enforcement may be less obvious, but no less true. Privatization requires an overarching legal authority to enforce private property rights. With either approach, we eventually return to the same problem—in a transnational, decentralized governance situation, there is no authority capable of enforcing the rules of the game. Thus, the challenge before us is to devise a solution that can produce stable coordination in the absence of such an authority.

C. The Proposed Solution: The Commons Management Fund

In light of these deficiencies, this discussion proposes a solution. The idea—the Commons Management Fund deposit scheme (“CMF”)—would work as follows: states joining (or already party to) an agreement would contribute an upfront “deposit” to an international regulatory body with the understanding that all or part of their contribution will be forfeited if they fail to honor their treaty commitments. The goal of the scheme, however, is not to remedy particular instances of non-compliance; rather—and this is an important point—it is to produce a sufficient degree of initial confidence in other parties’ level of commitment so as to prevent a tragedy of the commons from emerging. The working assumption here is that states *want* to comply—this is the reason why states enter into environmental agreements in the first place. The problem is simply one of trust. The CMF is designed to build trust.

The CMF would be an international regulatory body that could be established under the auspices of the United Nations (the “UNCMF”). The

CMF would comprise the deposit scheme but would also consist of the institutional structures required to implement and oversee the system. Any group of states could register a treaty (e.g., the Paris Agreement) with the CMF, and their combined deposits would be held in reserve.⁷¹ This deposit would have to be large—very large. The deposit with accrued interest would be returned to member states after a specified period of time (i.e., the conclusion of the treaty). For minor infractions, a deduction could be made from a state's deposit. For major breaches, the entire deposit may be forfeited (under one variant of the model, a state's deposit would be distributed to one or more other parties in order to incentivize monitoring).⁷² The CMF would include a regulatory body that would be charged with investigating alleged breaches. To accommodate potential wealth disparities between states, a percentage-based variant of the deposit scheme based on Gross Domestic Product ("GDP"), or other relevant metrics, could be designed. A percentage-based deposit would maintain its efficacy in that it would signal the same degree of commitment (building trust). Such a scheme would have the benefit of remaining financially accessible to all states regardless of the size of their economies. The extent of the deposit necessary to signal states' commitment and build sufficient trust could be left to the determination of the parties themselves—the parties are best positioned to understand how strong of a commitment is required. We can be confident that they will do so because in a tragedy of the commons, the stakeholders are typically acting in good faith—the problem is merely that the fear of defection by other parties drives all parties to defect.

The CMF is a governance mechanism available to governments to strengthen their ability to coordinate through *signaling commitment* (a detailed exposition of the theory that underlies this is discussed in the following section). Some readers may feel the proposal is unrealistic because governments would be reluctant to provide such large deposits. What should be appreciated, however, is that any level of deposit will boost the signaling ability of the parties—anything is better than nothing, and the higher the deposit, the stronger the signal. Moreover, the CMF would provide an invaluable separating equilibrium. A state's hesitation to contribute the funds necessary to administer the CMF would clearly signal to other governments that state's lack of genuine commitment to the agreement.

71. The CMF need not be limited to merely environmental agreements. However, the focus here is upon the tragedy of the commons, a problem that manifests quite starkly with respect to the conservation of common-pool resources.

72. The idea of using the forfeited sums to incentivize whistleblowing was suggested to me by Prof. Bryan Mercurio.

While the CMF model can be understood as falling on the regulatory side of the ledger, it is not top-down regulation—it is bottom-up regulation, self-imposed by parties trapped in a tragedy of the commons. This distinction is crucial because this bottom-up character allows the CMF to function on a supranational level. Indeed, because the current global order operates in a technical state of anarchy, there is no other choice but for enforcement to unfold in a bottom-up fashion. The model is deceptively complex. It may not be immediately apparent, however, given the peculiar dynamics of multilateral environmental agreements, as will be shown, the CMF is uniquely crafted to diffuse a tragedy of the commons. To appreciate why this is the case, a structural understanding of how multilateral environmental agreements typically unravel and the limitations of conventional enforcement mechanisms is required.

IV. HOW THE CMF DIFFERS FROM TRADITIONAL COMPLIANCE MECHANISMS

The tragedy of the commons is a unique dynamic that calls for a unique solution. The CMF concept is simple; however, its theoretical underpinnings are complex. Let us unpack this, paying special attention to the unique character of multilateral environmental agreements, and, in particular, how such agreements typically fail.

A. The Inherent ‘Tippiness’ of Multilateral Environmental Agreements

The vast majority of treaties in fact do not possess robust external enforcement mechanisms.⁷³ Nevertheless, there is a growing interest in employing compliance mechanisms in multilateral environmental agreements (“MEAs”) as a means to encourage compliance.⁷⁴ Compliance

73. Beth Simmons, *Treaty Compliance and Violation*, 13 ANNU. REV. POLIT. SCI. 273, 277 (2010). Enforcement mechanisms have been well-studied in theories of treaty compliance. This literature is large; however, there are prominent theorists. *See generally, e.g.*, MARKUS BURGSTALLER, THEORIES OF COMPLIANCE WITH INTERNATIONAL LAW (2005) (providing a comprehensive analysis of theories of compliance); EDITH BROWN WEISS & HAROLD KARAN JACOBSON, ENGAGING COUNTRIES: STRENGTHENING COMPLIANCE WITH INTERNATIONAL ENVIRONMENTAL ACCORDS (2000) (presenting a systematic examination of implementation and compliance with international environmental accords); Harold Hongju Koh, *Why Do Nations Obey International Law?*, 106 YALE L.J. 2599 (1997) (presenting a compliance theory predicated on vertical interaction between private and public actors); ABRAM CHAYES & ANTONIA HANDLER CHAYES, THE NEW SOVEREIGNTY: COMPLIANCE WITH INTERNATIONAL REGULATORY AGREEMENTS (1998) (proposing a managerial approach and arguing that coercion is not the primary instrument of compliance).

74. Nils Goeteyn & Frank Maes, *Compliance Mechanisms in Multilateral Environmental Agreements: An Effective Way to Improve Compliance?*, 10 CHINESE J. INT’L L. 791, 791 (2011).

mechanisms may be positive⁷⁵ or negative—carrot or stick in nature.⁷⁶ With respect to negative enforcement mechanisms, four main types of penalties can be discerned. These are: warnings; suspension of privileges; trade sanctions; and liability.⁷⁷ Each represents an escalation in severity.⁷⁸ A warning—the least severe penalty—indicates that stronger penalties are forthcoming if the actor does not change its behavior.⁷⁹ Some MEAs provide for a suspension of privileges whereby certain rights under the agreement are denied to the non-compliant party—for example, participation in voting or various committees.⁸⁰ The threat of trade sanctions may be effective; parties deemed non-compliant may incur substantial economic (and even political) costs.⁸¹ Non-compliant parties may be required to offer compensation, often in the form of financial reparations for the damage caused by their misbehavior.⁸²

While these penalties can exert substantial compliance pressure in international treaties, negative enforcement mechanisms of this nature do not always map well onto agreements involving a tragedy of the commons dynamic. The problem is that, because such agreements rest so much on expectations, coordination under governance regimes that involve a tragedy of the commons dynamic can be exceedingly fragile and thus easily undermined by such penalties. Such agreements are susceptible to collapse, which may be triggered by even trivial defections. The problem resides in the unique nature of MEAs—the value of an MEA is largely tied to the number of actors adhering to the agreement. An agreement to reduce carbon emissions between only two states, for example, provides little value. Not only does such an agreement achieve little in terms of actually reducing global carbon emissions, more crucially for our purposes, the two states will be highly reluctant to assume the burden of curbing their emissions while the

75. Indeed, the United Nations Environment Programme (UNEP) has provided guidelines that set out an assortment of techniques to facilitate compliance in MEAs, ranging from financial and technical assistance to capacity building and technology transfer. *See generally* UNITED NATIONS ENVIRONMENT PROGRAMME, MANUAL ON COMPLIANCE WITH AND ENFORCEMENT OF MULTILATERAL ENVIRONMENTAL AGREEMENTS (2006) for a fuller discussion.

76. ULRICH BEYERLIN, PETER-TOBIAS STOLL & RÜDIGER WOLFRUM, ENSURING COMPLIANCE WITH MULTILATERAL ENVIRONMENTAL AGREEMENTS: A DIALOGUE BETWEEN PRACTITIONERS AND ACADEMIA 306 (2006).

77. UNITED NATIONS ENVIRONMENT PROGRAMME (UNEP), COMPLIANCE MECHANISMS UNDER SELECTED MULTILATERAL ENVIRONMENTAL AGREEMENTS 117 (2007).

78. *Id.*

79. *Id.*

80. *Id.* The Montreal Protocol on Substances that Deplete the Ozone Layer is an example of an MEA that provides such a penalty.

81. *See* JACOB WERKSMANN, GREENING INTERNATIONAL INSTITUTIONS 102 (2014).

82. UNEP, *supra* note 77, at 117–18.

remainder of the international community does nothing. However, the value of the same agreement increases dramatically with twenty, ninety, or 190 governments in hand. This is why it was so vital that the Paris Agreement lock down the participation of all the states of the world. A strong argument could be made that the Kyoto Protocol's lack of success stemmed from its failure to secure an equal commitment from all the world's states; thereby undermining its chances at success from its very inception.⁸³

An MEA's value increases as more parties comply with the agreement, and the inverse is equally true: an MEA's value decreases commensurate with the number of actors who either do not comply or exit the agreement altogether. This is a classic example of what is known in the economics literature as a *network effect*.⁸⁴ The larger the network of adopters, the greater value the agreement provides and vice versa.⁸⁵ Perceptions are extraordinarily consequential under such conditions. Because the value of a standard or product depends upon how many other actors adopt it, actors'

83. The developed nations of the world accepted the initial reductions called for under the Protocol with the developing world not included in the reductions. See generally A.W. GALSTON & CHRISTIANA Z. PEPPARD, *EXPANDING HORIZONS IN BIOETHICS* (2005). For a good general discussion of the failure of the Kyoto Protocol, see KUTNEY *supra* note 44. See also generally DAVID G. VICTOR, *THE COLLAPSE OF THE KYOTO PROTOCOL AND THE STRUGGLE TO SLOW GLOBAL WARMING* (2011) (arguing that the Protocol does not provide for adequate monitoring and enforcement of emissions trading).

84. Network effects (also known as network externalities) emerge where the implicit value of a product or service increases as the number of other agents using the same product or service grows, which in turn draws more users. See S.J. Liebowitz & Stephen E. Margolis., *Network Externalities*, in *THE NEW PALGRAVE DICTIONARY OF ECONOMICS AND THE LAW* 671, 671 (Peter Newman ed., 1998). Network externalities arise from the need for compatibility between standards. The classic example of a network effect is language. The more people who, for example, speak English, the more useful English is to each one of its speakers. This creates a positive externality. As more people speak English, the value of the language increases for everyone. For the foundational literature on network effects, see M. L. Katz & C. Shapiro, *Network Externalities, Competition, and Compatibility*, 75 AM. ECON. REV. 424, 424 (1985); see also SCOTT BARRETT, *ENVIRONMENT AND STATECRAFT: THE STRATEGY OF ENVIRONMENTAL TREATY-MAKING* 261–62 (2003) (discussing network externalities in environmental treaties).

85. I have discussed network effects at length elsewhere. See, e.g., Bryan Druzin, *Buying Commercial Law: Choice of Law, Choice of Forum, and Network Effect*, 18 TUL. J. INT'L & COMP. L. 131 (2009) (arguing that network effects induce standardization in choice of law and choice of forum clauses in transnational commercial contracts); Bryan Druzin, *Anarchy, Order, and Trade: A Structuralist Account of Why a Global Commercial Legal Order is Emerging*, 47 VAND. J. TRANSNAT'L L. 1049, 1076–83 (2014) (arguing that network effects help standardize legal practices); Bryan Druzin, *Spontaneous Standardization and the New Lex Maritima*, in *OXFORD INTERNATIONAL ARBITRATION SERIES: THE CONTINUED DEVELOPMENT OF SHIPPING LAW* 63, 72–73 (Miriam Goldby ed., 2016) (arguing that network effects manifest powerfully in shipping law as a consequence of the high level of natural interconnection implicit in shipping networks, and that this helps spontaneously standardize the legal practices of the *lex maritima*); Bryan Druzin, *Why Does Soft Law Have Any Power Anyway?* ASIAN J. OF INT'L L. (2016) (arguing that network effects help explain why, although lacking legal and coercive force, so much soft law is widely adopted and followed); Bryan Druzin, *Towards a Theory of Spontaneous Legal Standardization*, J. OF INT'L DISP. SETTLEMENT (2016) (positing a theory as to how legal standardization may occur in a decentralized, spontaneous fashion as the result of network externalities and increasing returns) (forthcoming).

choices are largely based on the *expected* size of the network.⁸⁶ This being the case, “consumer expectations may drive market outcomes such that they become self-fulfilling.”⁸⁷ In markets exhibiting network effects (as with any game with multiple equilibria), expectations are key. As such, the network effect character of a MEA renders it uniquely vulnerable to “bandwagons.” A positive bandwagon of actors joining the treaty is a case of what is known as *increasing returns*. A negative bandwagon of actors abandoning the treaty—a sort of “jumping ship” effect—is a case of what is known as *decreasing returns*. The decreasing returns nature of MEAs makes them extremely ‘tippy’ and highly susceptible to collapse.⁸⁸ A case could be made that the United States’ sudden withdrawal from the Kyoto Protocol in the opening months of the Bush administration initiated a negative bandwagon, tipping the agreement towards eventual failure.⁸⁹ This dynamic is not as salient in the case of, for example, a multilateral trade agreement (at least it is not the primary problem). Even if a large number of signatories exit a trade agreement, the agreement may still retain a significant degree of value for the remaining treaty members. Such agreements can thus better withstand the blow of one or more parties withdrawing from the agreement or cheating. This difference is significant because it will determine which enforcement mechanism is most appropriate to attenuate a tragedy of the commons.

Traditional negative compliance mechanisms are designed to punish offenders. While this may work well when considered in isolation (indeed, it can be very effective in forcing parties to change their behavior), such punitive mechanisms do not apply well to treaties with the potential for decreasing returns (i.e. a tragedy of the commons). Negative compliance mechanisms can cause the collapse of a treaty, with a few defecting parties triggering a mass exodus from the agreement as a negative bandwagon takes hold. Even in the best of scenarios, such measures will significantly weaken an agreement’s cohesion because confidence in the commitment of other parties will be undermined. With a tragedy of the commons dynamic, perception is reality. If actors believe others will comply, they are more likely to comply; if actors believe others will not comply, they are less likely to comply.

86. LUÍS M. B. CABRAL, INTRODUCTION TO INDUSTRIAL ORGANIZATION 312 (2000).

87. Irina Suleymanova, et al., *On the Role of Consumer Expectations in Markets with Network Effects 2* (Dice Discussion Paper, Paper No. 13, 2010).

88. For a similar analysis in this vein, see BARRETT, *supra* note 84, at 254–67.

89. For a discussion of the U.S. withdrawal from the Kyoto Protocol, see DIANNE RAHM, CLIMATE CHANGE POLICY IN THE UNITED STATES: THE SCIENCE, THE POLITICS AND THE PROSPECTS FOR CHANGE 77–80 (2010); MICHAEL G. FAURE, GREEN GIANTS?: ENVIRONMENTAL POLICIES OF THE UNITED STATES AND THE EUROPEAN UNION 358–61 (2004).

As such, even relatively benign punitive measures against a party, such as a warning or a temporary suspension of privileges, signals to other parties that coordination has faltered. The perception that commitment to the agreement may be flagging may cause other parties to not comply. In this fashion, even a small spark can incinerate cooperation. As the severity of the punitive mechanisms increase, the possibility of a negative bandwagon effect increases. Economic sanctions or forcing a non-complying party to pay exacting reparations may cause the sanctioned party to simply withdraw from the agreement. While sanctions are typically considered essential to achieving compliance in trade agreements,⁹⁰ withdrawal of even one party can destabilize a treaty exhibiting a tragedy of the commons dynamic in that it can trigger a negative bandwagon—causing the treaty to ‘tip’ suddenly towards collapse. Some treaty regimes even provide for the expulsion of non-complying parties as a penalty.⁹¹ In a tragedy of the commons dynamic, treaty expulsion is highly self-defeating—expulsion of a few key members may lead to total treaty collapse. The unique nature of tragedy of the commons scenarios must be fully appreciated—i.e. the value of the agreement is contingent upon all the other parties also complying. The dynamic this produces is markedly different than those at play with respect to other international agreements.

B. The Power of Signaling

Understanding this, it becomes clear why the CMF is well-suited to address a tragedy of the commons dynamic. The problem for most treaty types is that parties may cheat if incentive structures change, so punitive measures are necessary *ex post* (after the fact) to discourage cheating. However, in the case of treaties exhibiting a tragedy of the commons dynamic, incentive structures may remain unchanged, yet parties otherwise willing to honor their commitments may cheat simply due to a lack of trust. In a tragedy of the commons, the mere fear of others cheating induces cheating. Because the primary problem is one of trust, robust *ex ante* (before the fact) signaling can be particularly effective in solving the dilemma. A sufficiently large monetary deposit achieves this by producing an initial burst of confidence that stabilizes the agreement and keeps the tragedy of the commons at bay. *Ex ante* signaling, if sufficiently robust, can short-circuit a tragedy of the commons before it forms and is a far safer method of inducing compliance given the implicit fragility of MEAs. Indeed, the CMF’s deposit

90. ISMAIL SERAGELDIN & JOAN MARTIN-BROWN, PARTNERSHIPS FOR GLOBAL ECOSYSTEM MANAGEMENT 147 (1997).

91. See AARON SCHWABACH, INTERNATIONAL ENVIRONMENTAL DISPUTES: A REFERENCE HANDBOOK 29–30 (2006).

scheme should be understood not as an *ex post* compliance mechanism, but rather as an *ex ante* signaling device.

Signaling models of international agreements are discussed in the international law literature.⁹² Such models are conceptually related to *credible commitment theory*, the basic idea being that actors credibly signal their commitment to carry out obligations in the face of future, yet-unrealized incentives to renege.⁹³ The “essential feature of credible commitment theory is that states must be willing to pay a nontrivial cost in order to participate in the agreement. It is the willingness to bear these costs that makes the agreement more credible than it would otherwise be.”⁹⁴ The literature distinguishes between *ex post* costs paid only in the case of non-compliance, and *ex ante* costs paid in advance.⁹⁵ These function very differently—“[h]igh *ex ante* costs send a credible signal of intentions: No rational government would pay a high ‘down payment’ on a cooperative enterprise if they did not intend to carry it out. High *ex ante* costs in effect screen governments by type, revealing their true intentions.”⁹⁶

In game theory, a party with private, but nonverifiable information as to their intentions can signal that information by their choice of behavior.⁹⁷ This is known in the literature as *costly signaling* (the conceptual analog to credible commitment theory in the political science literature).⁹⁸ The CMF

92. Simmons, *supra* note 73, at 276. Much of this has focused on the process of treaty ratification as a signal of commitment. *See generally, e.g.,* LISA L. MARTIN, *DEMOCRATIC COMMITMENTS: LEGISLATURES AND INTERNATIONAL COOPERATION* (2000) (examining the impact of institutionalized legislative participation on the credibility of state commitments).

93. Simmons, *supra* note 73, at 276.

94. *Id.*

95. *Id.*; *see also generally* James D. Fearon, *Signaling Foreign Policy Interests: Tying Hands Versus Sinking Costs*, 41 *J. CONFLICT RESOL.* 68 (1997).

96. Simmons, *supra* note 73, at 276.

97. *See* DOUGLAS G. BAIRD ET AL., *GAME THEORY AND THE LAW* 151–58 (1994) (using a case study involving penalty clauses in contract negotiations to show how parties can signal non-verifiable information).

98. The earliest work on signaling games was A.M. Spence’s model of education signaling. *See generally* Michael Spence, *Job Market Signaling*, 90 *Q. J. OF ECON.* 225 (1973). However, Thorsten Veblen in his study of conspicuous consumption should be credited with first postulating the idea of signaling. THORSTEIN VEBLEN, *THEORY OF THE LEISURE CLASS* (1899). The role of signaling has been extensively studied in economics. *See generally* In-Koo Cho & David M. Kreps, *Signaling Games and Stable Equilibria*, 102 *Q. J. OF ECON.* 179 (1987). For a good overview of signaling games in relation to the prisoner’s dilemma, *see* PRAJIT K. DUTTA, *STRATEGIES AND GAMES: THEORY AND PRACTICE* 383–402 (1999). The impact of signaling may of course be increased if it is costly—a dynamic known in both economics and biology as costly signaling, the basis of costly signaling theory (CST). For CST’s economic embodiment, Spence’s work is the foundational piece. I provide a more extensive overview of CST elsewhere (in the field of biology as well as economics). *See* Bryan Druzin, *Law, Selfishness, and Signals: An Expansion of Posner’s Signaling Theory of Social Norms*, 24 *CANADIAN J. OF L. & JURIS.* 5, 26–27 (2011) (arguing that norm internalization is an adaptive quality that enhances the individual’s ability to signal cooperation); *see also generally* Bryan Druzin, *Eating Peas with One’s Fingers: A*

is designed to facilitate costly signaling and preemptively thwart the emergence of a tragedy of the commons by building sufficient confidence among member states that they are equally committed to compliance. *Ex post* costs function in an entirely different manner—such penalties do not screen actors; rather, they constrain their behavior.⁹⁹ With respect to overcoming a tragedy of the commons, this is a crucial difference. *Ex post* penalties are far weaker signals. While *ex post* penalties also communicate commitment in that parties willingly subject themselves to these measures, the signal is *less robust* because it is unclear if the party will actually incur the penalty. In many cases, an actor will simply withdraw from the agreement at a later stage. In other cases, sanctioning mechanisms are rarely used even when they are available.¹⁰⁰ In actual practice, collective enforcement through penalties and binding judicial processes such as dispute settlement remain relatively rare.¹⁰¹ States rarely invoke enforcement mechanisms.¹⁰² There are several reasons for this. The imposition of sanctions is costly for the sanctioning state or states.¹⁰³ In many cases, states are simply reluctant to bear the burden of imposing sanctions on non-compliant parties.¹⁰⁴ Indeed, theorists “have long recognized that, with few exceptions, enforcement—from military action, to economic sanctions, to diplomatic hardball—is costly.¹⁰⁵ Where they are available, treaty-based sanctions are actually seldom used.¹⁰⁶ In fact, most treaties do not incorporate enforcement mechanisms of any kind.¹⁰⁷

As such, it makes more sense to impose costs on the “front end” of a treaty. This allows parties to signal their commitment at a far more crucial

Semiotic Approach to Law and Social Norms, 26 INT’L J. SEMIOTIC L. 257 (2013) (proposing a signaling theory of social norms). The role of signaling in repeated games has been comprehensively studied both empirically and theoretically. See, e.g., MOHAMMED ABDELLAOUI, UNCERTAINTY AND RISK: MENTAL, FORMAL, EXPERIMENTAL REPRESENTATIONS 280 (2007). For a good summary of the work on signaling in the economics literature, see DAVID M. KREPS, A COURSE IN MICROECONOMIC THEORY 645–54 (1990).

99. Simmons, *supra* note 73, at 277.

100. ABRAM CHAYES & ANTONIA CHAYES, THE NEW SOVEREIGNTY: COMPLIANCE WITH INTERNATIONAL REGULATORY REGIMES 32–33 (1995).

101. UNEP, *supra* note 77, at 7.

102. WALTER CARLSNAES ET AL., HANDBOOK OF INTERNATIONAL RELATIONS 367 (2012). There has in fact been a shift away from coercive mechanisms such as sanctions towards a more “managerial” approach which instead favours positive mechanisms such as transparency and capacity-building. See GEIR ULFSTEIN, MAKING TREATIES WORK: HUMAN RIGHTS, ENVIRONMENT AND ARMS CONTROL 373 (2007).

103. ABRAM CHAYES & ANTONIA H. CHAYES, THE NEW SOVEREIGNTY: COMPLIANCE WITH INTERNATIONAL REGULATORY AGREEMENTS 33 (2009).

104. See CARLSNAES, *supra* note 102, at 367.

105. *Id.*

106. REGINA S. AXELROD & STACY D. VANDEVEER, THE GLOBAL ENVIRONMENT: INSTITUTIONS, LAW, AND POLICY 124–25 (2014).

107. See BARRETT, *supra* note 84, at 254.

stage, nudging perceptions in the right direction and thereby stymieing the emergence of a tragedy of the commons. Communicating commitment through *ex ante* signaling better suits a tragedy of the commons dynamic because it is preventative rather than punitive. A tragedy of the commons dynamic is unique because it turns on expectations regarding the strength of other parties' commitment. An initial burst of confidence, if sufficiently powerful, can stabilize the agreement and prevent a tragedy of the commons from emerging. The core problem with agreements that do not involve a tragedy of the commons dynamic is that cooperation may be difficult to sustain if incentive structures change, but this is not the primary problem with agreements grappling with a tragedy of the commons (although this may also occur). Rather, the core problem is that parties otherwise willing to cooperate are *forced* to cheat because they cannot risk trusting other players, which initiates a downward spiral into non-cooperation.

Traditional compliance mechanisms are designed to prevent defection in the face of shifting incentive structures. Even if parties initially intend to comply, they may later renege due to a change in incentives. This is not the case with the tragedy of the commons (at least it is not the primary problem). A tragedy of the commons is unique in that all parties may continually wish to comply throughout the collapse of a treaty; however, the agreement may nevertheless collapse. This is an important difference. The dynamic in a tragedy of the commons is fundamentally different than in other cooperation scenarios and therefore calls for a fundamentally different solution—i.e. a greater use of *ex ante* signaling. The CMF is such a solution—it is a system for clear *ex ante* signaling designed to defuse the tragedy of the commons before it emerges. The CMF is essentially a massive signaling device—it is a tool to amplify commitment signaling during the early stages of an agreement when trust is at a premium.

C. Key Features of the Commons Management Fund

Several features of the CMF distinguish it from traditional compliance mechanisms. This final section of the discussion notes some of these features.

1. Commercial Signaling to Treaty Signaling

The CMF in fact mirrors strategies employed by commercial actors operating under similar conditions of distrust. The CMF simply imports this same process to the supranational level of treaty compliance between states. In commercial relationships lacking third party enforcement (or where such enforcement is unreliable or costly), private parties credibly signal their commitment through various means. This signaling often takes the form of

non-refundable deposits, deeds of guarantee, or large sums of money being held in escrow. For example, while the purpose of the damage deposit provided by a tenant renting property is to compensate the landlord for any *ex post* damage that may occur, the deposit in fact serves a second, less obvious function. It is a powerful signaling device—it credibly signals the tenant’s intention to exercise care and maintain the property. A financially-able tenant unwilling to pay a damage deposit would signal something about her commitment to properly care for the property. Commercial relationships are chalk full of commitment signaling, often in very subtle ways. For instance, two companies with plans to collaborate will often signal their commitment by early investments in sunk costs, such as costly machinery, office space rentals, etc. This *ex ante* commitment signaling instills immediate confidence in the authenticity of the other party’s commitment to the agreement. Such behavior allows parties to correctly decipher in advance the time horizons of other actors.

What is true with respect to agreements between private commercial parties is also true for international states parties to treaties. Indeed, treaties often provide repeated opportunities to signal commitment through staggered stages of performance in order to sustain cooperation.¹⁰⁸ Consider the terms of the New START treaty, which call for a number of specific actions within designated periods covering a period extending from the first few days after entering into force up to the entire ten-year life of the treaty.¹⁰⁹ This structure provides for rounds of commitment signaling (concentrated in the early stages of the treaty where there is a poverty of trust) before parties progress to subsequent stages of the treaty. For instance, the New START treaty calls for an exchange of inspector information within the first twenty-five days after entry into force;¹¹⁰ the provision of information on the numbers, locations, and technical characteristics of weapon systems no later than forty-five days;¹¹¹ an exhibition of strategic offensive arms no later than sixty days;¹¹² the one-time exhibition of U.S. heavy bombers no later than

108. I discuss this idea elsewhere where I term the concept *performance signaling theory*. Pertinent to the present discussion is the concept of *signal-induced trust* I have articulated in an earlier article. See generally Bryan Druzin, *Opening the Machinery of Private Order: Public International Law as a Form of Private Ordering*, 58 ST. LOUIS U. L.J. 423 (2014).

109. Treaty Between the United States of America and the Russian Federation on Measures for the Further Reduction and Limitation of Strategic Offensive Arms, U.S.-Russ., Apr. 8, 2010, S. TREATY DOC. NO. 111-5 (2010). The following account of New START is largely drawn from a previous description I have provided elsewhere. See Druzin, *supra* note 23, at 460–61.

110. Protocol to the Treaty Between the United States of America and the Russian Federation on Measures for the Further Reduction and Limitation of Strategic Offensive Arms, U.S.-Russ., pt. 4, § VI(5), Apr. 8, 2010, S. TREATY DOC. NO. 111-5 (2010).

111. *Id.* at pt. 2, § I (3).

112. *Id.* at pt. 5, §§ I (2), VIII(2).

120 days;¹¹³ and so on. This signaling structure encourages compliance even in the absence of third-party enforcement. The CMF builds on the same premise. However, unlike treaties which rely on static rounds of signaling embedded into a treaty regime, the CMF model possesses several unique features that should be noted.

2. Signaling Strength is Adjustable

A particularly useful aspect of the CMF is that the signal strength is adjustable to whatever level of intensity the stakeholders wish to make it—the larger the sum, the more costly the signal and thus the more credible each agent's commitment to the agreement. To use a colloquialism: the CMF allows parties to an agreement “to put one's money where one's mouth is.” The fact that the deposit is adjustable provides a tremendous degree of flexibility. The strength of the signal can be varied in relation to the precise circumstances of the agreement. It may be that in some cases a large deposit may not be required. Assuming a sufficient degree of monitoring, credible commitment may be signaled by setting the deposit amount just high enough to negate any potential benefit gained through noncompliance. The signal strength need only be powerful enough to convince parties that there is sufficient incentive for the majority of member states to comply. The stakeholders can calibrate the deposit sum accordingly.

The deposit need not be an unbreakable firewall against all defection—it need only significantly reduce the likelihood of defection and thereby maintain the impression that the agreement is robust. If the agreement is perceived as robust, it will be robust. In many circumstances, a minimal deposit may be sufficient to successfully inculcate this belief and prevent stakeholders from sliding into a tragedy of the commons out of mistrust. Treaty members may anticipate that some parties might still exit the treaty; however, so long as parties believe that the majority of the treaty members will keep their commitments, a negative bandwagon will not form.

In some cases a stronger signal may be needed. For instance, in periods of potential treaty instability brought about by unanticipated exogenous shocks (e.g., political shifts, sudden changes in market price or supply, etc.), the deposit sum may be increased to boost the signal strength in order to re-stabilize the treaty. A fresh round of signaling can short-circuit a negative bandwagon before it takes hold. The signal strength may also be adjusted downward. For instance, after a long period of treaty stability that has successfully fostered robust norms of cooperation, heavy signaling may no longer be required and so the deposit burden may be lightened accordingly.

113. *Id.* at pt. 9, Fourth Agreed Statement, 3.

Other cases may call for entirely different approaches. For instance, if governments are initially reluctant to make such a significant commitment, the deposit sum may be incrementally increased over a period of time, ratcheting up the signal in a graduated fashion. This will render the treaty less robust in the beginning phase but may be the only option when faced with a group of reluctant parties.

Whatever the case, the framework provides a high degree of flexibility: the simplicity of the CMF allows member states to adjust an agreement's signal strength to the precise level needed. This is a powerful feature of the model.

3. Can Be Grafted onto Existing Agreements

The CMF can be used to bolster existing treaties. The CMF is essentially a "heavy" signaling mechanism that may be grafted onto existing or future multilateral environmental agreements to strengthen compliance. Such an approach would not conflict with existing normative frameworks for multilateral environmental agreements. Indeed, guideline 14(d) of the *UNEP Manual on Compliance with and Enforcement of Multilateral Environmental Agreements*¹¹⁴ suggests the introduction of various techniques to enhance compliance.¹¹⁵ Tethering a multilateral environmental agreement to a corollary agreement under the CMF could be considered such a technique to compel compliance. In principle, the CMF can be generalized to augment and strengthen compliance for any type of treaty—it need not be restricted to multilateral environmental agreements. The CMF may be used to reinforce and strengthen compliance for any agreement between international actors. However, for reasons already discussed, it is particularly effective in strengthening MEAs because it is ideally suited to address tragedy of the commons scenarios where all parties desire coordination, but are nonetheless driven to uncooperative outcomes.

4. The Model is Scalable

The framework could be open to actors on all scales of governance—from the regional to the global level. The CMF allows for extraordinary flexibility in this respect. The CMF can reinforce treaty-based governance on any scale, facilitating the creation of tailor-made regional based MEAs

114. Guideline 14(d) states that countries "can consider the inclusion of non-compliance provisions in a multilateral environmental agreement, with a view to assisting parties having compliance problems and addressing individual cases of non-compliance, taking into account the importance of tailoring compliance provisions and mechanisms to the agreement's specific obligations." UNEP, *supra* note 77, at 116.

115. These may be warnings, trade sanctions, withdrawal or suspension of privileges, and other punitive measures. *See id.* at 103–22.

rather than fixed environmental protocols at the global level. Such an approach is advantageous in that parties on regional levels are arguably better equipped to set realistic conservation targets and gauge the size of deposits necessary to thwart a tragedy of the commons. Regional agreements can be tailored to offset specific factors that threaten to undermine coordination at the regional level. Global environmental protocols that require a broad base of commitment across many governments with targets that may be unrealistic for certain parties are more susceptible to collapse because they are more vulnerable to a negative bandwagon. As such, a ready-made governance mechanism like the CMF, available to parties on any scale of interaction, could engender more robust international environmental governance. In principle, there is no reason why even private actors could not register their agreements with the CMF. The CMF is a governance structure that remains accessible to all—from private parties to state actors. The CMF can function on the most regional level or it can be scaled up to include in its sweep the entire international community.

5. Coordination is Easy to Achieve

As we have seen, the disadvantage of common-pool resources is that they are highly susceptible to the tragedy of the commons. Their advantage, however, is that, because all actors desire cooperation, it does not take much to trigger it. The stakeholders desire cooperation so long as others also cooperate. Thus, if the correct measures are put in place, a stable coordination equilibrium is not difficult to achieve. This provides the CMF a significant advantage over other treaty types. The tragedy of the commons is a truly unique dynamic in that parties desire compliance, but are structurally driven toward non-compliance. It will often be the case, therefore, that only gentle shifts in perception are necessary to generate stability and thwart the emergence of a tragedy of the commons. The critical issue is the collective expectation that a sufficient number of actors will comply. While agreements exhibiting a tragedy of the commons dynamic are susceptible to collapse, the upside is that because such agreements revolve around collective expectations, coordination can be easily attained if the correct measures are implemented at early stages. In non-tragedy-of-the-commons type treaties, defection incentives may fluctuate wildly. Heavy-handed enforcement mechanisms are thus required. This is not the case with agreements imperiled by a tragedy of the commons. The remedy may be extremely light-touch. While common-pool resources are pre-disposed to the tragedy of the commons, its emergence can be easily averted with sufficient signaling. Again, the stakeholders desire compliance—we need only provide an environment in which it is rational for them to do so.

V. CONCLUSION

The question at the heart of the ecological crisis before us is essentially this: how can the international community successfully coordinate without a dominant coercive authority to keep states in line? The “dominant view in international relations—shared by a broad range of scholars working in the rationalist tradition—recognizes that agreements that cannot be enforced by a third party must in some sense be self-enforcing.”¹¹⁶ But how are we to achieve this? Short of a global empire, top-down regulation is not an option—the community of nations must somehow regulate itself. Given everything we know about the difficulty of sustaining cooperation in decentralized governance situations and the current political fragmentation of the world, this is not an easy task. Yet we do not have the luxury of waiting for the slow advance of global governance—we must accelerate this process through every means at our disposal. Governments need to stick to the international commitments they make, but for this there needs to be executive authority in some form. Without effective governance structures, treaties will reliably fail as parties spiral into the self-defeating morass of mutual distrust.

The Commons Management Fund is such a governance structure. Technically understood, the CMF is a regulatory solution. It is, however, bottom-up rather than top-down. This distinction is important because the decentralized juridical nature of the current world order requires a bottom-up approach to achieve cooperation—there is no alternative. Ultimately, the CMF’s viability is difficult to predict. The only true test of the approach will come with actual implementation, after which the plan’s efficacy would simply be an empirical question. What is not difficult to predict, however, is this: given the seriousness of the global ecological crisis before us, if meaningful action on a massive transnational scale is not undertaken now, our ability to collectively course-correct will soon reach a threshold where it will become impossible to do so.

116. Simmons, *supra* note 75, at 275.