

COMMONS, COGNITION, AND CLIMATE CHANGE

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I.	INTRODUCTION	297
II.	COMMONS AND CLIMATE	300
III.	COLLECTIVE ACTION AND ITS STRUCTURAL COGNITIVE IMPEDIMENTS TO COMMONS SOLUTIONS	301
	<i>A. Distrust</i>	302
	<i>B. Ignorance</i>	305
	<i>C. Insouciance (Freeform and Motivated)</i>	308
IV.	SOME ANTIDOTES TO THE COLLECTIVE ACTION COGNITIVE ISSUES	312
	<i>A. Motivated Belief</i>	313
	<i>B. Commitment: Exhortation, Conscience, and Esteem</i> ...	315
	<i>C. Interestingness and Fun</i>	319
V.	WHAT IF COGNITIVE ANTIDOTES DON'T SUFFICE? OR, REDUCING THE COGNITIVE TRAPS BY REDUCING THE SCOPE OF COLLECTIVE ACTION	320
	<i>A. Adaptation</i>	321
	<i>B. Geoengineering</i>	322
	<i>C. Appeals to Interest: National and Individual</i>	326
VI.	CONCLUSION	330

I. INTRODUCTION

Climate disruption has become big news. Throughout the world, human activities in all nations pour greenhouse gases (GHGs) into the atmosphere, in spite of the potentially disastrous direct impact on climate and the indirect impacts on all kinds of resources, from fish and corals to birds to flowers to growing crops. Can we stop ourselves? Can our national governments and international agreements stop us? Perhaps, and the series of international conferences on climate change argue powerfully that many scientists, organizations, and national leaders believe we should.

Nevertheless, we have seen conference after conference on climate change, raising hopes and then dashing them repeatedly. The Paris Climate Change Conference in December 2015 appeared

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to be more successful than most of its predecessors in achieving accord among the participants. But the agreement reached there is still not expected to achieve the goal of limiting global warming to the stated level—something less than two degrees centigrade above pre-industrial temperatures—even if the participants do what they say they will do.¹

The experience of climate change efforts to date, with results that are at best ambiguous and at worst disappointing, is the setting of this Essay. Commentators agree that the Paris Agreement, momentous though it is, leaves many actions to be taken by the participants—along with many doubts about their willingness or ability to take those actions.

These doubts loom larger in light of the participants' expectations about actions taken or not taken by other participants. This Essay revolves around expectations of that sort. I will discuss the cognitive aspects of commons or collective action problems, of which, of course, climate change is an enormous example. I do not mean to argue that cognition is the only obstacle or even the central obstacle to our ability to address climate disruption, or that if people simply changed their minds all would be well. Far from it; there are enormous technical and economic hurdles to dealing with this globally threatening phenomenon. Nor do I even plan to discuss all the cognitive impediments to understanding climate disruption. Several scholars have taken an interest in this topic, taking several different directions. Jeffrey Rachlinski and Barton Thompson have both analyzed climate problems in the light of "heuristics" of ordinary cognition—such as the ways that people perceive uncertainty, or their special aversion to losses—concluding that the ordinary ways of "thinking fast" present major impediments for our ability to come to grips with climate change.² Other scholars, grounding their arguments in the contributions of Dan Kahneman and his co-authors, have discussed attitudes to climate change in light of what has come to be called "cultural cognition"—the likelihood that people will perceive issues in the ways that their respective political or cultural

1. Gautam Naik, *Scientists Hail Climate Pact as Key Step in Fight Against Warming*, WALL ST. J. (Dec. 13, 2015), <https://www.wsj.com/articles/scientists-hail-climate-pact-as-key-step-in-fight-against-warming-1450028078>.

2. See Barton H. Thompson, Jr., *Tragically Difficult: The Obstacles to Governing the Commons*, 30 ENVTL. L. 241 (2000) (discussing fisheries and groundwater in addition to climate change); Jeffrey J. Rachlinski, *The Psychology of Global Climate Change*, 2000 U. ILL. L. REV. 299 (2000). For heuristics in cognitive psychology, see DANIEL KAHNEMAN, THINKING FAST AND SLOW (2011).

reference groups perceive them, whatever the evidence.³ Still others, notably Gary Libecap, have concentrated on the influence of distributive questions on people's ability to cope with evidence of climate change.⁴

While these scholars very interestingly describe cognitive issues in connection with the great commons of climate change, and while I will refer to some of their observations, this Essay takes a somewhat different approach. I will focus on a narrower but very basic set of cognitive impediments in commons situations: distrust, ignorance and insouciance. I focus on these because they are generated by the very structure of the commons or collective action settings. These impediments are in a sense prior to cognitive issues of "thinking [too] fast" about the evidence, or perceiving climate information according to one's cultural or political reference group, or letting one's perceptions be swayed by distributive issues. Instead, these impediments can stop people from even getting to any evidence about commons problems, or can cause despair at the very outset about arriving at any solution.

It is quite widely agreed that climate disruption has the characteristics of a commons or collective active problem,⁵ and for that reason, Part II of this Essay will discuss the point, but only briefly. In Part III, I will follow with a somewhat more extensive argument that collective action or commons situations inherently produce the three cognitive problems mentioned above—distrust, ignorance and insouciance—for those who might try to address these problems. In this Part, I will concentrate most extensively on the factor of distrust, not because it is logically prior to ignorance and insouciance, but because it most clearly illustrates how commons situations generate cognitive impediments to their own solution.

3. See Dan M. Kahan, *Foreword: Neutral Principles, Motivated Cognition, and Some Problems for Constitutional Law*, 125 HARV. L. REV. 1, 19-21, 23-24 (2011) (importance of reference groups in cognition); see also, e.g., Dan M. Kahan & Donald Braman, *Cultural Cognition and Public Policy*, 24 YALE L. & POL'Y REV. 149, 151 (2006) (linking beliefs about global warming to other cultural beliefs); Hari M. Osofsky & Jacqueline Peel, *Energy Partisanship*, 65 EMORY L. J. 695, 702 (2016) (extensive development of this approach to action on climate change); Robert R.M. Verchick, *Culture, Cognition, and Climate*, 2016 U. ILL. L. REV. 969, 975 (2016) (same).

4. Gary D. Libecap, *Open-Access Losses and Delay in the Assignment of Property Rights*, 50 ARIZ. L. REV. 379, 406-07 (2008).

5. See, e.g., Cinnamon Carlarne, *Delinking International Environmental Law & Climate Change*, 4 MICH. J. ENVTL. & ADMIN. L. 1, 39-40 (2014) and sources cited therein; Thomas M. Gremillion, *Setting the Foundation: Climate Change Adaptation at the Local Level*, 41 ENVTL. L. 1221, 1230 (2011); cf. Kirsten H. Engel & Scott R. Saleska, *Subglobal Regulation of the Global Commons: The Case of Climate Change*, 32 ECOLOGY L. Q. 183, 190-94 (2005) (recognizing the collective action character of climate change but arguing that unilateral subglobal action is not necessarily irrational and may be positive).

In Part IV, without attempting to be exhaustive, I try to identify some factors that might alleviate distrust, ignorance and insouciance in the context of climate-related collective action. Those factors I identify as motivated belief, commitment, and what I call a factor of interestingness and fun, all of which to some degree counteract distrust, ignorance and insouciance in commons situations. Nevertheless, climate disruption presents a commons or collective action problem that is so vast that these countervailing factors are likely to be overwhelmed. Thus, in Part V and again without attempting to be exhaustive, I will turn to some measures that might alleviate these structural cognitive issues through shrinking the scale of the collective action problems themselves, and through turning to actions on a smaller or even individual scale. In this Part, I will take up the topics of adaptation, geoengineering, and efforts to appeal to market-based decision-making. I will conclude with the observation that market-oriented actions may be the most promising of these three, though certainly not without their own problems.

II. COMMONS AND CLIMATE

I have long been interested in issues involving management of commons, or as Elinor Ostrom and her followers have called them, common pool resources.⁶ From the common pool perspective, the loading of GHGs into our atmosphere has a very familiar look, and a very familiar name: the Tragedy of the Commons.⁷

This sobriquet was created by biologist Garrett Hardin in 1968, and in his well-known explanation of the Tragedy, he used the example of a herder's reasoning about a field to which any and all herders have access while none have the right or ability to exclude others.⁸ According to Hardin, such a herder would realize that there would be no point in holding back from grazing on the one hand, or investing in regenerating the field on the other; he or she would consider that the other herders would simply free ride on any such measures, and that the common field would fare no better in the

6. I have had a longstanding friendly argument with Ostrom and her associates about whether terminology concerning "common pool resources" (Ostrom's preferred usage) should be kept separate from "common property regimes" (a phrase I often use). Ostrom's argument is that common pool resources have certain physical characteristics and should not be mixed with designations of property regimes; my argument has been that no resource is a common pool by nature, but rather that this status depends on the way it is managed (if at all), and that common property regimes are one form of management. For Ostrom's view, see, for example, NAT'L RESEARCH COUNCIL, *THE DRAMA OF THE COMMONS* 3, 14, 17–18 (Elinor Ostrom et al. eds., 2002) [hereinafter *DRAMA OF THE COMMONS*]. I am afraid I have only given my views orally, in mild conference spats with Ostrom and her associates.

7. See Garrett Hardin, *The Tragedy of the Commons*, 162 *SCIENCE* 1243 (1968).

8. *Id.* at 1244–45.

long run.⁹ The upshot would be that all the herders would graze their livestock and none would invest in replenishment, and the grazing field would be degraded or even ruined over the long run. By implication, the same could be said of any other valuable resource to which access goes unrestrained. Thus, Hardin generalized this pattern to many kinds of environmental problems, including pollution.

There have been many critiques of Hardin's account, including Elinor Ostrom's rejection of the designation of "commons" for what is more accurately designated "open access" to a common pool resource.¹⁰ The medieval common fields that Hardin cited actually were far from tragic; these commons-es were not in fact open access resources, and they endured under community management for the better part of a millennium.¹¹ Moreover, the underlying idea of the "tragedy" itself was not new when Hardin wrote; years before his article economists like Scott Gordon had applied what was essentially the same logic to a more realistic resource example, that is, fisheries.¹²

Misnomer or not, however, and original or not, what Hardin dubbed the Tragedy of the Commons has become ordinary usage, and I too will use his trope. But more to the point, many see the Tragedy playing out in a resource that covers the globe: the atmosphere. I turn, then, to some features of collective action that create structural cognitive impediments to solutions as a general matter—but particularly solutions to climate disruption.

III. COLLECTIVE ACTION AND ITS STRUCTURAL COGNITIVE IMPEDIMENTS TO COMMONS SOLUTIONS

My argument is that collective action or commons problems generate cognitive impediments by their very structure and, as mentioned earlier, I am focusing particularly on the cognitive impediments of distrust, ignorance, and insouciance. As a matter of chronology, ignorance should come first, but I begin with the impediment most strongly implied in Hardin's own account: *distrust*.

9. *Id.*

10. ELINOR OSTROM, *GOVERNING THE COMMONS* 222 n.23 (1990) (noting prior scholarship that recognized the distinction). The distinction between common and open access appears regularly in the later work of Ostrom and her colleagues. *See, e.g.*, *DRAMA OF THE COMMONS*, *supra* note 6, at 18.

11. *See, e.g.*, Susan Jane Buck Cox, *No Tragedy of the Commons*, 7 *ENVTL. ETHICS* 49 (1985) (discussing long-lasting medieval commons); Henry E. Smith, *Semicommon Property and Scattering in the Open Fields*, 29 *J. LEGAL STUD.* 131 (2000) (same).

12. *See* H. Scott Gordon, *The Economic Theory of a Common-Property Resource: The Fishery*, 62 *J. POL. ECON.* 124 (1954); *see also* Hakkan Eggert, *The Centenary of Jens Warming's Optimal Landing Tax in Fisheries*, 26 *MARINE RESOURCES ECON.* 107 (2012) (describing a similar idea by Jens Warming, originally written in Danish in 1911 and 1931).

A. Distrust

One of the most easily understood consequences of collective action scenarios is distrust among the interested parties. The logic of the Tragedy the Commons suggests the root of distrust: any given person, or group, or nation, is likely to ask, why should I make an effort when I am reasonably certain that others will not? My forbearance will just cost me, without doing much good in the long run, since others will take what I have tried to preserve. Indeed, a more malevolent take on the question would be, why should I make an effort *even if others do*? The efforts of others might do something to preserve the atmospheric resource, and then I will get to take a bigger portion of what they have saved—that is to say, I can free ride on their actions.¹³

Ultimately, then, no matter whether the other parties cooperate or malingering, the rational role for each person, and each nation too, is to malingering. This is of course the reason why the Tragedy of the Commons can be described in game theory terms as an “n-person Prisoner’s Dilemma” or PD.¹⁴

The PD is of course a very well-known situs in game theory, usually described in terms of two prisoners, each of whom is motivated to “rat” on the other no matter what the other prisoner does. The PD structure also explains that participants in the Tragedy can understand the motives of the others: each understands that the others have the same motivation to rat (or free ride). Ironically, game theorists call this phenomenon “common knowledge”—I know what you know, you know what I know, and we both know that we both know it. In the PD game, as well as in the Tragedy, what we both know is that we are both motivated to cheat or malingering.¹⁵

Common knowledge can sometimes help people to coordinate their actions—when we know that the others are cooperating. But the common knowledge of the PD or Tragedy argues that we are trapped. One should notice that as much as anything else, this is a *cognitive* trap—the trap of distrust. We are stuck in the PD or Tragedy because of our beliefs about others’ beliefs, which lead us to distrust their willingness to take cooperative action. It is not that

13. See William D. Nordhaus, *A New Solution: The Climate Club*, N.Y. REV. BOOKS (June 4, 2015), <http://www.nybooks.com/articles/2015/06/04/new-solution-climate-club/> (identifying the calculus of free riding as a chief impediment to international action on climate change).

14. ROBERT C. ELLICKSON, CAROL M. ROSE & HENRY E. SMITH, *PERSPECTIVES ON PROPERTY LAW* 107 (4th ed. 2014).

15. See Peter Vanderschraaf & Giacomo Sillari, *Common Knowledge*, STAN. ENCYCLOPEDIA PHILOSOPHY (July 23, 2013), <https://plato.stanford.edu/entries/common-knowledge/>.

our distrust is irrational; in fact, it is quite rational. In the ordinarily understood version of rationality as rational self-interest, no one would ever cooperate to solve commons problems.

In real life, of course, this lugubrious conclusion is by no means inevitable. The most austere version of rational self-interest has innumerable breaches in practice, and we are lucky that it does. When common knowledge does help people to coordinate their actions, the mutually desolating PD game can turn into a still-risky, but much more productive, “assurance game,” in which the partners advance through mutual assistance—if they can communicate with each other. The possibility of communication is often observed about the Prisoners’ Dilemma itself; if the prisoners can communicate and agree on a story, they may be able to avoid their plight.¹⁶ The same is equally and perhaps more intuitively true of contractual relationships where coordinated agreement to forego cheating at the outset can induce the parties to trust each other, potentially leading to highly beneficial long-term commercial relationships.¹⁷

In conjunction with her critique of Hardin’s story, Elinor Ostrom spent a career showing that people sometimes do arrive at solutions to commons problems, and they do so without the coercion that Hardin thought essential. Her most famous book, *Governing the Commons*, is replete with illustrations of cooperative solutions through which people turn open access resources into productive and fruitful ones that they manage in common. Even before Ostrom’s book, Edna Ullman-Margolit argued that PD scenarios, of which the Tragedy is one, may be predicted to produce cooperative solutions.¹⁸

Something to note, however, is the substantial difference between the ordinary one-on-one PD game and the n-person PD game or commons. The size of the “n” in the n-person situation matters a good deal. All other things being equal, the larger the

16. See, e.g., Robert S. Adler & Elliot M. Silverstein, *When David Meets Goliath: Dealing with Power Differentials in Negotiation*, 5 HARV. NEGOT. L. REV. 1, 68 (2000) (comparing PD communication to communication in negotiations).

17. See Carol M. Rose, *Giving, Trading, Thieving, and Trusting: How and Why Gifts Become Exchanges, and (More Importantly) Vice Versa*, 44 FLA. L. REV. 295, 314–15 (1992) [hereinafter Rose, *Giving, Trading, Thieving, and Trusting*] (describing and critiquing role of “Leviathan” or law in backing up agreements). While legally enforceable instruments like contracts can create a countervailing common knowledge that disrupts PDs and encourages trust, the results are not always socially beneficial; for an especially unfortunate example, see RICHARD R.W. BROOKS & CAROL M. ROSE, *SAVING THE NEIGHBORHOOD: RACIALLY RESTRICTIVE COVENANTS, LAW, AND SOCIAL NORMS* 219–21 (2013) (discussing the role of racial deed restrictions in creating common knowledge that bolstered neighbors in maintaining residential segregation).

18. EDNA ULLMANN-MARGALIT, *THE EMERGENCE OF NORMS* (1977); see also ROBERT AXELROD, *THE EVOLUTION OF COOPERATION* 129–32 (1984) (arguing that cooperation can arise from repeat play); but cf. ELLICKSON, ROSE, & SMITH, *supra* note 14, at 233 (noting some of the many critiques of the Axelrod thesis).

number (n), the less likely the participants will be able to perceive and verify the acts of others, the more likely that each will realize that they cannot observe and verify the acts of others, and the more likely the ensuing distrust. If we add heterogeneity of culture, beliefs, and interests, then distrust appears to be entirely predictable. Distrust arises from nature of the commons or the multi-person PD: we would all be better off in the long-run if we made some sacrifices in the shorter term, but each party would be *best* off cheating while the others cooperate. Here too, as the game theorists say, the advantage of cheating is common knowledge among all the participants.

Thompson elaborated the suggestion that people are more likely to cooperate in collective action solutions if they think that others are bound to do so too—that is, if they perceive their contribution or forbearance is part of a shared effort rather than an individual one.¹⁹ If that is the case, then perhaps Hardin’s mutually agreed-upon coercion might provide an antidote to distrust when put in place by an established governmental entity, say, within a given nation. More than that, even international solutions could be feasible: if individual people are in a sense “compiled” into nations, the “n” in “n-person” is substantially reduced to “n-nation.”

Unfortunately, as James Krier observed many years ago, generally binding arrangements of any sort depend on solving another collective action issue, that is, at the management or rule-making level above the resource level.²⁰ At that level too, the size and homogeneity of the “n” in “n-person” matters: a small and unified polity is likely to have an easier time deciding on rules than a large and diverse one. Given sufficiently large numbers of governmental entities, and given heterogeneity in their willingness or ability to persuade or coerce their own citizenry, the prospects that national parties will agree on mutual coercion itself may become vanishingly small.

These considerations sound very familiar in politics of climate change. They can be illustrated particularly by the phenomenon that has acquired the unlovely but now widely-used name of “leakage.”²¹ An example of leakage would be the following: Country A taxes carbon. Carbon-producing manufacturing interests

19. Thompson, *supra* note 2, at 245–46; see also JON ELSTER, *THE CEMENT OF SOCIETY: A STUDY OF SOCIAL ORDER* 203–04 (1989) (describing a variety of modes of conditional cooperation, depending on cooperation of others).

20. See James E. Krier, *The Tragedy of the Commons, Part Two*, 15 HARV. J. L. & PUB. POL’Y 325, 337 (1992) (identifying second-order commons problem at management level and hence circularity in call for coercion to solve commons problems).

21. See, e.g., Daniel A. Farber, *Carbon Leakage versus Policy Diffusion: The Perils and Promise of Subglobal Climate Action*, 13 CHI. J. INT’L L. 359 (2013) (describing the leakage phenomenon but arguing that it can be overcome).

in Country A then move to County B, which has no controls, or which has a sufficiently weak or corrupt government that its controls, whatever they may be, are easily evaded. Reasoning backwards from this “leakage” scenario, legislators in Country A may well decide not to tax carbon after all; Country A only loses industry while the atmosphere continues to load with carbon dioxide, but now from Country B. The issue is worse if Country A is contemplating not only Country B but also Countries C–Z. The logic of the leakage problem, then, is simply another variant on distrust—and distrust itself arises from the structure of the PD game, and most especially of the multiple-party PD or commons situation.

B. Ignorance

A second cognitive impediment to commons solutions occurs long before we fall into the distrust trap: we may not even *know* we have a commons problem.

Not long ago, I wrote a short article called “Surprising Commons,” which puzzled over the question of why we are so often surprised by commons problems.²² Simply *not knowing* is a very typical feature of commons problems. There is a reason for this phenomenon: like distrust among the participants in a collective action scenario, ignorance stems from the very structure of the commons or collective action problem.

It is widely recognized that open access to a common resource disincentivizes forbearance about its use as well as investment in its conservation; indeed, that is the lesson of Hardin’s famous article on the Tragedy. But open access to common resources also disincentivizes *learning* about the resource.²³ The reason is that open access undermines a principal feature (if not *the* principal feature) of property—the right to exclude. Blackstone himself described the way in which an inability to exclude others degrades a person’s willingness to invest in a resource. As he put it in a rhetorical question, “who would be at the pains of tilling [the earth], if another might . . . seize upon and enjoy the product of his industry, art, and labour?”²⁴ But once the investor loses the promise of a payoff from her investment, she loses not only the incentive to make the investment in the first place, but also a chief incentive to *learn* about the resource. Why bother, if nothing will come of the knowledge?

22. See Carol M. Rose, *Surprising Commons*, 2014 BYU L. REV. 1257 (2014) [hereinafter Rose, *Surprising Commons*].

23. See generally Carol M. Rose, *Scientific Innovation and Environmental Protection: Some Ethical Considerations*, 32 ENVTL. L. 755, 761–64 (2002) [hereinafter Rose, *Scientific Innovation*] (exploring the link between property rights and incentives to investigate).

24. WILLIAM BLACKSTONE, 2 COMMENTARIES ON THE LAWS OF ENGLAND 7 (1766).

The quest for payoff is a powerful incentive to investigation; absent that motivation, some learning will occur, but it depends more or less on accidental factors, like sheer curiosity. By comparison, there is a longstanding and enormous investment in learning about production that treats open access resources as free inputs, at least until those resources start to become scarce. Take wildlife, for example: the human technologies for hunting go back millennia, as do the technologies for farming, with its byproduct of habitat destruction. The Endangered Species List, on the other hand, is less than fifty years old.

The treatment of wildlife exemplifies a mistaken idea that often plagues large-scale open access resources. That is the idea that they are inexhaustible—that we can never run out. In the later nineteenth century, proposals for fisheries regulation in Britain were met with the argument that the fish in the seas were limitless.²⁵ We know now how wrong that was. In recent years, however, the inexhaustibility fallacy has re-emerged in the wake of a famous bet between biologist Paul Ehrlich and economist Julian Simon.²⁶ In 1980, Ehrlich took up a challenge from Simon, wagering that a selected basket of commodities (chromium, copper, nickel, tin, and tungsten) would become increasingly scarce and expensive over a period of ten years; for his part, Simon bet that these substances would remain available and even fall in price. Simon won the bet handily; indeed, some of these metals' prices decreased by as much as two-thirds.²⁷

Some say that Simon's victory proves that we never run out of resources, because we will always be able to substitute intellectual capital for natural capital; others say Simon's victory was an anomaly.²⁸ But quite aside from the ultimate meaning of the bet itself, the problem for Ehrlich was that he bet on the wrong kind of resources. He bet on commodities that were owned by someone and that were bought and sold in markets. Markets respond to increasing scarcity by price rise, and rising prices then encourage conservation and the development and use of substitutes, dampening the effect of scarcity itself. Unfortunately, Ehrlich's side of the bet would have been quite appropriate for resources not generally found in markets—that is to say,

25. Gordon, *supra* note 12, at 126.

26. See PAUL SABIN, *THE BET: PAUL EHRLICH, JULIAN SIMON, AND OUR GAMBLE OVER EARTH'S FUTURE* (2013) (extensive background and discussion of the famous wager).

27. *Id.* at 134–36, 181; Carol M. Rose, *Property and Emerging Environmental Issues—The Optimists vs. The Pessimists*, 1 BRIGHAM-KANNER PROP. RTS. CONF. J. 405, 407 (2013) [hereinafter Rose, *Optimists-Pessimists*].

28. See SABIN, *supra* note 26, at 184–89, (discussing reactions to the outcome of the bet).

environmental resources.²⁹ The goods that we call “environmental” generally have no owners and hence they are not in markets, have no observed prices, and thus their scarcity triggers no price-based conservation or turn to market substitutes. With such goods, we do keep on taking and taking because they are “free,” or in the case of pollutants, dumping and dumping, because that too is “free.” We halt only when the resource runs so low that the pursuit costs more than the good itself or when the externalities from overuse overwhelm us or finally make us realize a need for non-market rationing, generally through regulation.³⁰

Another fallacy about open access resources derives from what has recently been called the problem of shifting baselines in environmental resources.³¹ Oysters in the Long Island Sound give an example: shell middens dating from before the European discovery of the Americas included some very large oyster shells, indeed, from eight to ten inches in length or more, suggesting that the oysters themselves were the size of a flattened volleyball.³² But even before the arrival of Europeans, the shells were growing smaller.³³ Shellfish harvesters tended to focus on the larger specimens, causing the average size of the shellfish to decrease over time, altering perceptions of the normal size of oysters.³⁴ Similarly, when overfishing occurs, each generation of fishers is likely to see smaller and smaller fish and fish populations—as was certainly the case for oysters.³⁵ As these decreases occur, successive classes of resource takers come to expect diminution. Natural fluctuations add “noise” that obscures this pattern, but the underlying perception is one of a “new normal” that shrinks over time. The point is that overall, shifting baselines lend themselves to ignorance about the gradual decline in open access resources.

The inexhaustibility fallacy, the shifting baseline perception, and ignorance about open access resources more generally are all

29. Rose, *Optimists-Pessimists*, *supra* note 27, at 407–10. Simon himself was somewhat ambivalent about the validity of his thesis for one environmental resource—air. *Id.* at 410.

30. See Gordon, *supra* note 12, at 132–34.

31. See, e.g., Hugh Powell, *On the Antarctic Peninsula, Scientists Witness a Penguin Revolution*, *LIVING BIRD* (Jan. 26, 2016), <https://www.allaboutbirds.org/on-the-antarctic-peninsula-scientists-witness-a-penguin-revolution/> (describing problem of “shifting baselines” in recognizing changes in population of various species). The first reference to a “shifting baseline” appears to be in Daniel Pauly, *Anecdotes and the Shifting Baseline Syndrome of Fisheries*, 10 *TRENDS IN ECOL. & EVOL.* 430 (1995). Thanks to Doug Harris for this information.

32. MARC KURLANSKY, *THE BIG OYSTER: HISTORY ON THE HALF SHELL* 18–19 (2006).

33. *Id.*

34. See *id.*

35. See *Oyster Restoration*, NAT’L OCEANIC & ATMOSPHERIC ADMIN. CHESAPEAKE BAY OFFICE, <https://chesapeakebay.noaa.gov/oysters/oyster-restoration>, (reporting that Chesapeake Bay oyster population is less than one percent of historic levels) (last visited Apr. 21, 2017).

artifacts of *not bothering to find out*. Moreover, not bothering to find out is itself an artifact of the structure of the commons. Finding out takes effort and money. But if there is no focused payoff, the initiative weakens to investigate what is happening to open access resources, just as the absence of focused payoff undermines any other kind of investment. Property rights focus the payoff, but open access resources lack property rights.³⁶

This is not to say that no one ever learns anything about open access resources. Curiosity helps. Crises help too, if they do not come too late. But they sometimes do come very late, if not altogether too late, and we may not even realize we have a problem until we are faced with a crash.

C. Insouciance (Freeform and Motivated)

A variant on the *not knowing* point about common pool problems is this: we may indeed see that we have a diminishing or degrading common resource, but we do not see it as a problem. In the case of climate disruption, one version would go roughly as follows: all right, yes, it is true, we now have over 400-parts-per-million carbon dioxide in the atmosphere, and yes, it may mean that global temperatures are rising. But so what? Humans are nothing if not adaptable, and anyway, warmer temperatures will be a boon to a lot of areas on the globe. So why get into a lather about it? Let's wait to see what happens.

Why do some take this view of climate change? One reason is sincere belief, not a factor to be dismissed. But another reason is a phenomenon to which Bonnie McCay alluded in describing factors that may help or hinder finding solutions to resource overuse problems. As McCay said, even where people realize that there may be some problem, "nothing will happen unless they see possible solutions to the problem"³⁷ Indeed, one might suspect the participants may engage in a form of reasoning backward: if a person cannot readily see a solution to a problem, she may be unwilling to designate it as a problem at all, which means that the quest for solutions retreats even further. Literature in psychology has explored a closely related mode of reasoning; that is, people tend to seek out information that confirms the views that they already have.³⁸ Exploring alternative explanations could suggest

36. Rose, *Optimists-Pessimists*, *supra* note 27, at 408–09; Rose, *Scientific Innovations*, *supra* note 23, at 760–62.

37. Bonnie J. McCay, *Emergence of Institutions for the Commons: Contexts, Situations, and Events*, in *THE DRAMA OF THE COMMONS* 361, 369 (Elinor Ostrom et al. eds., 2002).

38. Rachlinski, *supra* note 2, at 304–05; Thompson, *supra* note 2, at 272.

that one may not only have to change beliefs but change behavior as well, whereas inertia seems the easier path.

Notice, however, that these cognitive aspects of insouciance—ignoring problems to which one sees no solution—are connected to the structure of the collective action problem in fisheries. It really *is* an arduous task to address collective overfishing, making inertia attractive in comparison to a quest for solutions.

Nevertheless, climate disruption hardly squares with an explanation that no one can think of solutions. On the contrary, climate change has generated a great number of suggested solutions, or at least partial solutions. Among others are ideas for technical controls on GHG producers; taxes on the extraction or refinement of carbon-based fuels; taxes on the use of those fuels; more taxes on products derived from carbon-using methods; caps on GHGs together with tradable emission rights; measures to halt or at least slow deforestation (or even better, plant trees); subsidies for alternative energies like wind, waves, or solar; land use requirements for green architecture; and many, many more.³⁹ Such a large array of proposed solutions leaves a puzzle: could people possibly ignore climate disruption as a problem because they do not see solutions? On the contrary, is there not a surfeit of solutions?

Of course, one might think that none of them would be effective. But an alternative explanation for insouciance has been suggested, among other places, in an article by Troy Campbell and Aaron Kay. The authors describe an attitude that they call “motivated disbelief.”⁴⁰ The authors identify this as disbelief stemming not from a failure to see solutions, but rather from an aversion to the solutions proposed.⁴¹

These attitudes may not be entirely rational, but they are not totally irrational either. The difficulty of finding effective collective solutions to climate disruption can make the costs appear to be greater than the expected benefits, especially when

39. See WORKING GRP. III OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *CLIMATE CHANGE 2001: MITIGATION* 26–54 (Rajendra Pachauri ed., 2001) (detailing a great variety of mitigation methods).

40. Troy H. Campbell & Aaron C. Kay, *Solution Aversion: On the Relation Between Ideology and Motivated Disbelief*, 107 *J. PERSONALITY & SOC. PSYCHOL.* 809 (2014).

41. See, e.g., Osofsky & Peel, *supra* note 3, at 722 (citing remarks of Navy Rear Admiral David Titley and explaining views of some who deny climate change). The psychological literature that Professors Rachlinski and Thompson discuss identifies a related phenomenon: a tendency to weigh one’s present losses more heavily than those that one might suffer in the future—particularly if the latter are uncertain. Rachlinski, *supra* note 2, at 307–11; Thompson, *supra* note 2, at 262–65, 272.

the latter are discounted to present value;⁴² in the meantime, why make one's self miserable?

Certainly one can think of many self-interested reasons for motivated disbelief, including simply identification with the views of a reference group, as discussed by scholars of "cultural cognition."⁴³ Distributional issues are likely to have a role as well; those who work in carbon-heavy industries like coal certainly have motives to discount climate disruption, or at least to disbelieve in human-induced contribution to climate disruption. One who works in a coal town might very much want to believe a message that foregrounds scientific uncertainty about climate change, and particularly about its connections to human carbon usage. Political representatives from that coal town might want to believe this message too. Other kinds of political motivations play a role as well. For example, advocates of limited government may not want to see efforts to combat climate disruption because they fear more bureaucratic intervention in their lives.

But perhaps the most significant and widely-shared self-interested motivation for disbelief is simply cost, and in particular, the perceived gap between costs and benefits, especially in light of the long time before benefits are likely to be realized.⁴⁴ The thought here is that proposed mitigation efforts are not true solutions because they are too expensive—that is to say, mitigation is too costly by comparison to ignoring the problem. Sophisticated versions of this position point out that the expenditures we make now on avoiding climate disruption will come at the expense of economic development and hence of funds available for other social expenditures; in turn, as a less wealthy society, we could be less equipped to deal with climate concerns in the future.⁴⁵ To take a relatively simple example, high current expenditures on climate issues may require cutting education or research budgets, leading to a future in which an impoverished scientific community has fewer resources for even understanding climate, much less for managing disruption.

42. See William H. Nordhaus et al., *The Question of Global Warming: An Exchange*, N.Y. REV. BOOKS (Sept. 25, 2008) [hereinafter Nordhaus et al., *Question of Global Warming*] (explaining the issue of discounting in the climate change context for events in the relatively distant future).

43. See Kahan, *supra* note 3, at 2, 23–24; Kahan & Braman, *supra* note 3, at 150; Osofsky & Peel, *supra* note 3, at 704; Verchick, *supra* note 3, at 969, 975.

44. Richard J. Lazarus, *Super Wicked Problems and Climate Change: Restraining the Present to Liberate the Future*, 94 CORNELL L. REV. 1153, 1160, 1167 (2009).

45. See, e.g., Bjorn Lomborg, *Global Priorities Bigger Than Climate Change* (Jan. 2007), in TED TALKS, https://www.ted.com/talks/bjorn_lomborg_sets_global_priorities/transcript?language=en (expenditures will do more good on problems other than climate change, expenditures on such problems lead to better future).

Quite aside from the more sophisticated arguments, however, the concern for expense translates easily into ordinary consumer preferences. Consumer A does not want her utility bills to go up. She also does not want to pay more for gas in the form of carbon taxes at the pump, or more for imports on which a carbon tax has been levied. Consumer B thinks that a house with green architecture is too expensive at the outset, and that even over a longer run, lower energy bills will not make up for the higher initial price. Consumer C is perplexed about the role of forests, hearing that tropical forests soak up carbon admirably, but that new trees in a cleared area might soak up more carbon than old ones did, and aside from that, that boreal forests could even have a warming effect because they replace heat-reflecting, white snow with heat-absorbing, green leaves. In addition, given the size and distance of tropical forests, Consumer C has no idea how to stop deforestation there, and in any event, she thinks that people in forested areas have legitimate reasons for wanting to cut down trees and devote the land to agriculture. It might be different if someone paid the locals to keep trees on the land, but Consumer C is reluctant to contribute to this effort, especially when the only other contributor she hears about is former Vice President Al Gore, with whose other politics she disagrees.⁴⁶

One can find many of these same concerns and cognitive processes in ordinary decision-making about individual matters, but they are exaggerated in connection with a large open access common resource. The complexity of subjecting such a resource to effective management can easily lead to a quite rational calculation that there really is no cost-effective solution to climate disturbance and, as McCay noted, that calculation can lead to insouciance.⁴⁷ Once again, one should notice that this cognitive impediment of insouciance comes with the territory of the commons. Ignoring a commons problem derives especially from the mistrust in others, not because they are bad people, but because they all know the same things. All parties know that the rational thing for them to do individually is to go on with business as usual; they know that all other parties are likely to come to the same conclusion; and finally, they know that all other parties will know what everyone else knows—and hence they know that restraint is likely to fall apart. This common knowledge about others creates the secondary

46. See Jesse Burkhardt, *Does Al Gore Affect Environmentally Related Behavior?*, *YALE ENV'T REV.* (June 5, 2012), <http://environment.yale.edu/yer/article/does-al-gore-affect-environmentally-related-behavior#gsc.tab=0> (reporting on finding that Gore's activism increased contributions to carbon offsets); but see John Schwartz, *The New Optimism of Al Gore*, *N.Y. TIMES* (Mar. 16, 2015), https://www.nytimes.com/2015/03/17/science/the-new-optimism-of-al-gore.html?_r=0 (describing vociferous political attacks on Gore's environmentalism); see also Kahan, *supra* note 3, at 19–21 (importance of reference group for perceptions).

47. McCay, *supra* note 37.

common knowledge: everyone knows that the problem is too big to try to solve, and hence the rational response is to ignore it.

IV. SOME ANTIDOTES TO THE COLLECTIVE ACTION COGNITIVE ISSUES

I have been arguing that the structure of the open access commons gives rise to cognitive tendencies that impede solutions to open access. These include distrust once a common pool problem is recognized, but also failure to realize that the problem exists at all, as well as indifference due to disbelief in the feasibility of solutions. Clearly there are other cognitive impediments to dealing with climate change—including differing perceptions of distributional consequences, differing views about fairness and merit or fault, and difficulty in weighing future benefits and costs against more immediate ones.⁴⁸ But distrust, ignorance, and insouciance are in a sense the most fundamental, springing from the very structure of commons or collective action problems.

After this lugubrious list, then, let me turn to some possible antidotes—some factors and phenomena that might grease the wheels to roll toward *solving* commons cognition problems, and in particular, toward overcoming structural cognitive hurdles to climate solutions. Unlike the issues I have been discussing so far, the following potential antidotes do not themselves spring from the structure of collective action, yet they do appear in practical life, and may offer some possible countervailing force.

Preliminarily, it is important to bear in mind that in spite of the substantial reasons for gloom about the cognitive issues arising from common pool scenarios, one positive point is that solutions do not necessarily require unanimity. As long as *some* actors are willing to tolerate *some* level of free riding, they can address collective action issues on their own. Moreover, once the ball is rolling, other participants may grow more willing to join. What this means is that leadership is especially important in addressing commons problems.⁴⁹ For my purposes, then, the chief inquiry is that of identifying factors that can overcome distrust, ignorance, and insouciance about climate disruption, leading to some adequate level of participation. What follows is by no means an exhaustive list of such factors, but it is at least a partial one.

48. See generally Kahan, *supra* note 3; Kahan & Braman, *supra* note 3; Libecap, *supra* note 4; Osofsky & Peel, *supra* note 3; Rachlinski, *supra* note 2; Thompson, *supra* note 2; Verchick, *supra* note 3.

49. See, e.g., Engel & Saleska, *supra* note 5, at 190–94 (efficacy of partial efforts to address climate disruption).

A. Motivated Belief

If motivated disbelief or motivated skepticism is one impediment to addressing climate disruption, its positive counterpart is motivated belief. Large scale collective action is very likely to involve heterogeneous interests, and that is clearly the case with respect to climate disruption. Some persons and organizations could actually gain from attention to climate disruption and from measures that address it. These are the people and businesses that economist Bruce Yandle and his co-authors have for several years been describing pejoratively as “Bootleggers and Baptists,” a name derived from the coalition that brought Prohibition to the U.S. one hundred years ago.⁵⁰

According to Yandle, the equivalents of the Baptists are environmental activists, of whom more will follow shortly. The Bootlegger equivalents, on Yandle’s account, are businesses that have something to sell if others get interested in climate issues—businesses like natural gas producers, nuclear power companies, and producers of wind and solar technology.⁵¹ Yandle’s nomenclature—“Bootleggers”—suggests that observers should view motivated belief with skepticism and distrust. From that perspective, motivated belief could become another impediment to collective action on climate concerns, adding to distrust and to a backlash against forward movement on climate concerns.

From a different perspective, however, some might say that we are lucky that we have the motivated believers. Putting the so-called Baptists to one side for the moment, and simply focusing on the more clearly self-interested Bootleggers, self-interest can serve an important purpose. Self-interest drives people to collect information, and information is especially important in coming to grips with a common problem as large and amorphous as climate change.⁵² Moreover, as Mancur Olson argued many years ago, concentrated self-interest can overcome collective inertia about political action.⁵³ Indeed, one might think that self-interest is essential in moving collective bodies toward action altogether.

50. The phrase first appeared in Bruce Yandle, *Bootleggers and Baptists—The Education of a Regulatory Economist*, 7 REG. MAG. 12 (1983). The ideas are further developed in Bruce Yandle & Stuart Buck, *Bootleggers, Baptists, and the Global Warming Battle*, 26 HARV. ENVTL. L. REV. 177 (2002). For the Kindle version, see ADAM SMITH & BRUCE YANDLE, *BOOTLEGGERS AND BAPTISTS: HOW ECONOMIC FORCES AND MORAL PERSUASION INTERACT TO SHAPE REGULATORY POLICY* (2014) (ebook).

51. Yandle & Buck, *supra* note 50, at 211–15.

52. Rose, *Scientific Innovation*, *supra* note 23, at 757–61.

53. MANCUR OLSON, *THE LOGIC OF COLLECTIVE ACTION: PUBLIC GOODS AND THE THEORY OF GROUPS* (1965).

Self-interest, then, can not only motivate learning about climate disruption, but it can also motivate action. Businesses in Arizona, along with local political figures, want to capitalize on the state's sunshine through solar power.⁵⁴ People in the U.S.'s northern plains and in Denmark hope to capitalize on wind power.⁵⁵ Chinese entrepreneurs, recognizing an economic opportunity, have already developed industries both in solar panels and modern windmills.⁵⁶ These industries have already brought down the cost of alternative energy sources, and no doubt more could be accomplished with further inducements to self-interest. Even more pointedly, island nations affected by rising sea levels also have an obvious motivation to generate information about the dangers of climate disruption.

All these interested players are likely to bring more attention to climate issues and to generate information about them, making others less likely to ignore climate disruption. To be sure, the Bootleggers' self-interest may sometimes cast doubt on the veracity of their climate pronouncements—but not always. Yandle has suggested that the island nation representatives are Bootleggers in disguise, on the ground that their true motives are aimed at garnering attention and aid.⁵⁷ But news coverage of the island nations argues that their plight enhances not only information about climate disruption, but also sympathy, perhaps reducing the level of motivated disbelief or sheer indifference.

In fact, the Bootleggers do seem to have made some difference in the climate disruption debate. Business interests as well as sinking island nations have dented ignorance and indifference about climate disruption. Despite some missteps and ambiguities—for example, the uncertainties around new natural gas sources to substitute for more carbon-intense fuels⁵⁸—the actual measures taken by interested industries have had the effect of making GHG mitigation seem more plausible, in spite of the enormous task ahead.⁵⁹

54. See, e.g., *Arizona Utility Company Plans to Build Solar Plant Near Phoenix*, KTAR NEWS (Jan. 28, 2016, 12:24 PM), <http://web.archive.org/web/20160129101613/http://ktar.com/story/877613/arizona-utility-company-plans-to-build-solar-power-plant-near-phoenix/>.

55. Roberta F. Mann, *Lighting in a Bottle: Using Tax Policy to Solve Renewable Energy's Storage Challenges*, 20 J. ENVTL. & SUSTAINABILITY L. 71, 79 (2013).

56. Robert V. Percival, *China's "Green Leap Forward" Toward Global Environmental Leadership*, 12 VT. J. ENVTL. L. 633, 635, 647–49 (2011).

57. Yandle & Buck, *supra* note 50, at 219.

58. See, e.g., Hannah J. Wiseman, *Risk and Response in Fracturing Policy*, 84 U. COLO. L. REV. 729, 734 (2013) [hereinafter Wiseman, *Risk and Response*] (environmentalists' splits on natural gas fracking).

59. See Schwartz, *supra* note 46 (describing Al Gore's new optimism about climate change mitigation).

B. Commitment: Exhortation, Conscience, and Esteem

What about the other side of the supposed “Bootleggers and Baptists” coalition—the “Baptist” side? Motivations on this side of the coalition are rather mysterious, at least from a rational-actor perspective. Yandle himself has not been entirely clear about the motives of the so-called Baptists in the climate change debate, and others have been equally murky, except perhaps to hint that the Baptist environmentalists are really Bootleggers in disguise.⁶⁰ For example, some have argued that scientists who warn about climate disruption are actually angling for more grants to fund their research.⁶¹

On the whole, however, conventional self-interest would appear to be a rather weak explanation for the motivation of many environmentalists. These so-called Baptists draw attention not to their own interests but rather to what they perceive as the interests and needs of others who are affected by human actions. In the case of climate disruption, environmentalists’ exhortations address issues on a huge scale; while some others may find their exhortations moralistic or self-righteous, it seems rather pointless to speak of self-interest in these contexts.

This is not to say that there is no “Baptist” element here, in the sense of an appeal to others to do the right thing. While vast collective action issues shape environmentalists’ messages on climate change, they often try to bring those issues to a human scale, using appeals to individual sympathy and even conscience. Many environmentalist writings focus on the special vulnerability of poverty-stricken or minority populations to sea level rise or increasingly violent storms, citing the plight of inundated island residents or small farmers in flood-prone regions.⁶² Some describe climate vulnerabilities that are not immediately obvious. For example, if climate disruption causes dry and hot places to become drier and hotter, not only will subsistence farming become all the more precarious, but water collection from greater distances will add to the burdens of already-overburdened rural women.⁶³ Former

60. See *supra* notes 50 & 51.

61. See, e.g., Roger W. Cohen et al., Letter to the Editor, *In the Climate Casino: An Exchange*, N.Y. REV. BOOKS (Apr. 26, 2012), <http://www.nybooks.com/articles/2012/04/26/climate-casino-exchange/> (claiming purposeful alarmism by climate scientists in Cohen’s Letter to the Editor and Nordhaus responding and refuting the claim).

62. Samuel P. Leatherman, *Social and Economic Costs of Sea Level Rise*, 75 INTERNATIONAL GEOPHYSICS 181, 199–204 (2001) (Sea Level Rise: History and Consequences, ed. Bruce C. Douglas, Michael S. Kearney, and Stephen P. Leatherman, Ch. 8).

63. See, e.g., Francie Diep, *Four Ways Climate Change Affects Women More Than Men*, PACIFIC STANDARD (Sept. 30, 2015), <https://psmag.com/four-ways-climate-change-affects->

President of Ireland Mary Robinson now heads an organization that appeals to “climate justice,” and other writers join her in addressing climate disruption as a problem in international human rights.⁶⁴ Even Pope Francis has now famously weighed in on topics relating climate disruption to poverty.⁶⁵

The human costs of climate disruption are not the only focus of environmental publicity. Following the 2014 Report of the Intergovernmental Panel on Climate Change (IPCC), environmental writers could cite its findings on the effects of ocean warming and acidification on coral reefs, fish, and shellfish populations, not to mention polar bears and large marine mammals.⁶⁶ Birding magazines describe what appears to be an increasing disjunction between some bird migration patterns and the seasonal plant and insect sources that have hitherto provided nourishment.⁶⁷ Forest destruction through wildfires, low water levels and high temperatures in fishing streams, and rising jellyfish populations—all are grist for environmentally-oriented books and periodicals, and add to the sense of urgency about the natural and aesthetic effects of climate change.⁶⁸

Garrett Hardin scoffed at appeals to conscience,⁶⁹ but all this hortatory literature may have made some difference in attitudes toward climate disruption and its effects. Descriptions of higher mean temperatures and altered ocean currents are rather abstract,

women-more-than-men-4ea0750c23b9#.tgxdq4r74 (describing water collection as one of the ways women are especially affected by climate change).

64. MARY ROBINSON FOUNDATION: CLIMATE JUSTICE, <http://www.mrfcj.org/> (last visited Apr. 21, 2017). See, for example, Margaux J. Hall & David C. Weiss, *Avoiding Adaptation Apartheid: Climate Change Adaptation and Human Rights Law*, 37 YALE J. INT'L L. 309 (2012), for other writings discussing human rights implications of adaptation measures.

65. See Pope Francis, *Encyclical Letter, Laudato si': On Care for Our Common Home*, VATICAN PRESS (May 24, 2015), http://w2.vatican.va/content/dam/francesco/pdf/encyclicals/documents/papa-francesco_20150524_enciclica-laudato-si_en.pdf.

66. For these and other effects on oceans, see generally Working Group II of the Intergovernmental Panel on Climate Change, *2014: Ocean Systems*, in CLIMATE CHANGE 2014: IMPACTS, ADAPTATION, AND VULNERABILITY 411 (C.B. Field et al. eds., Cambridge Univ. Press, 2014). For environmental comments, see, for example, Reed McManus, *Saving the Fuzzy Face of Climate Change*, SIERRA CLUB (Nov. 7, 2014), <http://www.sierraclub.org/sierra/2014-6-november-december/green-life/saving-fuzzy-face-climate-change> (citing IPCC report, describing polar bears as “poster species of climate change,” questioning the relationship with Coca-Cola advertising).

67. See, e.g., Jack Connor, *Purple Martins, Ecological Mismatches, and Climate Change*, LIVING BIRD (Apr. 15, 2015), <https://www.allaboutbirds.org/purple-martins-ecological-mismatches-and-climate-change/>.

68. See, e.g., Robert L. Glicksman, *Ecosystem Resilience to Disruptions Linked to Global Climate Change: An Adaptive Approach to Federal Land Management*, 87 NEB. L. REV. 833, 839-49 (2009) (listing wide range of environmental effects of warming, including forest fires and fish kills); Robin Kundis Craig, *Avoiding Jellyfish Seas, or, What Do We Mean by “Sustainable Oceans,” Anyway?*, 31 UTAH ENVTL. L. REV. 17, 19–20 (2011) (linking jellyfish proliferation to climate change).

69. Hardin, *supra* note 7, at 1246–47.

whereas photographs of flooded shacks and dead fish carry a graphic punch and a more visceral sympathy. One day in the fall of 2015, the *Wall Street Journal* ran a comment suggesting that the oil industry needs to show its credibility on issues of climate change; the papal encyclical *Laudate Si* got a prominent mention.⁷⁰ Moral suasion may actually be an important function of the numerous international conferences on climate change as well. Even though they generally have seemed to end in disappointment, they act as constant publicity and exhortation about the potential human costs of climate disruption.

What are the reasons for the responses to these appeals? Sympathy may be built into human cognition, even though sympathetic responses do appear to be powerfully mediated by the culture and by the expectations of others in one's surroundings. Well-known academic works have documented the increasing sympathy toward animals over the last several centuries,⁷¹ along with the more positive attitudes toward nature⁷² and even toward other human beings.⁷³ Even modern drug lords and religious fanatics use their terrible brutality to leverage widespread horror and shock, capitalizing not only on modern media but also on a highly developed sense of sympathy for unknown others—a sympathy that may be relatively new in human history.⁷⁴

Philosophy professor Philip Pettit, joined somewhat later by law professor Richard McAdams, explored a cognitive factor that is related to the sympathetic reaction to exhortation, and one that could have a similar role in overcoming collective action problems: the role of *esteem*. They argue that a quest for esteem can act as a motivator, leading individuals to behave generously or cooperatively, not only out of sympathy to others, but in addition from a wish to make others will think well of them.⁷⁵ If that

70. Liam Denning, '*Laudato Si*' and the Energy Industry's Change of Climate, WALL ST. J. (June 18, 2015), <https://blogs.wsj.com/moneybeat/2015/06/18/laudato-si-and-the-energy-industrys-change-of-climate/>.

71. See, e.g., KEITH THOMAS, MAN AND THE NATURAL WORLD: CHANGING ATTITUDES IN ENGLAND 1500-1800 (1983) (documenting changing attitudes to animals since seventeenth century).

72. RODERICK FRAZIER NASH, WILDERNESS AND THE AMERICAN MIND 9-12, 44-55, 263-64 (5th ed. 2014).

73. See STEVEN PINKER, THE BETTER ANGELS OF OUR NATURE: WHY VIOLENCE HAS DECLINED (2011).

74. *Id.* For another observation on the modern origins of sympathy, see ALEXIS DE TOCQUEVILLE, 2 DEMOCRACY IN AMERICA 172-77 (1945), which describes casual indifferences to sufferings of lower classes in earlier centuries, attributing Americans' compassion and "softening of customs" to equality.

75. See Philip Pettit, *Virtus Normativa: Rational Choice Perspectives*, 100 ETHICS 725, 745-50 (1990); Richard H. McAdams, *The Origin, Development, and Regulation of Norms*, 96 MICH. L. REV. 338 (1997).

analysis is true, the quest for esteem may help to pave one path out of the Tragedy of the Commons.

Prestige and honor do appear to matter both individually and collectively with respect to environmental matters such that individuals and organizations will go out of their way to give off an impression of contribution rather than indifference.⁷⁶ Some individuals buy houses built to Leadership in Energy and Environmental Design (LEED) standards despite the cost; many firms engage in green advertising; and states like California lead by example with respect to GHG reduction. It would seem that the U.S. and China have both been put on the defensive as laggards with respect to climate issues—and both appear to have responded in some measure to avoid disapprobation, though future actions are uncertain, particularly with respect to the U.S.⁷⁷

A few words of caution: As mentioned above, the cognitive factors of commitment discussed in this section—the response to sympathetic exhortation, the quest for esteem and the avoidance of shame—may help to overcome commons or collective action problems, even at large scales, but they do not flow directly from those commons or collective action issues in the way that, say, distrust or insouciance does. Instead, commitment factors have to *overcome* the usual distrust or indifference that plague commons problems. Unfortunately, commitment factors, like unilateral gifts, can backfire and themselves spark mistrust.⁷⁸ Hortatory appeals to righteous behavior can seem insincere or even devious.⁷⁹ Those who hope to garner esteem by setting a good example may instead seem self-interested—that is, interested only in fame or in some secret payoff.

Thus, the relationship between an actor's self-interest and a perceiver's distrust would appear to be a curious balancing act: too much self-interest is untrustworthy because it is rapacious, but too little self-interest is also untrustworthy, because it is false or at

76. See McAdams, *supra* note 75, at 370–71 (using example of recycling).

77. President Donald Trump's environmental chief casts doubt on climate change, Coral Davenport, *E.P.A. Chief Doubts Consensus View of Climate Change*, N.Y. TIMES (Mar. 9, 2017), <https://www.nytimes.com/2017/03/09/us/politics/epa-scott-pruitt-global-warming.html>; see also Brian Spegele, *World News: China to Put a Little Less Energy Into Clean Power*, WALL ST. J., Dec. 5, 2016, at A9 (describing grid problems and slowing economy as impediment to solar and wind industries in China).

78. See Rose, *Giving, Trading, Thieving, and Trusting*, *supra* note 17, at 299–301 (describing unease about unilateral gifts).

79. In addition, the quest for esteem can take ominous directions, as in the wish to establish a reputation for ferocity. See Jon Elster, *Norms of Revenge*, 100 ETHICS 862 (1990) (describing pervasive social approval of revenge in Albania). Former Vice President Al Gore, whose great interest in global warming has resulted in a profitable business venture, has come in for particularly sharp criticism and charges of hypocrisy. See Schwartz, *supra* note 46 (querying Gore about criticism).

least seemingly false. This leads to the question: might there be a Goldilocks position of just-rightness, particularly with respect to climate disruption? I explore one possibility in the next section.

C. Interestingness and Fun

One aspect of well-known and successful commons regimes has perhaps not received the attention it should: they have a good deal of room for recreation, enjoyment, and excitement. In her great work, *Governing the Commons*, Elinor Ostrom listed a number of factors that have been essential to success in traditionally managed common pool resources, including: capacity for monitoring among the participants, methods for punishing infractions without unduly alienating culprits, regular mechanisms for dispute resolution, and so on.⁸⁰ One factor that Ostrom might have noted more prominently, however, was hedonic—that is to say, simply fun. Students of medieval commons know that commons communities had regular events for amusement: festivals, community meals, dances, carnivals, along with sporting events, like cricket and horse races.⁸¹ Some of those events have lasted to this day—like the horse races in Siena.⁸² Modern public trust doctrines about beaches and parks have also included an important element of recreation, arguably as a kind of social glue, to keep even a very large and diverse community together.⁸³

However, aside from Earth Day celebrations and the daredevil antics of Greenpeace, large-scale environmental issues would not appear to generate much collective recreation—especially when those issues have the global scale of climate disruption. But what those issues do have is *interestingness*. Interestingness has already had an impact on the very widespread collection of information through the internet, famously in connection with Wikipedia and Linux. Contributors to these sites form a kind of open community—one that might be replicated in at least some aspects of climate information collection.⁸⁴ Citizen Science projects already inform

80. OSTROM, *supra* note 9, at 88–102.

81. Carol Rose, *The Comedy of the Commons: Custom, Commerce, and Inherently Public Property*, 53 U. CHI. L. REV. 711, 740–41 (1986) [hereinafter Rose, *Comedy of the Commons*].

82. See Rick Steves, *Siena and Its Crazy Horse Race*, SMITHSONIAN MAGAZINE (Apr. 2009), <http://www.smithsonianmag.com/ricksteves/siena-and-its-crazy-horse-race-20432031/>.

83. Rose, *Comedy of the Commons*, *supra* note 81, at 779 (describing parks and recreation as “social glue”).

84. See Yochai Benkler, *Coase’s Penguin, or, Linux and The Nature of the Firm*, 112 YALE L. J. 369, 386 (2002).

climate-related data collection, among other matters on snowfall patterns, insect and bird migrations, and budding and flowering times of plants.⁸⁵

Interestingness probably also plays some role in the international conferences on climate change. These conferences involve travel to distant locations, meetings of colleagues and friends, excitement of visitations by powerful political figures, and so on. The interestingness of these conferences must help to keep some participants coming, in spite of regularly dashed hopes.

Interestingness and fun do seem to have found the Goldilocks position between self-interest and distrust in some common pool situations. To do something for fun in a common pool situation—like observing and reporting bird migrations—is to do something that is self-interested, but that is also very unlikely to arouse the suspicion of others, because one's motives are easily understood. However, I do not think it wise to rely a great deal on this hedonic cognitive factor as an antidote to the collective action problems presented by climate disruption. A fun factor is not likely to play much of a role in finding common ground in issues of such enormity, and with such great economic and political ramifications. But unfortunately, there may not be many other occupants of a Goldilocks position with respect to climate-related collective action issues.

Summing up so far, then, it appears that on the one hand, large scale commons problems produce a cognitive impasse to efforts to address climate disruption, while on the other hand, only few and lightweight cognitive factors loosen the blockage. Given that doleful imbalance, perhaps we need to face the possibility that conventional large-scale collective action solutions are not to be found.

V. WHAT IF COGNITIVE ANTIDOTES DON'T SUFFICE? OR, REDUCING THE COGNITIVE TRAPS BY REDUCING THE SCOPE OF COLLECTIVE ACTION

In a talk at the University of Arizona in the spring of 2015, Climate Justice founder Mary Robinson asserted that the then-upcoming Paris Climate Conference had better work, because, as she said, there is no Plan B.⁸⁶ University of Arizona professor and author Chris Kokinos attended that talk, as did I, and his reaction

85. See, e.g., *Citizen Science*, SCIENTIFIC AMERICAN, <https://www.scientificamerican.com/citizen-science/> (last visited Apr. 21, 2017) (listing an extensive array of ecology-related citizen science projects, including Snowtweets, Migratory Dragonfly Partnership, Season Spotter, among others).

86. Mary Robinson, *Everybody Matters: Climate Change and Human Rights*, Speech at the University of Arizona in Centennial Hall (Mar. 12, 2015).

was, there better be a Plan B, because Plan A—getting agreement and action by the national actors—has only very uncertain prospects.⁸⁷

Might there be some way to address climate disruption in a way that does not involve global cooperation to solve this wicked commons problem? That is to say, might there be some alternative paths that reduce the collective action aspects of dealing with climate disruption?⁸⁸ And if so, what might these be? In this final section, I will briefly comment on a few that have appeared on the horizon.

A. *Adaptation*

A first alternative path might be to concentrate on *adaptation* to climate change in addition to, or instead of, mitigation of the GHGs now flowing into the earth's atmosphere. Whatever might be done to mitigate GHGs, adaptation strategies concentrate on adjusting to current conditions: if coastal areas flood, move back; if some endangered squirrels are trapped on an overheating mountaintop, relocate them by helicopter; if the wells run dry, adopt some version of rationing or pricing, and so on.

One great advantage of adaptation is that the adapting entities do not need to act in concert. Small wonder, then, that the U.S. Department of Defense is much engaged in adaptation planning, as are a number of businesses and state and local governments.⁸⁹

Adaptation as a strategy certainly has raised some concerns. One set of concerns is at least partially psychological: the fear that attention to adaptation will lull us to under-expend on mitigation.⁹⁰ On the other hand, several environmental scholars have found, at least preliminarily, that these substitution effects may not be so

87. Kokinos made this remark as an invited guest to the seminar on Sustainability that I co-teach with Dean Marc Miller at University of Arizona's James E. Rogers College of Law in Tucson, Arizona, on April 15, 2015.

88. See Rachlinski, *supra* note 2 (concluding, after discussing a number of psychological barriers to addressing climate change, that nothing can be done unless the related collective action problems are substantially reduced).

89. See Sara E. Light, *The Military-Environmental Complex*, 55 B.C. L. REV. 879 (2014). For a recent example of local efforts, see Greg Allen, *As Waters Rise, Miami Beach Builds Higher Streets and Political Willpower*, NPR (May 10, 2016), <http://www.npr.org/2016/05/10/476071206/as-waters-rise-miami-beach-builds-higher-streets-and-political-will-power>. See also Robin Kundis Craig, "Stationarity is Dead"—*Long Live Transformation: Five Principles of Climate Change Adaptation Law*, 34 HARV. ENVTL. L. REV. 9, 25–31 (2010) (describing complex tasks for adaptation measures).

90. Eric Biber, *Climate Change and Backlash*, 17 N.Y.U. ENVTL. L.J. 1295, 1362 (2009) (noting IPCC concern about "trade-off" between adaptation and mitigation).

great.⁹¹ Indeed, it is at least possible that adaptation measures can be important psychologically in the opposite direction, lessening the sense that nothing can be done about climate change. Adaptation measures may be undertaken locally (or even individually) and over considerably shorter time frames than mitigation, and possibly with less political rancor.⁹² This means that at least some adaptation measures may bypass major collective action conundrums—as well as the sense of helplessness that they engender—simply because adaptation measures substantially reduce the scope of the collectivity. Their smaller scale means that they do not require massive agreements by everyone, or even by other major players in the climate disruption arenas.

This is not to say that effective adaptation is likely to be easy or cheap, however. On the contrary, while environmental scholar Eric Biber regards adaptation as a necessary complement to mitigation, he nevertheless uses the example of sea level rise to observe that effective adaptation measures may be enormously expensive⁹³—which of course complicates the prospects for their adoption.

B. Geoengineering

Much more radical than most adaptation measures is another approach that would dramatically reduce the collective action aspects of climate disruption measures. That approach is what is now called *geoengineering*.

In the climate context, geoengineering generally means conscious, large-scale intervention in the earth's climate through some kind of technology, with the aim of counteracting the effects of greenhouse gas emissions. There are several different varieties of geoengineering, but the main versions fall into two types: first, *carbon reduction*, and second, *heat reduction*. Carbon reduction proposals often entail the enhancement of natural carbon sinks. Thus bioengineered plants might absorb large amounts of carbon from the atmosphere, or iron filings seeded in the ocean might encourage the growth of algae, which in turn absorb carbon and sink

91. See Amanda R. Carrico et al., *Does Learning about Climate Change Adaptation Change Support for Mitigation?*, 41 J. ENVTL. PSYCHOL. 19, 26–27 (2015). The reason why support does not change, however, is unfortunate: many people's views about climate change are so hardened politically that little can affect them. Note, however, that these findings do not focus on actual adaptation measures but rather on *learning* about adaptation possibilities.

92. See Biber, *supra* note 90, at 1361 n.195; see also Dan M. Kahan, *Cognitive Bias and the Constitution*, 88 CHI.-KENT L. REV. 367, 406–09 (2013) (arguing that local adaptation can avoid political conflicts associated with national climate change debates); Osofsky & Peel, *supra* note 3, at 715–16, 750–58 (same); Verchick, *supra* note 3, at 1006–10 (same).

93. Biber, *supra* note 90, at 1352–54, 1363–64.

to the ocean floor. Still another approach involves breaking up large quantities of rocks, which then absorb atmospheric carbon more rapidly.⁹⁴

Lest anyone thinks these approaches are merely science fiction, the Chinese have already used biotechnology to grow trees rapidly; while they are using this technology for paper production, carbon storage would seem to be only a short step away.⁹⁵ Iron filings for algae growth have already reached an experimental stage as well.⁹⁶

Aside from carbon reduction, a second major version of geoengineering concentrates on heat reduction—and it is even more controversial. There are various ideas about altering the reflectivity of the earth through plantings of light colored vegetation, but most of the discussions on this issue focus on sending particle materials into the atmosphere in order to reflect solar heat back into space. These particles would act as miniature mirrors; the most likely candidates are sulfate aerosols. Here too there has already been an experiment, though it was created by nature: when the Philippine volcano Mt. Pinatubo erupted in 1991, it sent vast quantities of sulfates into the atmosphere, resulting in a global cooling of one half degree Celsius.⁹⁷

It may seem absurd, not to say insane, to try to reduce global warming by replicating a volcano. But the great attraction of this particular geoengineering proposal—that is to say, sulfate aerosol seeding—is that it is very cheap. The cost of such a project was estimated in the mid-1990s at one to eight billion dollars per year to offset the warming effect of *all* greenhouse gases. A decade later, others estimated the cost at one billion per year. Even taking inflation into account, these are clearly trivial amounts by comparison to the cost of emissions limits on the one hand, or damage from warming on the other.⁹⁸

But, for purposes of this Essay, the truly revolutionary aspect of geoengineering proposals is that they do not really involve collective action at all, or if they do, it is only on a quite limited scale. Many

94. CHRIS WOLD ET AL., *CLIMATE CHANGE AND THE LAW* 1139–42 (2d ed. 2009); Freeman Dyson, *The Question of Global Warming*, N.Y. REV. BOOKS (June 12, 2008), <http://www.nybooks.com/articles/2008/06/12/the-question-of-global-warming/>.

95. See Mark Clayton, *Now, Bioengineered Trees Taking Root in China*, CHRISTIAN SCI. MONITOR (Mar. 10, 2005), <http://www.csmonitor.com/2005/0310/p14s02-sten.html>.

96. WOLD ET AL., *supra* note 94, at 1142; Paul Preuss, *Climate Change Scenarios Compel Studies of Ocean Carbon Storage*, SCI. BEAT BERKELEY LAB (Feb. 1, 2001), <http://www2.lbl.gov/Science-Articles/Archive/sea-carb-bish.html>.

97. David G. Victor et al., *The Geoengineering Option: A Last Resort Against Global Warming?*, 88 FOREIGN AFF. 64, 67 (2009).

98. Scott Barrett, *The Incredible Economics of Geoengineering*, 39 ENVTL. & RESOURCE ECON. 45, 49 (2008).

individual nations could afford to expend a few billion dollars per annum for aerosols. Indeed, quite a number of wealthy individuals could do so on their own.⁹⁹ To be sure, someone has to pay while others take a free ride, but readers will recall a point mentioned above: that solutions to collective action problems do not require universal accord, so long as some entity or person takes the lead and is willing to accept the non-contributing free riders. This kind of initiative may be predicted to occur most readily if the cost to the leaders is relatively low. It might also be predicted to occur more readily if something like fun kicks in to attract the relevant actors. The very high-tech, sci-fi-like character of geoengineering could be a major draw for some. As we have seen, a fun factor can counteract the cognitive blocks to collective action, and the prospect of fun might equally induce some individual or group of individuals to undertake geoengineering projects on their own.

There are of course major objections to technological climate measures like geoengineering—among others, those stemming from the lack of political consensus about tinkering with the global environment. But to stick simply to environmental objections, one such objection is that all these geoengineering ideas and measures involve unknown dangers, because we really do not know the consequences of such experiments with the earth, the oceans, or the atmosphere.¹⁰⁰ An answer to that objection, however, is that we have already been meddling with climate through our massive emissions of greenhouse gases, and it may be time to experiment consciously and on purpose, by contrast to our extremely clumsy and dangerous accidental “experiment” to date.

A second type of objection applies particularly to heat reduction measures: that these measures entirely neglect the problem of excess carbon not only in the atmosphere but increasingly in the oceans as well. As for the oceans, while sulfate aerosols may reduce heat, they do nothing to address the damage of carbon acidification, which is widely blamed as a factor in coral collapse as well as other kinds of fish mortality.¹⁰¹ And as for the atmosphere, sulfate aerosol seeding raises the frightening prospect of a start-and-stop scenario: that is, some entity might begin to seed sulfate aerosols in the atmosphere while no one addresses the buildup of carbon emissions, and then might suddenly stop the seeding. The earth could be overwhelmed by a sudden spike in temperature,

99. Victor et al., *supra* note 97, at 71–72.

100. *See, e.g., id.* at 69–71 (describing dangers).

101. *Id.* at 69.

due to the now-unmitigated and excessive pulse of GHGs, with all its heat-trapping effects.¹⁰²

Still another objection replicates and magnifies a concern about adaptation mentioned above: that geoengineering distracts us from the real problem, which is mitigation of greenhouse gases. Like adaptation—and indeed, one might class geoengineering as adaptation on a grand scale—geoengineering threatens to make us satisfied that we have done enough to deal with climate disruption when in fact we have not.¹⁰³

Thus, there is an ironic aspect both to adaptation and to geoengineering: neither necessarily depends upon breaking massive collective action blockages, and each could help us to get over the discouraging thought that nothing can be done about climate disruption. Moreover, that heartening effect could make it easier to address the much larger collective action issue of mitigation of greenhouse gases, while giving the world a breather during which we figure out how to address the knotty problem of mitigation. On the other hand, it could well be that the very fact of doing something on the adaptation front—especially geoengineering—makes mitigation seem less pressing. Why bother with mitigating GHGs, if the icecaps and glaciers build up again, the oceans recede, and the summers return to more normal temperatures?

I have to confess, though, that in spite of all the objections, I see a substantial possibility of geoengineering in our future. Our history of environmental engagement has been one of “muddl[ing] through,” or what James Krier calls “exfoliation”: trying the easiest thing first, until we realize that it is not working, or not working sufficiently, and then trying the second easiest, and so on.¹⁰⁴ Geoengineering’s potential escape from collective action, together with its low cost in the case of sulfate aerosols, form a combination that will be hard to resist unless we somehow either solve the global commons problem or come up with something else. This brings me to a third alternative route, and in fact, the one that seems to me most promising over the long run—if we get to have a longer run.

102. *Id.* at 69–70; see also Marlos Goes et al., *The economics (or Lack Thereof) of aerosol geoengineering*, CLIMATIC CHANGE (2011), http://sunburn.aoml.noaa.gov/phod/docs/Goes_etal_2011.pdf.

103. Victor et al., *supra* note 97, at 75.

104. James E. Krier, *The End of the World News*, 27 LOY. L.A. L. REV. 851, 851 n.3, 855–56 (1994) (describing origin of exfoliation idea). See generally JAMES E. KRIER & EDMUND URSIN, POLLUTION AND POLICY: A CASE ESSAY ON CALIFORNIA AND FEDERAL EXPERIENCE WITH MOTOR VEHICLE AIR POLLUTION, 1940-1975, at 12 (1977) (establishing the concept of exfoliation for the first time).

*C. Appeals to Interest:
National and Individual*

A third route bypasses the global commons problem by appealing to self-interest—that is to say, an appeal that casts a very wide net and draws in many people, rather than a unilateral action by some small set of actors, as in geoengineering. Here I would like to mention two sub-types of appeals to self-interest: one is a mixed strategy that uses self-interest to motivate collective action progress; the other simply bypasses the collective action issue altogether.

As to the first, William Nordhaus, who has argued that the free rider problem is the major impediment to climate cooperation, proposed in the same review essay a plan that he thought might overcome this impediment on a national basis.¹⁰⁵ Nordhaus argued for a trading club of nations to take the lead in limiting GHG emissions. This group would be likely to include the major developed nations at the outset, with whom trade is a valuable activity; others could join the club (and avoid tariffs on their trading goods), but only if they would do their part to limit emissions. The “climate club” would thus leverage something that most national entities should want—membership in a trading community—to induce them to do something they are reluctant to do, that is, take the efforts necessary to limit GHG emissions.¹⁰⁶ The underlying strategy should be familiar to parents the world over in speaking to children: you can do X, but only if you do Y. Parents, like the climate club, use self-interest in participation in one arena, in order to overcome self-interest in non-participation in another.

A strategy of this kind can have an impact on incentives, while it can also have an impact on cognitive element of distrust. Suppose that Country A has an interest in trade (X), and Country A knows that Countries B–Z are also interested in trade, so that Country A can have some confidence that Countries B–Z will also agree to emission controls (Y). The strategy creates a version of common knowledge, but here it is common knowledge of something positive: that others are likely to make cooperative contributions to dealing with climate disruption.

105. Nordhaus, *A New Solution*, *supra* note 1313.

106. *Id.* The argument is more fully developed in the original version. See William D. Nordhaus, *Climate Clubs: Overcoming Free Riding in International Climate Policy*, 105 AMER. ECON. REV. 1339, 1341 (2015) [hereinafter Nordhaus, *Overcoming Free Riding*]. For the initial and more general idea of a “climate club” of leading nations, see DAVID VICTOR, *GLOBAL WARMING GRIDLOCK: CREATING MORE EFFECTIVE STRATEGIES FOR PROTECTING THE PLANET* (2011).

Clearly there are many details that would need to be addressed before such a proposal could be brought into play, including the problem of integration into existing international trade agreements,¹⁰⁷ and then the very thorny issues of verification and enforcement—not to speak of the problems presented by a rising populism and anti-trade politics in Europe and the U.S. But from the perspective of this Essay, Nordhaus' proposal is interesting because it addresses a cognitive problem—distrust—that arises from the very structure of collective action. It does that by linking collective action in one domain to self-interest in another.

Let me come finally to another appeal to self-interest to address the massive collective action problem embedded in dealing with climate disruption. A bit of a parenthesis here goes to the topic of natural gas and hydraulic fracturing or “fracking,” particularly given that Florida State Law Professor Hannah Wiseman is a recognized national expert on the various legal challenges that fracking has posed. As Professor Wiseman has demonstrated in a remarkable series of articles on the topic, there are many serious problems with fracking, including, for example, water contamination from leaking pipes and potential small earthquakes from the disruption of the substrate layers.¹⁰⁸

But there is at least one important, positive lesson that we have learned from the (literally) explosive growth of fracking in the last several years: if a lower-cost alternative to carbon-intensive fuels is available, people will use it. Most notably, coal-burning electric utilities, one of our major producers of GHGs, have been shifting from coal or oil to natural gas all over the country. Do they expect regulatory limitations on greenhouse gas production? Yes, probably, though perhaps fewer than they did before the 2016 elections. Is the relatively clean-burning natural gas less troublesome for other air pollution regulation? Yes, definitely. But there is another factor, and it is enormously important: given the emergence of fracking, natural gas simply costs less.¹⁰⁹ And there is a lesson buried in that fact:

107. Nordhaus, *Overcoming Free Riding*, *supra* note 106, at 1349.

108. *See, e.g.*, Wiseman, *Risk and Response*, *supra* note 58, at 788–91 (recounting some of the hazards associated with fracking); Hannah Wiseman, *Fracturing Regulation Applied*, 22 *DUKE ENVTL. L. & POLY F.* 361, 364–68 (2012) (same). A partial list of Wiseman's other articles on fracking includes: John M. Goldin & Hannah J. Wiseman, *The Fracking Revolution: Shale Gas as a Case Study in Innovation Policy*, 64 *EMORY L. J.* 955 (2015); David A. Dana & Hannah J. Wiseman, *A Market Approach to Regulating the Energy Revolution: Assurance Bonds, Insurance, and the Certain and Uncertain Risks of Hydraulic Fracturing*, 99 *IOWA L. REV.* 1523 (2014); Hannah J. Wiseman, *Governing Fracking From the Ground Up*, 93 *TEX. L. REV.* 29 (2014); Hannah J. Wiseman, *Coordinating the Oil and Gas Commons*, 2014 *B.Y.U. L. REV.* 1543 (2014); Hannah J. Wiseman, *Regulatory Islands*, 89 *N.Y.U. L. REV.* 1661 (2014).

109. Goldin & Wiseman, *supra* note 108, at 966–67.

with all the problems associated with fracking, our experience shows that we should be looking for market-based routes around the collective action problem that climate change presents.

Examples of this route have already arisen in a number of different contexts. The energy-efficient Tesla automobile, once little more than a joke, is now attracting emulation from other automakers with an eye for profitability.¹¹⁰ Giant pork producer Smithfield is exploring methods to reduce its hog farms' considerable production of greenhouse gases, in part by capturing some of the major gases for energy.¹¹¹ These examples are not completely market-based, or at least not yet; electric autos still depend on governmental subsidies (though perhaps warranted in the effort to cut air pollution), while Smithfield hopes that consumers will pay somewhat higher prices for environmentally friendly products.

Another example that is more straightforwardly aimed at market forces is now playing out at the University of Arizona, under the leadership of two world-class astronomers (now retired), Roger Angel and Peter Strittmatter. Angel and Strittmatter have something of an environmental "Baptist" attitude: they regard climate disruption as a major threat to the planet, and they want to do something about it. But they have also taken a very hard-headed view: that the only effective route to greenhouse gas reduction will be to create alternative energy sources that are cheaper than coal or oil, or even natural gas—and to do so without subsidies, which they regard as unsustainable.¹¹²

These distinguished scientists have very extensive expertise with astronomical mirrors. They have formed a company, REhnu, that exploits their knowledge; they have developed a technology of simplified small-scale solar collecting mirrors together with a device to transfer their energy to photovoltaic cells.¹¹³ Their generating

110. See Sean McClain & John D. Stoll, *Toyota Chief to Oversee New Electric-Car Project*, WALL ST. J. (Nov. 30, 2016), <https://www.wsj.com/articles/toyota-chief-to-oversee-new-electric-car-project-1480528916>; see also Osofsky & Peel, *supra* note 3, at 729–35 (describing several programs based on economic benefits of climate change action, including Tesla, highlighting their capacity to smooth out partisanship).

111. Jacob Bunge, *Smithfield Sets Plan to Cut Carbon Emissions by a Quarter*, WALL ST. J. (Dec. 4, 2016), <https://www.wsj.com/articles/smithfield-sets-plan-to-cut-carbon-emissions-by-a-quarter-1480870861>. See also Michael P. Vandenbergh & Jonathan A. Gilligan, *Beyond Gridlock* 40 COLUM. J. ENVTL. L. 217 (2015) (description and analysis of numerous private firm efforts to limit GHGs).

112. See *About Us*, REHNU, <http://www.rehnu.com/about-us> (describing project to make solar energy competitive with fossil fuel). Professor Rachlinkski concluded his early survey of the psychology of climate change with the same view. See Rachlinkski, *supra* note 2, at 318–19 (only route to dealing with climate change is cheaper alternative fuel).

113. REHNU, *supra* note 112.

equipment is already well on the way to competing with more standard fossil-fuel energy, and in mass production could be even cheaper.

Obviously there have been false starts in the efforts to find alternative fuels. And obviously, the burden of introducing new alternatives would be relatively lighter if the existing competitors—carbon intensive fuels—were taxed for the environmental externalities that they produce. But Angel and Strittmatter, and others like them, are not counting on that.

In spite of the lack of a level playing field, inventors like these seem to be onto something: the way to make an end-run around collective solutions to climate disruption is to appeal to the individual self-interest of consumers. Notice that this approach differs from geoengineering in that it does not entail unilateral decisions by a few nations or individuals who make momentous decisions that affect everyone else. Instead, if cheaper and cleaner energy sources can be found, we will indeed see individual decisions, but in the enormously distributed universe of the market.

Individual decision-making to this kind dissipates the distrust issue that haunts climate change action, because on the whole, and all other things being equal, people can be relied upon to act in their individual self-interest. Moreover, that proclivity is common knowledge among all decision makers.

I do not wish to say that these efforts will necessarily succeed. It is indeed a major obstacle that carbon-based fuels enjoy an effective subsidy now, because they do not pay their environmental costs.¹¹⁴ One thing that governments might do, of course, is something that many economics-oriented environmentalists have proposed: impose a tax on carbon-based fuels. Ideally such a tax would come close to internalizing the environmental damage that carbon-based fuels cause. A tax of that magnitude may not be feasible politically, but even a more modest tax would allow entrepreneurs like Angel and Strittmatter to compete more realistically.¹¹⁵ One encouraging note is that the idea of a carbon tax has gained traction with at least

114. *See, e.g.*, David Weisbach, *Designing Subsidies for Low-Carbon Energy*, 20 *J. ENVTL. & SUSTAINABILITY L.* 1, 2–5 (2013) (describing tax breaks and untaxed external costs of carbon-based fuels); Cutler Cleveland, *Why Coal Should Not Be Saved*, *ENERGY IN CONTEXT* (Mar. 30, 2015), <http://energyincontext.com/2015/03/why-coal-should-not-be-saved/> (describing environmental and other harms of coal use for electricity).

115. *See, e.g.*, Weisbach, *supra* note 114, at 12–13 (advocating carbon tax); SHI-LING HSU, *THE CASE FOR A CARBON TAX: GETTING PAST OUR HANG-UPS TO EFFECTIVE CLIMATE POLICY* (2012) (same). William Nordhaus was an early advocate of carbon taxes and has proposed them in many of his writings. *See, e.g.*, Nordhaus et al., *Question of Global Warming*, *supra* note 42 (observing that a tax would convey information about carbon use as well as encourage innovation). His recent thinking would combine such enforcement through trade policy; *see supra* text accompanying note 105-107.

some conservative political actors.¹¹⁶ There are of course other possibilities for governmental action, from offering prizes, to rethinking the length of patents, to improving and integrating the power grid—all with the object of making consumers turn to clean or at least cleaner energy sources out of their own self-interest.

VI. CONCLUSION

In his 2015 papal encyclical, *Laudato si'*, Pope Francis called on all Catholics, and really all of the rest of us too, to take better care of the earth.¹¹⁷ The Pope's message, however, was noticeably hostile to technological approaches and market appeals. Francis instead thought that people should change their ways, becoming more careful and more caring about "our earthly home" and about one another.

Columnist and commentator David Brooks wrote a brief essay that disagreed with the Pope. Brooks argued that we human beings are flawed creatures, but that technological creativity is something that we do have, and that we need to use what we have instead of hoping that exhortation will make us good.

In this little debate, I have to say that I find Brooks' position more persuasive, however appealing Pope Francis' exhortation may be. Brooks stressed technology, but he might have made more of markets, because market activity is also something that persistently runs through our flawed human psyche. If climate science has taught us nothing else, however, it has taught us that our current energy markets are deeply flawed, because the standard fossil-fuel-based energy sources are effectively subsidized to cause great harm. Governments can help by lessening those subsidies, thereby encouraging alternative, technological developments that avoid climate harms.

My own view is that we need to look both to technology and to markets, as the thinkers and writers just discussed are arguing. Allaying climate disruption through geoengineering would certainly be a technological endeavor, but it is very unlikely to be market-based. Rather, given the opportunities for free riding, the deployment of geoengineering on any large scale is likely to depend on some nation's or some individual's initiative. Such efforts could even count as exercises in goodwill, based on the idea of taking the lead, spending some money, and making the world

116. John Schwartz, 'A Conservative Climate Solution': Republican Group Calls for Carbon Tax, N.Y. TIMES (Feb. 7, 2017), https://www.nytimes.com/2017/02/07/science/a-conservative-climate-solution-republican-group-calls-for-carbon-tax.html?_r=0.

117. Pope Francis, *Encyclical Letter, Laudato si'*, *supra* note 65.

better, even if others do not contribute. But like other unilateral efforts, geoengineering would not really dispel the distrust inherent in collective action. Questions would arise: What are the actors' true motivations? How do we know that they will not change their minds, with potentially disastrous consequences? And perhaps most important, who are you, actors, to make these risky decisions for all the rest of us?

On the other hand, technological improvements that speak to market demand depend on something more reliably human than goodwill gestures from a small number of nations or individuals, and more politically acceptable than unilateral action by those nations or individuals. If technological improvements not only displace GHGs but also appeal to large numbers of people and businesses through their pocketbooks, then those people and businesses will act accordingly. These widely distributed decisions may not be to everyone's liking, but they do not arouse distrust; people will quite reliably avail themselves of energy that is cheaper than the alternatives. Instead, multiple, distributed, market-based decisions create a positive common knowledge: that people can be trusted to do good, because they are doing well at the same time.

