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Perspectives

Beyond the tragedy of the commons: Reframing effective climate change governance

Anthony Patt

ETH Zürich, Switzerland

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ABSTRACT

The tragedy of the commons provides a powerful narrative for a class of environmental problems, and serves to frame them in a way that allows people to identify effective solution strategies. But the problem frame also rests on a set of factual and value-based assumptions, and is inappropriate to guide decision-making when these assumptions are violated. The climate change mitigation challenge – reducing greenhouse gas emissions, mainly from the energy sector, to limit global warming to less than 1.5 or 2 °C – violates these assumptions. Climate change requires us not to reduce, but to completely prohibit greenhouse gas emissions. Before any such prohibition is feasible, it is first essential to develop a clean energy system that can meet our basic needs. The main barriers to this are not economic, but rather are associated with evolving knowledge, networks, and institutions. Framing climate change in evolutionary terms can help us to appraise policy options more effectively, and ultimate identify those that get us where we need to go.

1. The tragedy of the commons

The biologist and ethnic nationalist Garrett Hardin wanted society to restrict people's reproductive freedom, and believed that only those parents who would raise their children the right way should be entitled to have babies [1,2]. To support this politically charged belief, Hardin developed an argument based on the idea of the *tragedy of the commons*, a game theoretic model involving farmers' letting their cows graze on the communally owned village green [3]. Every farmer obtains the full benefit of placing an extra cow on the commons to graze, while suffering only a small share of the cost to the community as a whole, in terms of less grass being available to the other cows. Overgrazing is the inevitable equilibrium, unless the community as a whole steps in. Limiting the number of cows, and ideally allocating them to those farmers who can manage them most profitably, is the obvious solution. The lesson transferred well to the point Hardin was trying to make about people in his now famous article.

Today, few would use a tragedy of the commons framing, or related terms such as *commons problem*, *common pool resource problem*, or *externalities problem*, to describe the issue of human population growth. This is largely because the world has witnessed birthrates falling globally, on most continents to below replacement levels, as a result of factors Hardin didn't consider: the education of women, reductions in infant mortality, and urbanization [4,5]. But most analysts *do* use Hardin's idea to describe other environmental problems, most notably climate change, and based on this framing suggest a strategy similar to what Hardin advocated [6]. The framing may be appropriate for some of these problems, fisheries management being an example that comes to mind. But it is not appropriate for climate change, and the sooner we stop framing climate change in this way, the better.

As a starting point, it is worth considering what the key aspects of a commons problem actually are. Hardin himself described four, and these are as valid today as they were then. First, of course, there needs to be a common pool resource, such as the grass on a village green, or the global carrying capacity for people. Second, there needs to be a use of that resource, or an activity that depletes it, that is legitimate and valuable, accepted by society at large. In Hardin's model, we *do* want cows to graze on the village green, as long as they do so productively, just as we *do* want a planet that is home to people. In fact, because the use is so valuable, we want to ensure that it takes place in a manner that is both optimal and sustainable. Third, the common-pool nature of the resource has to be the thing that leads people to overuse or over-deplete the resource, to the point that is clearly suboptimal, perhaps even exceeding its sustainable limits. Fourth, there cannot be a technical solution. By this, Hardin meant that it is not possible to use technology to expand the resource in order to continually accommodate the growing use.

The tragedy of the commons acts a problem frame. The effect of a problem frame is to take a complex issue – which affects multiple values and can be considered from a variety of perspectives – and to simplify it around one particular conceptualization, leading to one particular solution strategy [7]. In the case of this framing, it is the third aspect

E-mail address: anthony.patt@usys.ethz.ch.

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listed in the paragraph above that is crucial. The common-pool ownership structure, meaning that agents do not pay the full cost of their use, is seen as the driving force behind their overuse. Framing a problem as a tragedy of the commons automatically implies that if one could privatize the ownership structure, or make the agents pay the full costs to society of their use of the resource, then an optimal outcome would be achieved. In the case of a village green, the easy solution is to divide it up with fences, and have each subdivided plot belong to a single farmer. In the case of a resource that cannot be subdivided so easily, like the global carrying capacity for humans, then the solution is only slightly more complicated. Either one has to establish a limited number of rights to use the resource, and allocate these to people in advance, or one has to charge people *ex post* for their use of the resource. An important feature of the model is that the solution increases the resource's overall productivity. And that means that as long as the allocation mechanism or tax is fair, then reaching an agreement to privatize the use rights or internalize their costs should be politically feasible.

But the usefulness of such policy guidance depends on the underlying applicability of the problem frame. The presence of a common pool resource does not guarantee that Hardin's solution strategy is the best; the problem frame ceases to provide useful guidance if any of the other three criteria are violated. A case that illustrates failure on the second of the four criteria is the act of murdering one's neighbor. This depletes the common pool resource of public safety, but murder is not an activity that we want, so we don't solve it by imposing a tax or allocating a limited number of permits. We prohibit it. To illustrate failure on the third criterion, drinking alcohol is a behavior that we tolerate in moderation, and even encourage in some situations, but when people get drunk and start breaking things, they become a public nuisance. Yet we don't believe that internalizing the cost of drunken behavior will get the person on the verge of intoxication to say no to another drink. So we address it by other means, including charging bartenders with cutting people off, and providing treatment programs for alcoholism. To illustrate failure on the fourth criterion, the local public school may be overcrowded, but we can solve this by enlarging the building and hiring more teachers. So we do that, rather than limiting the number of places available or imposing high school fees. Failure on any of these criteria matters. Climate change fails on all three.

2. Why climate change fails the tragedy of the commons criteria

Many people see the 2015 Paris Agreement as representing a turning point in climate governance, but in fact the events that foreshadowed Paris occurred a decade prior to then, culminating in 2007. It was then that the idea of the 2 °C target gained popularity, based on risk management arguments, and was incorporated into a global action plan agreed to in Bali, Indonesia, at the closing of a failed set of negotiations to extend or replace the Kyoto Protocol [8–10]. Paris built on this decision, and added an additional level of ambition by suggesting the desirability of limiting climate change to 1.5 °C. More importantly, Paris set up a process that could help countries to take the steps to achieve one or the other, in terms of a regular "global stock take," as well as a set of mechanisms to provide financial and capacity-building support to developing countries.

The one thing that the Paris Agreement does not include is a set of negotiated binding national targets, of the kind that are the heart of the Kyoto Protocol. In fact, the failed desire to include such binding targets is what led to the eight-year delay, starting in Bali. And yet this failure should not surprise us, for a simple reason. The tragedy of the commons framing suggests that negotiating binding targets should be politically feasible, with the main hurdle being the identification of a mutually acceptable allocation rule for the net benefits. But this presupposes that the global target is one that will maximize the value to society of whatever activity it is that degrades the common pool resource. Partial decarbonization as per Kyoto could take place by eliminating inefficiencies in the energy system, and arguably could deliver immediate net economic benefits; negotiating the allocation rule took less than two years. Achieving the Paris targets of 2 °C or 1.5 °C, however, requires that net anthropogenic emissions of greenhouse gases into the atmosphere cease entirely in the second half of this century [11]. Finding immediate net benefits to allocate that are associated with a complete halting of emissions is more or less impossible, and so negotiating such an agreement required convincing people to pay attention to large benefits anticipated in the future, in some cases centuries hence [12,8]. So the temperature target qualitatively changed the character of negotiations, making them far more difficult, arguably impossible. More fundamentally, the need to eliminate emissions entirely, essentially as soon as possible, makes those emissions something that society will no longer tolerate. So climate change fails the second of the four criteria Hardin identified, just like murder.

There has been another major change since about 2007, and that is the recognition that the medium-term costs of eliminating greenhouse gas emissions are likely to be trivial, and may in fact be negative, even before considering the long-term benefits from avoided climate impacts [13,14]. What drove this recognition was the realization from the field of evolutionary economics that policies to expand renewable energy also make them cheaper [15,16]. This fact has become especially salient lately, as the costs of supplying energy from some renewable resources have fallen to below those of fossil fuels [17], especially if one takes into account local environmental effects such as air pollution or water demand [18]. A study in the United States, for example, examined the avoided local and regional environmental impacts associated with installing wind and solar power instead of new coal capacity, and found the value of those impacts to be far larger than the difference in cost between the two technologies [19]. As another example, the costs to own and drive an electric car charged by wind or solar power are approaching parity with those of a conventional gasoline model, at least under some conditions [20].

These trends suggest two additional ways in which the tragedy of the commons framing fails for climate change. First, there is no longer a necessary misalignment of incentives between the emitters of greenhouse gases and society at large. Every country, with the possible exception of major oil and gas exporters, has reason to mitigate climate change and transform its national energy sector away from fossil fuels, regardless of what other countries may do. Every household will soon have a financial incentive to stop burning oil and gas, regardless of what their neighbors do. So if fossil fuels are still in business, it will not be because of an unjust cost advantage, born from the existence of an externality. Climate change is like the example of public drunkenness: internalizing the cost will not change anything qualitatively. Second, it now appears that a technical solution does exist for climate change. Integrated assessment models suggest that by switching to non-fossil energy sources, we can continue to see global economic activity grow, at roughly the same pace, even as greenhouse gas emissions come to a halt [21]. Climate change is like enlarging the public school.

3. Framing today's challenge in evolutionary terms

But we still have a problem needing to be solved. Using electric cars as an example, a household may soon have a financial incentive to switch over from their gasoline model, but it will not do so unless there is a dense network of charging stations where they want to take long trips. At the same time, there is no business case to install such a network as long as the number of electric cars on the road remains low. This is a chicken and egg problem: you need a chicken to get an egg, but an egg to get a chicken. Similar problems exist across the energy sector. At the most general level, we need to prohibit greenhouse gas emissions, which almost certainly means prohibiting fossil fuels. But which comes first: prohibition, or clean energy? Before prohibition can be politically and socially feasible, we need a clean energy system that is good enough to sustain us. Yet given more than a century already spent improving and optimizing an energy system based on fossil fuels, the first steps towards a clean energy system are necessarily expensive, clunky, and unreliable. Most of the improvements to the clean energy system – built around new knowledge, networks, and institutions – only come once we start relying on it. Progress can occur, but without policy intervention, it will be slow. It took millions of years to get a chicken egg when the starting point was a dinosaur. Accelerating evolution is the key challenge for climate policy.

Just as the tragedy of the commons framing offered clear guidance in terms of the appropriate policy instruments, so too does an evolutionary framing, based on insights from the emerging scientific study of socio-technical transitions [22]. Our policy instruments need to be those that build the new knowledge, networks, and institutions that will enable a clean energy system to function smoothly and affordably, which is a prerequisite to phasing out fossil fuels. When we think about all of the policies that support renewable energy innovation and deployment – state-sponsored R & D, tax credits or feed-in tariffs for project developers, and streamlined permitting processes for green infrastructure – that is exactly what is going on. As they create a new system that is viable, these policies lay the groundwork for a second generation of sectoral regulations, already beginning to appear, which prevent new investment into fossil fuel infrastructure. If you frame climate change as an evolutionary problem, it is this sequence of policy instruments that makes the most sense [23].

The issue of how we frame climate change mitigation is important, precisely because the two framings point us in different directions with respect to policy. When there is a true tragedy of the commons, then neo-classical economics and game theory provide a solid basis to favor market-based instruments, those that allocate limited rights to deplete the resource or internalize the costs of doing so [24]. Confusion can arise, however, because proponents of market-based instruments also suggest that these will provide the needed stimulus for innovation, promoting systemic change [25,26]. But just because these instruments are the best solution to one kind of problem does not mean they are very good or effective with respect to another. In fact, a growing literature shows that they aren't, and that the effective policies to stimulate a transition are those that directly support the development of new knowledge, networks, and institutions, directly addressing the barriers to systemic change [27]. The choice of how we frame climate change dictates the terms by which we evaluate the relative strengths and weaknesses of the different possible solution strategies. Judged by the appropriate criteria, market instruments are generally a poor fit.

The tragedy of the commons framing made sense at a time when we believed that people needed to adjust the energy system at the margins, and believed that the cost of doing so would be high. We no longer believe these things. The atmosphere may be a common pool resource, but using it as a place to put our greenhouse gas emissions is no longer something for which we have any long-term rights to allocate. To prohibit dumping our greenhouse gases there, we first need to accelerate a technological transition towards non-fossil sources of energy, for which the main barriers have to do with knowledge and networks, rather than an inherent difference in cost. Policies providing active and direct governmental support for new technologies and technological systems can change the conditions that hold the new technologies back. In fact they have already done a great deal; they have led to a dramatic decline in the costs of key energy technologies, and contributed to the possibility that global emissions have already peaked. There is still more work to be done, and we can solve climate change if we build on what we have learned. At all costs, we should resist the temptation to reverse course because the policies don't fit one man's convenient story of too many cows on a village green.

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