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# Much Can Be Learned about Addressing Antibiotic Resistance from Multilateral Environmental Agreements

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## Introduction

Antibiotic resistance (ABR) is a common-pool resource challenge like those that global environmental scholars have been addressing for decades. Just like clean air, fish stocks, and oceans, antibiotic effectiveness shares the two defining qualities of a common good: it is rivalrous in that it is limited or subtractable upon use, and it is non-excludable in that it is very difficult to stop people from abusing them inappropriately.<sup>1</sup> This is because each use of antibiotics increases the likelihood that affected bacteria will adapt and evolve in ways that makes them less susceptible to these bacteria-harming antibiotics. The natural development of resistance is what separates antibiotics from most other medicines — the use of which do not affect the effectiveness of these medicines for others.

In this sense, ABR is a global ecological problem and a tragedy of the commons.<sup>2</sup> This means that any attempt to address the global threat of ABR can glean lessons from the environmental sector, at the core of which lies many global collective action problems like ABR and attempts to correct them. Much can be learned from what has worked in global environmental governance and the many areas where there has been failure.<sup>3</sup> This article identifies a few lessons for addressing ABR to inform research and policy directions going forward.

## Global Governance of the Environment

The backbone of global environmental governance is made up of almost 1,200 international treaties known as “multilateral environmental agreements” (MEAs). Most of these MEAs are bilateral — between two states — but a significant number are regional and global.<sup>4</sup> Over the past decades there has been significant progress in terms of the approach and sophistication of MEAs, such that they can be grouped into different “generations” of treaties.<sup>5</sup> In the 1970s, government negotiators of MEAs generally limited themselves to just identifying the existence of a problem and did not specify how they would address it. In these MEAs, such as the North Sea environmental regime, there were few tangible commitments and actions — if any. In the 1980s and 1990s, MEAs started including both targets and timetables. For example, a particular emissions target might be set for a certain calendar year. This generation of MEAs allowed state parties to the agreement and other stakeholders to measure progress, or lack thereof. In the 1990s differentiation was added as a feature of MEAs because it became evident that equal targets and timetables for all countries — rich and poor alike — was too simple and infeasible. This was also needed for reasons of global justice as developing countries could not reasonably be expected to reach the same goals within

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the same time period. Finally, most recently, market-based mechanisms have been added to some MEAs to give states incentives to reduce emissions. The most prominent example is the flexible mechanisms of the Kyoto Protocol to the United Nations (UN) Framework Convention on Climate Change (FCCC), which allowed for carbon credits, joint implementation and “cap-and-trade” solutions according to each country’s own preference.

States are necessarily the main actors involved in MEAs: only states can negotiate and be parties to international legal agreements, with a few minor exceptions such as United Nations (UN) entities and regional bodies like the European Union. Yet since the UN’s Rio Earth Summit in 1992, civil society organi-

environmental summits and have been integrated into global decision-making processes. Scientific and technical advisory groups have become an increasing mainstay of MEA negotiations as the complexity and scientific uncertainty of global environmental issues increased. The advice of these bodies is heeded more frequently than when such bodies do not exist; their influence increases when their advice is consistent and represents a broad consensus among scientists. Still, despite its increasingly central role, science has remained only one among many legitimate concerns and considerations in MEA negotiations. Political decisions are seldom taken directly from scientific advice.<sup>6</sup>

Although MEAs are the backbone of global environmental governance, they do not represent the sole way through which the world has governed the environment. Non-legal approaches abound. The most visible non-legal strategy is the convening of global summits, some of which have served as the focal point for MEA negotiations but others not. Particularly high-level summits have been arranged nearly every decade (i.e., 1972, 1992, 2002, and 2012). These summits have been important for facilitating cross-country learning, global agenda-setting, and the adoption of new approaches and principles. Their real-world significance, however, is probably diminished by the dense institutional networks that exist in global environmental governance and that already facilitate this “learning” function.<sup>7</sup>

Perhaps the most innovative dimension of global environmental governance is how legal and non-legal approaches have been combined with promising outcomes.<sup>8</sup> One example is the way that some ambitious actors develop and adopt non-binding commitments, advocate for them, and then encourage their uptake by states over time — eventually becoming part of MEAs and legally binding on all state parties. Another example is the emergence of many partnerships over the last 10-15 years, both public-private as well as purely private ones. These partnerships have often been established upon the failure of states to agree on an MEA, such as in the case of the international management of forests.<sup>9</sup> In this sense, partnerships have served as both alternatives to and supplements for MEAs.

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zations (CSOs) have had a strong presence at environmental meetings and have been important participants. Businesses joined the fray in a major way ten years later starting with the Johannesburg Earth Summit in 2002. Both of these groups are now considered legitimate participants; they lobby actively in the making of MEAs to achieve a diplomatic and legal outcome that aligns with their interests. CSOs are plentiful — now far outnumbering governmental representatives at most environmental summits — but their influence is limited as it is national governments, especially the most powerful ones, that tend to call the final shots. Businesses have been less visible but also probably more influential on MEA negotiations as they tend to advocate core national economic interests.

Scientists and scientific organizations represent a third group of non-state actors who have played an increasingly important role in the making of MEAs. Initially it was natural scientists who dominated, but more recently social scientists have also attended global

## Evaluating Global Governance Arrangements

It is clear that global environmental governance has become more sophisticated over the decades. But has this progress in the development of increasingly complex institutional arrangements translated into more effective governance? This question is vital to understand and answer before global health researchers and decision-makers should draw lessons from the environmental sector for ABR — as the relationship between sophisticated governance and effectiveness is not straightforward.

Studies evaluating the effectiveness of global environmental governance have been conducted for at least two decades by scholars of international relations.<sup>10</sup> There is now general agreement among these scholars that effectiveness is best studied in terms of outputs, outcomes and impacts. *Outputs* are most often the metric of interest among international lawyers; they deal with the ambition, specificity and stringency of rules emanating from a particular regime. In theory, the more ambitious, specific and stringent the rules, the greater the effectiveness that observers can expect to see. However, in reality, any output metric deals only with potential effectiveness; this is because rules — no matter how perfect — are not always followed. *Outcomes* bring us one conceptual step deeper by setting out to establish a causal link between the regime that was established and the resulting actions that are taken by target groups, including state parties but also others like CSOs, businesses, and scientific organizations. *Impact*, finally, is about the actual problem-solving capacity of the regime; in other words, to what extent has the regime been able to solve the problem it was set up to address. This final metric is of course the most important of the three possibilities, but methodologically it is also the most difficult to identify, evaluate or quantify due to interference from a host of intervening variables. For example, it is difficult to know whether adoption of the World Health Organization's Framework Convention on Tobacco Control (FCTC) in 2003 caused a decrease in global tobacco consumption or whether such a decline in consumption (if there has even been one) was caused by greater global awareness of tobacco harms which allowed both the adoption of this international treaty and the decline in tobacco use.<sup>11</sup>

When evaluating what makes some regimes effective and others not, there is relatively broad agreement among global environmental scholars that what matters is both the design of institutions within the regime as well as external factors beyond global decision-makers' control. These factors have been

conceived of in terms of *problem structure* and the regime's *problem-solving capacity*.<sup>12</sup>

Specifically, some problems are intrinsically more difficult to resolve than others due to competing interests, scientific uncertainty and/or political disagreement. Both climate change and biodiversity are examples of problems that, by their nature, are difficult to resolve. Ozone layer depletion — the problem addressed by the much-celebrated Montreal Protocol on Substances that Deplete the Ozone Layer — is far more benign and easier to resolve. ABR probably falls somewhere in the middle between these opposing examples because there are many competing interests at play but there is relative scientific consensus about the problem, its causes, and actions required to resolve it.

Likewise, the regime's problem-solving capacity is a function of power, leadership and institutional design. If there are powerful states taking strong leadership roles within a well-designed regime, then the chances of effective problem-solving capacity are much higher. While power and leadership are naturally hard for most decision-makers to muster, institutional design is relatively easier to shape as it represents a necessary political choice that is often subject to open political contestation among negotiating parties. There must be an institutional design of some sort; the only questions are what that design looks like and how effective it will be at achieving the desired impact (see Panel 1).

## How Effective Is Global Environmental Governance?

The story of global environmental governance is one of dramatic successes and disappointments. On the one hand, it has been documented that MEAs and other institutions have achieved a net positive effect in that global environmental problems would be worse in their absence. On the other hand, most observers of environmental challenges — both experts and the general public alike — know that few, if any, have been fully resolved. According to the most recent UN Environment Programme's Global Environmental Outlook in 2012, only a handful of some 90 global environmental goals investigated were given a high effectiveness score.<sup>13</sup> Some regimes received a medium score while others did not score well at all, which indicates there are many environmental problems for which little progress has been achieved.

Perhaps the most interesting feature of the UN's Global Environmental Outlook evaluation is the wide variation in effectiveness scores given to different regimes. This reveals quite starkly how the environment is a sector in which some problems have

Panel I

**Determinants of Regime Effectiveness**

	<b>Determinants</b>	<b>More Effective</b>	<b>Less Effective</b>
<b>Problem Structure</b>	<b>1. Political consensus</b>	High levels of political consensus can make it easier to find common ground and craft creative solutions that work for most actors	Low levels of political consensus can lead to polarization, hostile disputes, and deadlock that can prevent agreement on pathways forward
	<b>2. Scientific certainty</b>	High levels of scientific certainty and consensus can contribute to a better understanding of the problem and potential solutions for addressing it.	Low levels of scientific certainty and consensus can prevent knowing what needs to be done and casts doubt on the value of intervention
<b>Problem-Solving Capacity</b>	<b>3. Power</b>	Presence of powerful actors supporting the regime increases the likelihood of an effective regime and high rates of compliance	Absence of powerful actors makes problem-solving difficult given key parties are not committed so needed resources may also not be available
	<b>4. Leadership</b>	Strong leadership can provide direction to the regime, support coordination, and rally key parties around solutions for implementation	Weak leadership can lead to chaotic decision-making environments and no clear sense of what is needed to resolve problems
	<b>5. Institutional design</b>	Robust institutional designs can facilitate good decision-making, financing, transparency, oversight, dispute resolution and enforcement	Fragile institutional designs can lead to indecision, insufficient financing, poor coordination, and a lack of accountability

While the factors related to problem structure are probably the most important determinants of regime effectiveness, institutional design is relatively easier to shape as it represents a necessary political choice that is usually subject to open political contestation among negotiating parties.

been quite effectively resolved whereas others represent near-total failures of collective action. The most important factors explaining this variation are those related to the underlying problem structure. This lesson can be illustrated by contrasting experiences with two particularly prominent MEAs that were mentioned earlier: the Montreal Protocol (including later additions) and the FCCC (including the Kyoto Protocol).

The Montreal Protocol, for its part, is hailed as one of the few true successes in global environmental governance. To some extent this is the result of good institutional design such as creation of a Multilateral Fund for the Implementation of the Montreal Protocol that has disbursed over \$3 billion USD since its 1991 creation. But primarily the success of this protocol is attributable to the benign problem that it addressed. Ozone depletion can be considered a benign environmental problem because effective substitutions existed

to replace the harmful chlorofluorocarbon gases that caused it. In other words, a quick technological fix already existed, and the number of producers and consumers of these gases that needed to adopt the technological fix were relatively limited. The effectiveness of this regime has been aided by strong involvement of American industry and American government negotiators who saw it in their strategic self-interest to push for a robust international agreement.<sup>14</sup>

In contrast, climate change implicates virtually all economic activity globally. The challenge raises deep-seated conflicts between developed and developing countries, the powerful United States has dragged its feet, and unfortunately there are no quick technological fixes — at least not yet. All of this makes climate change an exceedingly difficult problem to solve. Thus, we should not necessarily consider the negotiators of the “successful” ozone treaty as more proficient than those negotiators behind the “failed” climate change

treaty; instead, the best lesson learned is probably about the varying nature of different types of problems faced and their corresponding difficulty in resolving them.

When considering ABR, these contrasting cases of environmental challenges show there is no universally successful approach to designing effective international agreements. But two concrete lessons can be drawn. The first is how vital it will be to always keep the problem structure of ABR in mind when setting

First, an international ABR agreement should contain robust reporting and verification procedures for tracking actions, inputs, processes, outputs, outcomes and/or impacts.<sup>17</sup> Such basic transparency and oversight mechanisms are often neglected in diplomatic negotiations; they tend to be seen as “technical” matters and therefore less important than commitments, goals and principles. However, reporting procedures are crucial for understanding the nature of the problem, evaluating progress toward addressing it, celebrat-

When considering ABR, these contrasting cases of environmental challenges show there is no universally successful approach to designing effective international agreements. But two concrete lessons can be drawn. The first is how vital it will be to always keep the problem structure of ABR in mind when setting ambitions for and crafting changes to the global antibiotics regime. The institutional design of any international ABR agreement should ideally reflect its underlying problem structure to maximize its potential for impact. The second lesson is that efforts that can be undertaken to change the problem structure may be just as important — if not even more important — than the design of any new global policy solutions. International agreements or ad-hoc efforts that could change the problem structure of ABR would include developing better diagnostics, infection control strategies, and alternatives to antibiotic use in animals as key components.

ambitions for and crafting changes to the global antibiotics regime.<sup>15</sup> The institutional design of any international ABR agreement should ideally reflect its underlying problem structure to maximize its potential for impact. The second lesson is that efforts that can be undertaken to change the problem structure may be just as important — if not even more important — than the design of any new global policy solutions. International agreements or ad-hoc efforts that could change the problem structure of ABR would include developing better diagnostics, infection control strategies, and alternatives to antibiotic use in animals as key components.<sup>16</sup>

### **Global Institutional Design for Addressing Antibiotic Resistance**

While it may not be the most important determinant of regime effectiveness, there are some institutional design features that boost the chances of international agreements being more effective. Five were selected on the basis of their perceived relevance for addressing the global threat of ABR.

ing any successes, and holding state parties and other stakeholders to account for any failures.<sup>18</sup> To the extent that these procedures do currently exist in MEAs, they usually rely on states submitting self-reports on their own progress to a coordinating secretariat, which are then synthesized in databases and made publicly available. The challenge is that states often fail to submit their required reports (usually due to limited bureaucratic capacity in developing countries) and may paint a rosier picture of progress than is actually deserved (usually to safeguard their reputations). This points to the importance of supporting countries to meet their reporting requirements and independently verifying the veracity of self-reported data. In some MEAs this function is served by the Global Environmental Facility. Although no central information clearinghouse is perfect: a review of the World Health Organization’s FCTC implementation database in 2012 found that the secretariat had misreported 32.7% of entries.<sup>19</sup> The experience with MEAs shows that self-reporting is perhaps the weakest of transparency mechanisms but

that it is a good starting point. Negotiators of international agreements should aim higher.

Second, an international ABR agreement should include both sanctions for non-compliance and assistance for implementation. This reflects the wisdom of two different schools of thought within international relations: the “enforcement school” and the “managerial school.”<sup>20</sup> To simplify, the enforcement school believes that states will try to free ride and cheat such that strong compliance procedures and the possibility of sanctions are needed. The managerial school believes that states want to comply with international agreements — whether by coincidence or by consequence of the agreements — such that non-compliance is evidence of inability or incapacity which should be remedied with financial and technical assistance. Empirical evidence lends support to both assumptions.<sup>21</sup> Politically, sanctions can be quite difficult to negotiate and employ, but they have proven quite impactful for those agreements that manage to incorporate and apply them.<sup>22</sup> Assistance is less difficult politically to negotiate, but just because support is written into an agreement does not mean that it is ever delivered.<sup>23</sup> This points to the potential value of a global pooled fund for addressing ABR that could finance access, conservation and innovation efforts, particular in resource-poor settings. The existence of this kind of fund is partially responsible for the Montreal Protocol’s success in protecting the ozone layer. A similar mechanism is currently being developed to address climate change. For ABR, a pooled fund with differentiated contributions based on gross national income could help ensure that necessary assistance is actually delivered to support compliance and implementation.

Third, an international ABR agreement should be designed in such a way that allows maximally ambitious content.<sup>24</sup> Decision-making rules play an important role here. Indeed, one of the most obvious weaknesses of many MEAs is their frequent reliance on consensus-based decision-making which often leads to a “race to the bottom” or a “law of the least ambitious program.”<sup>25</sup> In short, with a consensus decision-making rule, the state that is least willing to act is most decisive. A majority vote decision-making rule is better even though it may polarize states.<sup>26</sup> It may also be helpful to start negotiations with a smaller or more homogenous group of states — fewer actors to compromise and fewer interest groups to accommodate — but ABR’s need for near-universal action on access, conservation and innovation imperatives means this approach may not be possible.<sup>27</sup>

Fourth, an international ABR agreement should include implementation mechanisms for strengthening political decision-making and securing independent scientific advice.<sup>28</sup> Experience with MEAs sug-

gests that strong and competent secretariats improve the effectiveness of international agreements.<sup>29</sup> They are important for creating knowledge, disseminating it, shaping discourse on how problems are understood, and facilitating negotiation of collective solutions through sharing their ideas and expertise. Although, realistically, their influence varies considerably, depending on the problem structure they are addressing, the resources available to them, the quality of their staff, and the dynamism and strategic foresight of their leaders.<sup>30</sup> For ABR, the World Health Organization secretariat is a most obvious choice for supporting intergovernmental decision-making; though the UN agency’s recent financial, governance and human resource challenges may make this additional responsibility both burdensome and infeasible.<sup>31</sup> Either way, a separate and independent scientific panel on ABR should be created by the agreement to continually synthesize the evolving research evidence, recommend updates to the agreement, and inform its implementation. The chances of science influencing policy are greater when that science is communicated in a reader-friendly way from an authoritative and independent panel that is free from apprehensions of bias.<sup>32</sup> Like with secretariats, the nature of the problem also matters: scientific panels will be most influential when offering advice on benign problems, characterized by a high degree of scientific certainty and low levels of political conflict.

Fifth, an international ABR agreement should contain provisions, obligations, and targets that are as specific, precise, and clear as possible. Specificity makes it easier to evaluate whether the agreement is being followed. Precision helps facilitate positive competition among state parties regarding who is the best performer. Clarity minimizes the risk of future disputes caused by different interpretations of the same text. Overall, MEAs have shown considerable progress across generations of agreements in slowly moving away from vague rules. However, this has been possible to different extents among different environmental challenges. While it may be fairly easy to specify quantitative targets for atmospheric emissions, for example, it proved much harder to do so for biodiversity — which makes the Convention on Biological Diversity an illustrative example of generality and vagueness. As far as possible, negotiators of an international ABR agreement should aim to maximize the specificity, precision and clarity of the text they adopt. Different parts of the ABR challenge may allow for different levels of these virtues — which should be expected given the very different political-economy problems preventing access, conservation and innovation for antibiotics.

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