

# **From Green to REDD: Private regulation and the politics of carbon sinks**

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*Presented at NYU School of Law*  
**3 March 2014**

Forests cover approximately 30% of the globe. Estimates suggest that deforestation and unsustainable use of forests is responsible for between 15-20% of annual greenhouse gas emissions.<sup>2</sup> It is no wonder, then, that discussions about climate change have long focused on the role of carbon sinks – forests and other terrestrial ecosystems that remove greenhouse gases from the atmosphere. Formally defined as “any process or mechanism which removes a greenhouse gas, an aerosol, or a precursor of a greenhouse gas from the atmosphere,” sinks are a key component in managing climate change.<sup>3</sup>

The issue of carbon sinks has been extremely controversial throughout the history of the climate regime.<sup>4</sup> It was first raised in the Framework Convention as a measure to help mitigate emissions. Later, during the design of the Kyoto Protocol, sinks became a key issue, mobilizing strong opposition by many developing nations and civil society, and nearly derailing the negotiations. As a consequence, the use of sinks has been extremely limited in the market for carbon credits under the Kyoto Protocol, known as the Clean Development Mechanism.

More recently, however, sinks are newly fashionable in the world of climate politics. States have endorsed a new approach: a proposal to pay actors (whether states, firms, local governments or land users) to prevent deforestation and/or the general degradation of the quality of extant forests. Known as “REDD” (reducing deforestation and forest degradation), this supposedly “new” approach is the same policy with a new name, and less political baggage. Instead of producing acrimonious debate, REDD has garnered support from the global North and South, as well as much of civil society.

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<sup>2</sup> Intergovernmental Panel on Climate Change 2007.

<sup>3</sup> Watson et al. 2000.

<sup>4</sup> This paper focuses exclusively on carbon sequestration in *terrestrial* sinks — forests, vegetation and soils. Other sinks include the ocean, which is a vast repository for carbon dioxide and underground geological formations. These latter two categories will not be considered here.

What explains this shift in the role of sinks policy in the climate change regime? In this paper, I examine how *private authority*—private regulations governing carbon offsets and carbon sinks in particular—has contributed to the change in intergovernmental policy.

At first glance, the change in intergovernmental policy appears to be a straightforward story about bargaining. Initially, the use of sinks was undesirable to two powerful negotiating blocs – the Group of 77 and China, which represents the majority of the developing world, and the European Union. In its reincarnation as REDD, sinks has become a mechanism for wealth transfer that is politically palatable to both the developed and the developing worlds.<sup>5</sup>

Yet a more nuanced analysis demonstrates that private authority—rules and standards created by non-state actors—has also made important contributions to this shift. In this paper, I aim to advance the literature on private authority by examining how *interactions* between public and private authority change over time and how these interactions ultimately affect public rules. I show that while initial interactions between public and private authority were conditioned by strategic calculations based on distribution of resources, subsequent interactions were also governed by a “logic of appropriateness.” Together, these findings demonstrate how private authority can expand in breadth and depth to influence public authority through a largely unexamined mechanism: the growing legitimacy of private rulemakers.

The paper proceeds as follows. The first section reviews the literature on interactions between public and private authority and legitimacy in private authority. The second section briefly reviews the (tortured) history of sinks in the intergovernmental process. The third section traces the history of interactions between public and private authority, showing a trend of increasing cooperation between the two sets of regulations. This evolution proceeds in roughly three phases: pre-Kyoto (pre-1997), during the lifespan of the Kyoto Protocol (1997-2012) and since REDD was introduced (2005-present).<sup>6</sup> The fourth section discusses the observable implications of the two logics in each phase of sinks policy.

## **1. Theory: Interactions between public and private authority**

In this paper, I ask two linked questions. First, what explains the change in intergovernmental policy on sinks? Why has a policy that was once shunned by most governments, and carefully restricted from the Kyoto Protocol recently been reborn and embraced as REDD? Certainly, there are many factors that contribute to the shift, including changes in states’ preferences, the increasing deadlock of the intergovernmental negotiations and subsequent attempts by states and others to find other politically feasible solutions.<sup>7</sup> But, in order to understand those changes, we must also investigate a second

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<sup>5</sup> McDermott, Levin, and Cashore 2011, 91.

<sup>6</sup> Although these phases are characterized by different activities, there is some temporal overlap between them.

<sup>7</sup> On these issues see Falkner, Stephan, and Vogler 2010; Hoffmann 2011; Hale, Held, and Young 2013.

and related question: How has private authority influenced public regulation? I argue that the growing legitimacy of private authority around carbon measurement has influenced state interests, and as a result, intergovernmental policy.

Briefly, private authority can be understood as situations in which non-state actors make rules or set standards that other actors in world politics adopt.<sup>8</sup> This definition refers exclusively to *rulemaking behavior*; instances in which NGOs or other non-state actors engage in service provision or lobbying are not included. It is also characterized by regularized activity as opposed to one-off events.

A number of works seek to explain interactions between public and private authority. Theories of “the shadow of hierarchy” posit that governance can occur without government, where “regulatory mechanisms in a sphere of activity function effectively even though they are not endowed with formal authority.”<sup>9</sup> The shadow of hierarchy predicts that private actors cooperate to supply public goods in response to threats or incentives from legislative and executive bodies.<sup>10</sup> The initial interaction, then, is largely one of “call and response,” where states supply some impetus for reactions by non-state actors; interactions occur in one direction. Over time, this initial interaction may change the relationship between public and private authority. Either private authority (or other new forms of governance) may come to substitute for government action; alternatively, it can “prepare the way” for public regulation.<sup>11</sup>

Other works emphasize the complementary nature of public / private interactions over time. Vogel suggests corporate social responsibility can provide incentives for private firms to move “beyond compliance,” and exceed regulatory requirements.<sup>12</sup> Similarly, Cashore and colleagues suggest that properly constructed, public policies can help “ratchet up” the effects of private regulations. Knill and Lehmkuhl acknowledge the “synergetic relationships” between public and private authority, which vary with the governance capacity of each actor.<sup>13</sup>

In general, theories of interaction focus on the strategic explanations. Interactions are complementary or conflicting because of the material interests of the actors involved.<sup>14</sup> By and large, these works do not consider how interactions might be motivated by considerations beyond a utilitarian “logic of consequences.”<sup>15</sup> I maintain that interactions between public and private authority are not solely governed through this logic. Rather, the perceived legitimacy of private authority as regulators also affects interactions between public and private rules, and in turn, the content of public rules.

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<sup>8</sup> Green 2014.

<sup>9</sup> Rosenau 1990, 5.

<sup>10</sup> Héritier and Lehmkuhl 2008, 2–3.

<sup>11</sup> *Ibid.*, 4.

<sup>12</sup> Vogel 2005.

<sup>13</sup> Knill and Lehmkuhl 2002.

<sup>14</sup> On conflictual interactions, see e.g. Fuchs and Kalfagianni 2010, Mayer and Gereffi 2010, Besky 2010.

<sup>15</sup> For an exception, see Overdevest and Zeitlin 2012.

Since private regulators lack the authority of the state, a number of scholars have investigated their sources of legitimacy. Avant and colleagues argue that “global governors” (which include private actors) gain governing authority based on their expertise, capacity, principles, institutional home, or through delegation by states.<sup>16</sup> Cashore and colleagues argue that “non-state market driven” authority is legitimized through the power of the supply chain.<sup>17</sup> These works share the assumption that private actors are able to regulate in some realm because they are perceived to be a legitimate source of authority.

I postulate that this same legitimacy can also contribute to their rulemaking authority in other venues—namely, public rulemaking arenas. I draw on March and Olsen’s work to suggest that interactions between public and private authority can also be governed in part by a “logic of appropriateness”, where state behavior is partially conditioned by the view that private actors are legitimate rulemakers.<sup>18</sup>

Bernstein and Cashore develop a similar argument, though they seek to understand the motivations that drive *firms* to view private authority as a “fully legitimate” regulatory system.<sup>19</sup> Here, I focus on how *states* come to a similar conclusion. They argue that private rulemakers initially gain authority through a logic of consequences: firms defer to private rules as the result of strategic calculations of costs and benefits. Because of reputational gains, or perhaps threats to reputation through boycotts or naming and shaming, firms calculate that adopting private regulations, such as those that certify the sustainability of timber, is beneficial.

However, over time, growing support for private regulation can be increasingly explained by a logic of appropriateness. Eventually, “fully legitimate” forms of non-state market driven governance generate norms that change firms’ identities, such that they redefine their interests and thus, their behavior.

I hypothesize that the changing role of private authority vis-à-vis public regulation can be understood in similar terms. As private authority is recognized as increasingly legitimate by adherents and by states, it can generate norms that help redefine states’ interests, and thus their behavior. In other words, as private regulators attain legitimacy in policy domains of their own making, they also gain increasing rulemaking influence in the public arena. If this assertion is correct, states’ policy changes in part as a result of the perceived legitimacy of private authority. I discuss the observable implications of this assertion in Section 4.

As March and Olsen note, the world is not neatly divided into actions motivated by material calculations and those motivated by norms and rules, and “as a result, political action generally cannot be explained exclusively in terms of a logic of either consequences or

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<sup>16</sup> Avant, Finnemore, and Sell 2010.

<sup>17</sup> Cashore 2002; Cashore, Auld, and Newsom s2004.

<sup>18</sup> March and Olsen 1998, 951.

<sup>19</sup> Bernstein and Cashore 2007.

appropriateness.”<sup>20</sup> I am not arguing that norms promulgated by private authority are the sole explanator for changes in state behavior. Rather, I suggest that the influence of private authority may be broader than is often perceived. It can affect public regulations not only by providing material benefits to states, but also by shaping norms that in turn affect state behavior.

Finally, a word about case selection is in order. The postulate being investigated here is that the growing legitimacy of private authority is influencing public authority by changing norms of appropriate behavior. As a result, states are not governed solely by a logic of consequences; their rulemaking behavior is also based on a logic of appropriateness. I argue that climate change constitutes a hard case for this argument. Climate change is now an issue of state survival. Some small island states are facing the imminent threat of rising sea levels. Others have argued that climate change will create “climate refugees” spurring migration to more habitable corners of the world. Moreover, climate change is a “super wicked” problem, requiring cooperation among the world’s most powerful countries if problems of free-riding are to be avoided.<sup>21</sup> Given the high stakes of the issue, it is more likely that states would be motivated solely by material considerations rather than normative ones. For this reason, it is a good case to investigate.

Sinks policy is part of the reason that climate change constitutes a hard case. The issue of conserving carbon sinks strikes at the heart of state sovereignty. Developing countries, which possess the majority of the world’s forests, do not want to be told what to do within their borders. Conservation of forest carbon is seen to be directly related to economic activity, and the economic viability of the state. Indeed, the high political stakes of carbon sinks were most evident in the climate negotiations in 2000, where sinks was such a polarizing issue that it considered “one of the primary culprits” for the collapse of negotiations in the Hague.<sup>22</sup> Given that both climate change and carbon sinks are issues of high politics, this is not an area in which we would expect influence from private actors, much less normative influence. For these reasons, this can be considered a hard case for the influence of norms and of private authority over states’ preferences.

## **2. A brief history of sinks**

The issue of carbon sinks first surfaced in the drafting of the Framework Convention on Climate Change in 1992. The Framework Convention is more an aspirational document than a set of detailed policy prescriptions. The Convention defines sinks, and then names them as one among many policies that states could include among other precautionary measures to “anticipate, prevent or minimize the causes of climate change.”<sup>23</sup> In other words, sinks initially had a vague role in climate policy.

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<sup>20</sup> March and Olsen 1998, 952.

<sup>21</sup> Levin et al. 2012; see also Keohane and Victor 2011.

<sup>22</sup> Fry 2002, 165.

<sup>23</sup> UNFCCC 1992, Article 3, para 3.

The real debate about sinks did not begin until the negotiations of the Kyoto Protocol. The Clean Development Mechanism (CDM) is one of three market mechanisms created by the Protocol. It allows developed countries to meet their reductions targets by paying for emissions reductions in the developing world. The CDM is now a complex institution, responsible for hundreds of millions of dollars of investment and over three thousand projects. However, when it was agreed to in 1997, the CDM was little more than an idea. The so-called “Kyoto surprise” was agreed to at the last minute, without any details about how it would actually function.<sup>13</sup> As a result, the role of sinks in the CDM was not discussed until *after* Kyoto was signed, with the bulk of the debate occurring between 1997 and 2001.<sup>24</sup>

There were a variety of technical questions to be sorted out in the design of the CDM; among them was whether carbon sinks would be accepted as a type of offset. States quickly divided on the issue. The negotiating bloc representing the largest group of developed country emitters strongly supported the use of sinks as a way for developed countries to meet their reduction targets.<sup>25</sup> However, virtually all other parties objected to their use. The EU was opposed to flexible mechanisms in general—any policies that allowed developed nations to meet their reduction requirements in ways *other* than domestic measures.<sup>26</sup> The negotiating bloc representing the majority of developing nations, the G-77 and China, also objected to the inclusion of sinks, on the grounds that the Protocol should not include any joint measures, but focus solely on developed country action.<sup>27</sup> Indeed, in its proposed negotiating text, it removed all references to sinks.<sup>28</sup> In addition, most of civil society was also opposed to the use of sinks in the CDM on scientific, moral and efficacy grounds. Under the auspices of the transnational advocacy network called the Climate Action Network, they argued that sinks would be hard to measure, would absolve developed countries of obligations to reduce emissions domestically, and in the end, might not actually reduce overall emissions.<sup>29</sup>

In 2001, states finally agreed to a very limited role for sinks in the CDM. Their use is limited in three ways. First, they are temporally limited to the first commitment period of the Kyoto Protocol (i.e. until the end of 2012). This not only restricts the amount of sinks credits that could enter and persist in the market, but also requires that the issue will have to be revisited in full as post-Kyoto negotiations move forward. Second, they are substantively limited to afforestation and reforestation (A/R) activities. Avoided deforestation, which would grant credits for preserving standing forests that might otherwise have been logged, is not included as an acceptable form of carbon sink; there is at least some consensus that this outcome is at least in part due to civil society

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<sup>24</sup> For a technical account of the issues from an insider perspective, see Fry 2002; Fry 2007.

<sup>25</sup> This was the so-called JUSCANNZ bloc – Japan, US, Canada, Australia and New Zealand.

<sup>26</sup> Yamin 2005. For a full discussion of the split between the US and the EU on a variety of issues related to the Protocol, see Schreurs 2004.

<sup>27</sup> The exception was a small group of Latin American countries, which supported the inclusion of sinks. For further details on various nations’ positions, see Boyd, Corbera, and Estrada 2008.

<sup>28</sup> UNFCCC 2000.

<sup>29</sup> These arguments are made repeatedly in the newsletter published by the Climate Action Network, which was, at the time, the main transnational advocacy network active in the climate negotiations.

mobilization.<sup>30</sup> This prevents the possibility of at least one perverse outcome of which was of concern to civil society: developing countries could have received funding to “protect” forests they threaten to cut down. Third, the amount of credits allowable through sink activities was capped at one percent of 1990 emissions levels time five. Fourth, the EU trading scheme decided not to accept afforestation and reforestation projects, further limiting the demand for such projects. As a result of these limitations, sinks currently comprise less than 1% of total projects in the CDM.<sup>31</sup>

In contrast to the protracted and acrimonious debates about sinks in the CDM, recent discussions in the intergovernmental process about reducing deforestation have reintroduced the idea of using sinks to achieve emissions mitigation. In 2005, Costa Rica and Papua New Guinea—two heavily forested countries—proposed that states consider additional ways to reduce emissions, by addressing one of its largest sources: deforestation.<sup>32</sup> They founded and were soon backed by a larger “Coalition for Rainforest Nations”, which advocated for new policies to address avoided deforestation—the same category of sink that was excluded from the CDM.<sup>33</sup> In the proposal, Costa Rica and PNG insist that “their emphasis is on carbon emissions, not ‘sinks.’”<sup>34</sup> Yet REDD is clearly a sink by another name: what was once avoided deforestation was reborn with a new name with less political baggage.

The Costa Rica / PNG proposal began a new round of discussions within the intergovernmental process about carbon sinks, now re-christened as REDD.<sup>35</sup> Yet the reappearance of the issue did not spark the same acrimonious objections that surrounded the CDM negotiations. In fact, the opposite was true: previously opposed actors embraced REDD. For example, the EU had opposed all manner of flexibility mechanisms, including sinks in the CDM. By contrast, in July 2008, the EU tabled a proposal to promote REDD activities, which emphatically endorsed the potential of sinks to combat climate change: “We shall not, in the EU’s view, succeed in limiting global warming to 2C without efforts in all sectors. This includes action to reduce emissions from deforestation and forest degradation.”<sup>36</sup> China, as part of the G-77, tabled a proposal that systematically deleted all references to sinks, called for “innovative incentives...for emission reductions from avoided deforestation, conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries.”<sup>37</sup>

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<sup>30</sup> Lecocq and Ambrosi 2007; O’Sullivan 2008, 181.

<sup>31</sup> As of 20 May 2013. See <http://cdm.unfccc.int/Statistics/Public/CDMinsights/index.html>.

<sup>32</sup> UNFCCC 2005.

<sup>33</sup> The Coalition for Rainforest Nations began as Bolivia, Central African Republic, Chile, Congo, Costa Rica, Democratic Republic of the Congo, Dominican Republic and Nicaragua, and has since expanded considerably into an intergovernmental organization comprised of both developed and developing nations.

<sup>34</sup> UNFCCC 2005.

<sup>35</sup> There has been an evolution from RED to REDD to REDD+, where each successive version includes more activities. RED includes only avoiding deforestation and was the acronym describing the original Costa Rican and PNG proposal. REDD adds the additional category of forest degradation. REDD+ includes other measures to sustainably manage forests.

<sup>36</sup> <http://unfccc.int/resource/docs/2008/sbsta/eng/misc04.pdf>. See FCCC/SBSTA/2008/MISC.4.

<sup>37</sup> UNFCCC 2008.

The Climate Action Network, which lobbied extensively to exclude sinks, and particularly avoided deforestation from the CDM, also changed its views. In 2006, it tabled a position paper in which it “strongly welcomes the initiative to discuss reducing emissions from deforestation as proposed by PNG and Costa Rica and discussed at COP-11 in Montreal.”<sup>38</sup> Shortly thereafter a representative of Greenpeace addressed the plenary on behalf of CAN, noting that a discussion about deforestation was “long overdue.”<sup>39</sup>

In sum, the second coming of sinks has thus far proven to be much less contentious than the initial discussions under the Kyoto Protocol. What has changed?

### **3. Public / Private interactions in sinks policy**

Many factors have contributed to the shift in policy on sinks. The intergovernmental process is faltering, if not altogether stalled. A number of countries have pulled out of the next round of Kyoto. Others have pursued unilateral approaches. Some developing nations have begun to voluntarily implement climate policies. And private authority around climate change has exploded. Clearly, an examination of all of these moving parts is beyond the scope of a single paper. As such, I focus on one piece, the role of private authority and its changing interactions with public authority.

To provide some greater precision in characterizing the nature of interactions among public and private authority, I turn to recent work by Eberlein and colleagues who outline four main types of interaction: competition, coordination, cooptation and chaos.<sup>40</sup> In competitive interactions, rulemakers vie for resources, regulatory authority, legitimacy and reputation. Coordination emphasizes the interdependent nature of many governance activities. Rulemakers may choose to “nest” their rules within a broader regulatory scheme, or carve out a niche, which reduces competition.<sup>41</sup> In cooptation interactions, one set of rules chooses to recognize another, which may result in the dominance of one set of rules.<sup>42</sup> Chaotic interactions have, as their name suggests, have no particular logic save for the fact that different modes of authority have an effect on others.

The following discussion demonstrates a clear trajectory of interactions. As private actors become more firmly established as legitimate rulemakers, their interactions with public authority become increasingly coordinated. In the pre-Kyoto phase, private actors’ work in the area of carbon sinks were one-off events. Public and private authority on sinks did not yet exist, and thus, there were no interactions. However, this is an important phase in establishing private expertise: Private actors pioneer methods and practices for measuring carbon—an important pre-cursor to their role as regulators.<sup>43</sup> Shortly after the drafting of the Kyoto Protocol, private authority emerges in the form of a “voluntary market” for carbon offsets. Cooptation interactions mark the Kyoto phase. Many private rules on

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<sup>38</sup> CAN 2006.

<sup>39</sup> CAN 2007.

<sup>40</sup> Eberlein et al 2013.

<sup>41</sup> See also Aggarwal 1998; Abbott, Green and Keohane 2013.

<sup>42</sup> For an example in carbon accounting, see Green 2010.

<sup>43</sup> Green 2014, chap. 4.



carbon offsets choose to recognize public ones. The reverse interaction also emerges in the Kyoto phase in which national and sub-national governments choose to recognize some private standards. In the REDD phase, interactions become more cooperative, with both sets of actors involving the other during their respective rulemaking processes, rather than recognizing others' rules *after* they are made. Table 2 (at the end of the paper) provides a brief summary of these interactions.

#### *Pre-Kyoto: Private pioneers*

Carbon sinks are not a new idea. Preserving forests was a “green” idea before it was a REDD one. As early as the 1980s, a number of international environmental NGOs such as Conservation International and the Nature Conservancy created “debt-for nature swaps.” Today, we would call these REDD projects, but then, they were simply conservation projects which paid developing country governments to keep trees in the ground. NGOs raised money to purchase the debt of a developing country. In exchange for the cancellation of debt, the developing country agreed to enact conservation measures, usually in the form of protecting large swaths of forests.

The first debt-for-nature swap agreement was concluded in 1987 between Conservation International (CI) and the government of Bolivia. CI purchased US\$650,000 of Bolivian debt (purchased for US\$100,000) and in exchange, Bolivia enhanced legal protections of the Beni Biosphere Reserve, and created surrounding protected areas. It also provided local funds to finance the activities therein.<sup>44</sup> By the early 1990s, these had become a significant phenomenon; Deacon and Murphy catalogue 23 debt-for-nature swaps active in 1992, in 14 countries ranging from South America to Africa.<sup>45</sup> All were initiated by environmental NGOs. These efforts were focused more on the preservation of biological diversity than the climate benefits of sequestering carbon; indeed climate change had barely appeared on the international agenda at that time.

In addition to debt-for-nature swaps, a number of international NGOs cooperated with large corporations, to help them offset their carbon emissions. Applied Energy Services worked with the World Resources Institute, CARE, the Nature Conservancy and Oxfam to plant trees, fund conservation zones and promote proper land titling to indigenous peoples to preserve tropical rainforests.<sup>46</sup> The Nature Conservancy also created one of the longest-running carbon offset projects in concert with a Bolivian NGO and three energy corporations.<sup>47</sup> This was a natural progression from efforts that the Nature Conservancy had pioneered a decade earlier: debt-for-nature swaps. The project has been operating continuously since 1997, and is expected to avoid emissions of 7-10 million metric tons of carbon over 30 years.<sup>48</sup> It has since been re-born as a *new* kind of pilot project under the UN-REDD program.

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<sup>44</sup> Resor 1997.

<sup>45</sup> Deacon and Murphy 1997.

<sup>46</sup> Moura-Costa and Stuart 1998.

<sup>47</sup> <http://conserveonline.org/workspaces/climate.change/ClimateActionProjects/NoelKempff/ProjectProfile/NKProfileEnglish/view.html>.

<sup>48</sup> Powers 2009

Since I have defined private authority as regularized events, I maintain that these one-off swaps and carbon sequestration projects cannot be considered a form of private authority. In these instances, NGOs are undertaking activities to preserve carbon sinks, but are not creating rules to govern behavior over time. Thus, these activities are best considered a form of “proto-private authority.” However, they are significant in understanding the evolving legitimacy of private authority, since these early activities allowed NGOs—who would become private regulators in the future—to build up their expertise and experience with carbon sinks, facilitating their entry into the rulemaking arena in the future.

Even so, there was little, if any interaction with transnational public authority. Private actors voluntarily engaged in conservation projects with willing governments, in exchange for debt reduction. These voluntary activities were not associated with any intergovernmental activity, and only some sought to address climate change. Many were focused on preserving biological diversity in forests. There were no transnational private rulemakers at the time, and thus it follows that there were no interactions with intergovernmental processes. Thus, the first phase of carbon sink activity can be characterized as one of non-interaction between public and private actors, marked also by an absence of private authority, but creating the foundation for future private regulation.

#### *The Kyoto Phase: From Advocates to Regulators*

The Kyoto phase is marked first by acrimonious debate about the appropriate role of sinks in the CDM, one of the three market mechanisms created by the Kyoto Protocol. Civil society mobilized through a transnational advocacy network called the Climate Action Network (CAN) to oppose the inclusion of sinks in the CDM. In particular, it was concerned about whether offset projects in the CDM would promote *other* environmental goals, such as the preservation of biodiversity or promotion of sustainable livelihoods, in addition to reducing emissions.

Although the use of sinks is limited in the CDM, they failed to achieve most of their objectives.

After their loss on the sinks issue, a number of CAN member organizations—including Environmental Defense, the Nature Conservancy, World Wildlife Fund, the Rainforest Alliance and Conservation International—switched tactics. Instead of trying to influence the intergovernmental process, they began to create their own standards to govern the creation, verification and sale of carbon offsets. Between 2000 and 2010, 22 private offset standards were created.<sup>49</sup> The private standards and offsets created by them jointly constitute the “voluntary carbon market.” The market is voluntary because the participants are not purchasing offsets in order to comply with any global regulations. Rather, they choose to offset their emissions—largely for reasons of reputational enhancement, and to a lesser extent, in anticipation of future regulation.<sup>50</sup> The voluntary market contrasts with the “compliance market” for offsets, which is governed by CDM. These are offsets purchased by those countries that require additional reductions in order to meet the reductions requirements set forth in the Kyoto Protocol.

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<sup>49</sup> Author’s data.

<sup>50</sup> Peters-Stanley and Hamilton 2012.

Private regulations sought to fill what was perceived to be a clear gap in sinks policy in the CDM: insufficient focus on environmental and social aspects of offset projects, and concern about the veracity of credits generated.<sup>51</sup> The emergence of private standards was a conscious attempt to fill this gap. One participant in the voluntary market put it quite bluntly: “the CDM is good at reducing emissions...but has failed at ensuring sustainability.”<sup>52</sup> The logic invoked by many private standards is “climate plus” — climate benefits *plus* other environmental and social benefits.

Moreover, a number of standards *specifically* include sinks as part of their portfolio of standards. Thus, despite earlier objections by private actors, carbon sinks are no longer incommensurate viewed as with sustainability. Private rules can offer the “climate plus” logic that public rules were perceived to have lacked. The number of private standards and the complexity of their methodologies preclude an in-depth discussion of their content. However, one brief example might be useful to illustrate the pervasiveness of carbon sinks in private offset standards. The International Carbon Reduction and Offset Alliance was created in 2008 “to promote best practices in carbon management and offsetting.”<sup>53</sup> Since then, it has created a code of good practice for carbon management, which includes standards on carbon offsets. The code endorses five private offset standards, all of which include sinks. In other words, as private regulators seek to ensure quality and bring uniformity of to their rules and standards, they have chosen to include sinks as part of this definition.

Since its emergence in 2000, private authority has become a progressively more legitimate form of regulation, attracting ever greater numbers of adherents. There has been steady (and at times, explosive) growth in the voluntary market, both in the number of standards created, and in the value of the offsets sold (see Table 1). The growth in the voluntary market shows that private regulators have successfully gained legitimacy: they have attracted a growing number of rule-takers—individuals, NGOs and firms buying and selling offsets created by private rules.<sup>54</sup>

Moreover, leaders have emerged in the field over time. There are now a small number of standards that dominate the market both in terms of market share and prestige. The Verified Carbon Standard is the clear market leader; almost 60% of all credits transacted used the VCS standard.<sup>55</sup> The next two most popular standards are the Gold Standard and the Climate Action Reserve, which each captured 12% of market share.

Each standard’s prominence can be further evaluated by measuring its “prestige” among the network of private carbon regulations—the number of other standards that choose to

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<sup>51</sup> This is consistent with other theories of private authority which see private regulation emerging in areas where states are not regulating.

<sup>52</sup> Brennan Duty, Commercial Coordinator, Sustainable Carbon. Personal communication, 29 June 2011.

<sup>53</sup> <http://www.icroa.org/25/about-us/>.

<sup>54</sup> Bernstein and Cashore 2007 refer to this as the first phase of legitimacy; rule-makers that fail to generate demand for their rules will fold.

<sup>55</sup> Peters-Stanley and Hamilton 2012, 29.

recognize its rules. Thus, if standard A is recognized by 20 other standards, and standard B is only recognized by five other standards, then A is more “prestigious” than B. Among private offset standards, the three standards with the largest market share—VCS, the Gold Standard and the Climate Action Reserve—are also the most prestigious: they are most frequently “chosen” by other private standards.<sup>56</sup>

**TABLE 1 about here.**

At first glance, the Kyoto phase can be characterized by two separate spheres of regulation that govern carbon offsets—one private and one public. Each has a different set of regulatory targets. The CDM creates offsets purchased by regulated entities for the purposes of complying with public rules, while the voluntary market creates credits for any well-meaning actor who wishes to purchase them. Yet a closer examination reveals that public and private authority are characterized by two forms of interaction.

First, although the voluntary market exists in parallel to the compliance market created by the CDM, there is a very high degree of recognition among rules. Approximately 80% of the standards created by private actors recognize or build upon the CDM rules.<sup>57</sup> However, the reverse relationship does not hold; public rules under the CDM are unconcerned about their relationship to the voluntary market, and do not recognize any private standards. Recognition of public rules by private ones constitutes the first interaction between the voluntary and CDM markets.

Second, and more recently, some national and sub-national carbon markets have begun to accept certain offsets generated on the voluntary market. For example, Australia’s National Carbon Offset Carbon Neutral Program will accept offsets generated under Australian domestic regulation, as well as those created by Verified Carbon Standard and the Gold Standard—two private offset standards.<sup>58</sup> There are several other similar examples, including domestic policies in Korea, Thailand, Costa Rica, the Netherlands and California.<sup>59</sup>

This interaction—where public authority recognizes private authority—can be characterized in a number of different ways. Eberlein and colleagues refer to it as “conditional referencing”: “if you comply with X’s rule, that will constitute compliance with my regulation.”<sup>60</sup> Put more simply, this is an implicit act of delegation, since governments are implicitly transferring rule-making authority to private agents. Similar practices occur in the area of forestry, where a number of governments accept adherence to private

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<sup>56</sup> The “choosers” are not just private carbon offset standards, but include other kinds of carbon standards, as well as private regulations related to sustainability and forestry. For a full discussion of the methodology used to construct this network, see Green 2013.

<sup>57</sup> This is further described in Green 2013.

<sup>58</sup> Peters-Stanley 2012, 21.

<sup>59</sup> Peters-Stanley 2012.

<sup>60</sup> Eberlein et al 2013.

regulations created by the Forest Stewardship Council in lieu of compliance with public rules.<sup>61</sup>

Importantly, states are choosing among a diverse field of private regulations. They consistently choose market leaders—VCS and the Gold Standard in particular. Thus, this cooptation interaction correlates to perceived legitimacy of *specific* rulemakers. Not all private regulators are seen as equally legitimate by states.

Thus, the Kyoto phase marks an interesting shift in the relationship between public and private actors. In the design of the CDM, private actors mounted a vehement campaign against the use of sinks. Once they lost, they began to formulate their own rules to correct what they perceived as shortcomings in public regulations—ensuring additional environmental and social benefits beyond simply mitigating carbon emissions. An unsuccessful interaction – the attempt to influence intergovernmental outcomes – was the impetus for private regulatory efforts.

After this unsuccessful interaction, public and private authority each have cooptation interactions—private actors recognize public rules and vice versa. Although the voluntary offset market exists entirely separately from the CDM market, the vast majority of private regulators have made an effort to be compatible with public authority, through the recognition of CDM standards. Moreover, although they have no incentive to do so, a number of governments have chosen to recognize private offset rules, incorporating them into their own regulatory regimes.

### *REDD*

The third phase of sinks policy begins in 2005, when Costa Rica and Papua New Guinea—two heavily forested countries—tabled a proposal that reinvigorated the intergovernmental discussion around sinks.<sup>62</sup> Their proposal and the subsequent emergence of the Coalition for Rainforest Nations sparked a new track of negotiations—discussions about whether and how to implement REDD in the climate regime.

Unlike the design of the CDM, where Parties first created regulations and then moved to implement them, REDD has proceeded in the reverse order. Rulemaking has proceeded incrementally, as states and IOs experiment with implementation of REDD activities.

Intergovernmental discussions about REDD began in mid-2006. In 2007, states endorsed a multi-faceted approach, encouraging Parties "to explore a range of actions...including demonstration activities."<sup>63</sup> The decision is essentially a *carte blanche* to all of those interested to experiment with different approaches. In response, a number of international organizations have organized REDD programs. The most prominent is UN-REDD, which was launched in 2008 to help nations plan for REDD and ascertain out how it

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<sup>61</sup> See, e.g. Overdevest and Zeitlin 2012; Gulbrandsen 2013.

<sup>62</sup> It is important to note here that the discussion about REDD is ongoing. Its final institutional form has yet to be decided, as do important rules about accounting, financing and trading.

<sup>63</sup> UNFCCC 2007.

could be carried out in practice. There are now national programs in 16 countries, funded by approximately \$US120M in contributions by Denmark, Japan, Norway and Spain.<sup>64</sup> There are a variety of other efforts by international organizations (IOs) including: the Forest Carbon Partnership Facility (run by the World Bank), the Forest Investment Program (run jointly by multilateral development banks) and the International Climate and Forest Initiative (funded by Norway). The Global Environment Facility also funds projects on sustainable forest management and REDD. The Coalition for Rainforest Nations, the original proponents of REDD, also have a host of activities to promote its implementation at the national level. Most of these activities fall under the category of implementation: IOs and potential REDD countries are trying to figure out how to *do* REDD projects—including dealing with difficult issues of measurement, and verification and so-called “safeguards” of local peoples’ rights and livelihoods.

Private actors are also creating rules to implement REDD. Even before 2005, private standards included sinks activities. Many of these emphasized the “climate plus” logic, which delivers economic, environmental and social benefits beyond carbon sequestration. Indeed, because of restrictions on the use sinks in the CDM, the vast majority of sinks offset projects (also referred to as “forest carbon”), has occurred in the voluntary market. Historically, the voluntary market has transacted 76 million tons of forest carbon, whereas the equivalent figure for the CDM market is only 15 million tons.<sup>65</sup> Overall, sink activities comprise less than 1% of all offsets generated in the CDM.<sup>66</sup> By contrast, in 2011, forest carbon constituted approximately 40% of credits generated on the voluntary market.<sup>67</sup> Despite being much smaller in volume and value, there is much more forest carbon being bought and sold in the voluntary market.

All of the leading private standards include sinks. Three in particular, stand out in the implementation of REDD. The American Carbon Registry was created in 2007, though its earlier incarnation, the GHG Registry, was created in 1996. Connected to the development NGO Winrock International, ACR has a number of standards related to forestry and avoided deforestation. In 2011, ACR credits comprised 25% of the total market share for forest carbon.<sup>68</sup>

The Climate, Community and Biodiversity (CCB) standard was created in 2005. Its standards do not certify the carbon reductions created by offsets projects, but rather their social and biodiversity impacts. Thus, its rules are used in conjunction with other offset standards (either public or private). In this auxiliary role, CCB has become tremendously important in the voluntary market: In 2010, the CCB standard was used in almost 60% of all forest market transactions.<sup>69</sup>

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<sup>64</sup> <http://www.un-redd.org/AboutUNREDDProgramme/tabid/583/Default.aspx>.

<sup>65</sup> Forest Carbon Report 2012: ii

<sup>66</sup> [http://cdm.unfccc.int/Statistics/Public/files/201304/proj\\_reg\\_byScope.pdf](http://cdm.unfccc.int/Statistics/Public/files/201304/proj_reg_byScope.pdf)

<sup>67</sup> Peters-Stanley and Hamilton 2012, iv.

<sup>68</sup> Ibid.

<sup>69</sup> Diaz, Hamilton, and Johnson 2011, v.

The Verified Carbon Standard (VCS) regulates a diverse portfolio of offset projects, including carbon sinks. It is the market leader in forest carbon, capturing 28% of the 2011 market for forest carbon. More importantly, in 2011, VCS has pioneered a new commodity in the global carbon market: It produced the first REDD credits to be verified and issued on the voluntary market. Since the CDM does not include REDD activities, and IOs are still in the process of building capacity and piloting new approaches, these represent the very first REDD credits created anywhere. Thus, while intergovernmental process moves ahead incrementally on discussing REDD issues, the voluntary market is already buying and selling REDD credits.

Both VCS and CCB have recently set their sights on moving beyond the voluntary market, creating new standards which explicitly target governments. To date, sinks activities have always been undertaken at the project level – a discrete set of activities in a bounded geographical area. This approach raises measurement challenges about whether projects simply displace carbon emissions outside the project boundaries (a phenomenon referred to as leakage). To combat this problem, public and private regulators alike have begun to discuss different geographic approaches, which broaden the geographical scope of measurement to the state, provincial or even national level.

The new CCB standard, called REDD+SES is specifically designed to be used by governments at multiple scales: "The standards are designed for government-led REDD+ programs implemented at national or state/provincial/regional level and for all forms of fund-based or market-based financing."<sup>70</sup> Five nations—Ecuador, Nepal, Tanzania, Brazil and Indonesia—are currently implementing the standard. All implementing nations except Indonesia have government representatives participating in the standards committee, which oversees standards development and implementation.

VCS is similarly trying to move beyond the voluntary market, targeting governments as end users of its standards. It has created a "nested" REDD standard, which allows bottom-up REDD projects to nest within existing regulatory frameworks. This would apply to states participating (or planning to participate) in national or regional compliance markets. VCS recently released the standard, based on input and consultation of governments, as well as NGOs and the private sector. Indeed, the advisory council for the standard included government representatives from Brazil, Columbia, Ecuador, Ethiopia and Mexico. A number of governments are also piloting the draft rules.

Just as private rulemakers are seeking to expand their ambit to include public regulatory targets, so too are governments increasingly including private regulators in the public rulemaking process. As the CCB and VCS examples demonstrate, governments are considering using private rules in their domestic approaches to REDD. At the intergovernmental level, states are involving private regulators in the rulemaking process.

Thus, in the third phase of sinks policy, interactions between public and private authority have shifted from cooptation to coordination, which is evidenced by the “deliberate

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<sup>70</sup> REDD+SES, n.d. Accessed at [http://www.redd-standards.org/files/pdf/lang/english/FactSheet-logo\\_En.pdf](http://www.redd-standards.org/files/pdf/lang/english/FactSheet-logo_En.pdf).

collaboration” between public and private regulators.<sup>71</sup> Private regulators are now explicitly developing rules for government use, and governments are involved in their creation and piloting their implementation.

#### **4. The normative influence of private authority**

This section is a first cut at demonstrating the hypothesized shift in states’ bases for action from a logic of consequences to one that includes a logic of appropriateness. As a result of the growing legitimacy of private authority, interactions between public and private regulators have changed from no interaction to cooptation to coordination. At the same time, there is evidence that these interactions are increasingly governed by a logic of appropriateness.

In the Kyoto phase, some states began to use private standards on offsets in addition to, or in lieu of creating their own rules—what I have called a cooptation interaction. If governed by a logic of consequences, states would adopt rules that provide the maximal number of credits with the least amount of effort—in other words, the weakest rules. This would maximize the material benefits by lowering the cost of compliance. In these cases, states would either develop their own weak rules, or adopt the weakest private standards available. We should then observe a race to the bottom in the use of private regulations. By contrast, if states’ decision about sinks is governed by a logic of appropriateness, they should coopt strict private standards that emphasize the “climate plus” logic, which delivers both emissions reductions as well as other public goods.

The observed variation provides mixed evidence. A recent report by Ecosystem Marketplace examines thirteen national and sub-national policies on carbon markets, and their interactions with the voluntary market.<sup>72</sup> Of these, eight recognize private offsets standards. However, half of them *also* use their own domestically-created standards. Only three private standards are recognized: VCS, the Gold Standard and the Climate Action Reserve. The Gold Standard clearly aligns with the “climate plus” logic. Founded by the environmental NGO World Wildlife Federation, its standards emphasize local consultation, environmental assessment and evaluation of other “co-benefits” of offset projects.<sup>73</sup> The VCS, by contrast, is less focused on the climate-plus logic and instead emphasizes its compatibility with a number of other private standards. It was launched by a number of business organizations including the World Business Council for Sustainable Development. The Climate Action Reserve (CAR) has its roots in early efforts by the state of California to establish a carbon market. It is independent from the state, and standards are created through a multistakeholder process.<sup>74</sup> CAR does not explicitly emphasize the “climate-plus” logic. Since most of its projects are based in the US, the emphasis on biodiversity and

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<sup>71</sup> Eberlein et al. 2013, 16.

<sup>72</sup> Peters-Stanley 2012.

<sup>73</sup> This is evident from its website, and also confirmed by a survey that I conducted of private carbon standards.

<sup>74</sup> Offsets generated by CAR standards can be used for compliance purposes under the new California cap and trade system.



sustainable livelihoods is not as relevant as it is for those that conduct offset projects in the developing world.

On balance then, the evidence is mixed (and admittedly, the N is quite small). However, it suggests the dominance of a logic of consequences. Roughly one-third of all public carbon markets only utilize their own standards. Without an in-depth analysis of each one, it is difficult to assess their stringency. Moreover, 50% of those that do use private standards have chosen to recognize VCS, which does *not* emphasize the climate-plus logic of additional environmental and social benefits of sinks projects. Here it appears that states are adopting private standards to maximize compatibility with other standards, rather than to promote the additional environmental benefits associated with many private regulations. Only three markets – those in Australia, Costa Rica and the Netherlands – accept a private standard that adopts a “climate-plus” approach (i.e. the Gold Standard). However, two of these also accept the decidedly less climate-plus oriented VCS standard.

In the REDD phase, states’ and private regulators’ interactions are much more collaborative, as demonstrated in the previous section. If governed by a logic of consequences, states would structure their interactions in a way that minimizes private actors’ ability to *actually* influence the rules. In other words, interactions would be window-dressing, to enhance the *appearance* of a legitimate rule-making process while minimizing their influence. By contrast, if governed, at least in part, by a logic of appropriateness, states would seek out private actors to participate and actively contribute their knowledge to the rulemaking process. Thus, they would seek to maximize their ability to provide input, including them early in the rulemaking process, before the scope of decision-making is reduced to a “yea or nay” choice.

Indeed, in contrast to the previous Kyoto phase, rulemaking around REDD has maximized input by private actors. Whereas the first discussions of the CDM occurred at a large intergovernmental meeting (the third Conference of the Parties, held at Kyoto), the negotiations around REDD have proceeded much more gradually. In the CDM, civil society input began “midstream,” once key decisions were already been taken. Negotiations had already progressed to a point where the decision was whether or not to include sinks in the CDM. As a result, civil society response was simply to protest the likely outcome.

This is contrasted with REDD, where discussions have proceeded much more cautiously and incrementally. Private actors, particularly private standard-setters involved in the voluntary market, have been active in the rule-making process from the outset.

After the introduction of the idea of REDD in 2005, the Secretariat convened a series of workshops to discuss some of the bigger issues surrounding the proposal. No negotiations took place at these meetings, which happened over the course of almost two years; rather, these were a means of information exchange—to identify and discuss issues that would need to be addressed in the rulemaking process, and to ensure that the proposal for REDD

was technically feasible.<sup>75</sup> A number of private regulators participated in these meetings, both as speakers and participants, at the invitation of the Secretariat.

At the first workshop, of the 15 NGO participants, 3 represented private standard-setting organizations. At the second, 4 of 8 NGO participants were private standard-setting organizations. At the final workshop, the equivalent figure was 2 of 10. Others have pointed out that influence is often more easily exercised at early stages of the decision-making process, when trade-offs have yet to crystallize and interests are not always entrenched.<sup>76</sup> Through their attendance and advice at these meetings, private regulators were able to shape the nature of the discussions that followed.

Those involved in the early REDD discussions have also confirmed the role of private actors in helping states address the technical issues involved. One former member of the Costa Rican Foreign Ministry noted that some of the large international NGOs were key contributors to REDD discussions on two fronts. First, they helped push for the inclusion of forest conservation after it had been excluded from the CDM and "played a very important role in creating the political conditions" in expanding the scope of REDD.<sup>77</sup> Second, they were now seen as experts on matters relating to forest conservation and surrounding measurement issues, and as such, were solicited to contribute their expertise.<sup>78</sup> As such, they were involved in the development of technical frameworks for REDD, which was particularly useful to nations who were new to this issue area.<sup>79</sup>

That private regulators were involved in genuine problem-solving discussions with states about REDD provides some evidence that a logic of appropriateness was at work. Instead of tightly constraining private actors' input to limit their influence, a small number of private actors were invited into the earliest stages of the conversation—well before rules on these issues were put in place.

In addition, the re-appropriation of former conservation projects initiated by NGOs (who later became private regulators in their own right) provides additional evidence for the view that a logic of appropriateness is operating in the REDD phase of sinks policy. REDD has facilitated the re-appropriation of extant "conservation" projects as newly-christened REDD projects. As noted above, private actors have long-standing experience with forestry projects: many early conservation projects spearheaded by international NGOs aimed to preserve the world's forests and biodiversity. Some of these formerly "green" projects have recently become REDD ones.<sup>80</sup> For example, the Noel Kempff project was launched in Bolivia in 1997 by the Nature Conservancy, a Bolivian NGO and the Bolivian

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<sup>75</sup> These are the 2006, 2007 and 2008 Workshops on REDD convened in Rome, Italy; Cairns, Australia and Tokyo, Japan, respectively. Information on the meetings and their participants are available at [http://unfccc.int/methods\\_science/redd/items/4615.php](http://unfccc.int/methods_science/redd/items/4615.php).

<sup>76</sup> Betsill and Corell 2008.

<sup>77</sup> Interview with Ricardo Ulate, Policy Advisor, Conservation International. 10 August 2012.

<sup>78</sup> Interview. Ulate. Interview with Federica Bietta, Managing Director, Coalition for Rainforest Nations. 26 July 2012.

<sup>79</sup> Interview, Ulate.

<sup>80</sup> Others were subsequently registered as CDM projects.

government as a way to address climate change by avoiding deforestation. It was created before the advent of the CDM, and was a free-standing initiative, independent of the intergovernmental process. In 2005, it was reborn as a one of the earliest REDD projects. According to one negotiator with longstanding experience on deforestation issues, Noel Kempff has been "touted as a flagship" for dealing with complex measurement issues.<sup>81</sup> Thus, although the Noel Kempff project began as something completely independent from the intergovernmental process, it has since been embraced by states.

## 5. Conclusion

This paper has identified a curious shift in an important policy in the climate regime: the transformation of carbon sinks from a contentious issue to one accepted unquestioningly. I have argued that the growing legitimacy of private regulation has led to increasingly cooperative interactions between public and private authority, which in turn have helped produced this change. Early interactions between public and private rulemakers were governed by a logic of consequences, where states recognized private rules for strategic reasons. To the extent that they recognized private authority, they generally selected private rules that did not emphasize the "climate-plus" logic, where carbon sink projects also produced other public goods. During the more recent "REDD" phase of sinks policy, states structured interactions with private regulators in ways that allowed maximal private influence, rather than mere appearances of collaboration. They have included private regulators in early meetings about REDD before the agenda was clearly set and decisionmaking underway. Moreover, they have even agreed to implement privately-created rules around REDD as pilot initiatives in their home states. Public regulators are collaborating with private rulemakers and then implementing the results of those collaboration.

Interestingly, the domination of some standards in the generation of REDD credits points to another potential way that private authority may influence the future REDD regime. The prominence of standards such as the CCB and the Verified Carbon Standard has led some to speculate that these leaders will become the *de facto* standards in future REDD efforts. As noted earlier, among all REDD activities, both public and private, VCS is the only actor to create and sell REDD credits, and is dominating the REDD market.<sup>82</sup> Although it is too soon to tell what the final set of intergovernmental rules on REDD will look like, these are all indications that private regulations will have some role to play.

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<sup>81</sup> Email communication with Ian Fry, 26 July 2012. Measurement issues include reference levels (what is the baseline from which sequestration should be measured) and leakage (the extent to which sequestration in one area is offset by deforestation in another). He also noted problems with some of the information coming from the voluntary market.

<sup>82</sup> Diaz, Hamilton, and Johnson 2011.

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**Table 1: Growth in the voluntary market<sup>83</sup>**

Year	Market Value (\$US millions)	Market Volume (MtCO <sub>2</sub> )
2004	5.6	2.9
2005	43	6.1
2006	55	13
2007	263	43
2008	419	57
2009	358	47
2010	394	125
2011	569	87

**Table 2: Public-Private Interactions**

Phase	Type of Regulatory Interaction	Direction of interaction	Nature of interaction
Pre Kyoto	None	NA	Debt-for-nature swaps by environmental NGOs
Kyoto	Cooptation	Private → public	Private rules on the voluntary market recognize CDM standards
Kyoto	Cooptation	Public → private	National and sub-national governments accept certain private rules in their own policies.
REDD	None	NA	REDD credits created and sold on voluntary market, independent of intergovernmental activities
REDD	Coordination	Public → private	IGO consultations include private regulators
REDD	Coordination	Public → private and private → public	Private rulemakers include governments; governments pilot private rules.

<sup>83</sup> Hamilton et al. 2007; Kollmuss, Zink, and Polycarp 2008; Peters-Stanley et al. 2011.

