

# The semiotics of carbon: Atmospheric space, fungibility, and the production of scarcity

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*According to the Intergovernmental Panel on Climate Change, greenhouse gases are responsible for climate change, and for this reason, the reduction of these gases' emissions has become one of the main tenets of international climate change policy. Against this backdrop, parties at the United Nations Framework Convention on Climate Change decided that emissions trading would be one of the main instruments to reduce emissions. Through the critical examination of several documents about carbon markets, this article argues that the codification of carbon dioxide as a commodity constitutes a semiotic process that transforms atmospheric space into a more tangible product, providing it with several levels of fungibility. Within this semiotic process, carbon is also fetishized, acquiring a mystic power. While identifying dissonances between the belief in markets' efficiency to solve the problem of climate change and demands for governments to address the problem of excessive supply, this article asserts that carbon's fetishization results in a tautology sustaining carbon markets' existence; that is, the existence of carbon markets becomes an end in itself, independent of their efficiency in reducing greenhouse gas emissions.*

**Keywords** Carbon; Semiotics; Fungibility; Fetishization

Classified by the Intergovernmental Panel on Climate Change (IPCC)<sup>1</sup> as one of the gases with greenhouse effect,<sup>2</sup> carbon dioxide has been at the center of the policy instruments created by the United Nations Framework Convention on Climate Change (UNFCCC)<sup>3</sup> to combat climate change. Following assumptions about markets' efficiency, parties at the UNFCCC have decided that emissions trading should be a key strategy for combating this environmental problem and have identified carbon as the trade unit within these mechanisms. But what exactly is being traded? How has carbon been constructed as a commodity? Why have markets been elected as the main policy instrument to address the problem of climate change? I will argue that the constitution of carbon dioxide as a trading unit is a semiotic process, in which carbon acquires multiple levels of fungibility, and that through this semiotic process, carbon is fetishized, acquiring a mystic power. In the first part of this article, I focus on the creation of market-based mechanisms to address the problem of emissions, and then I focus on the semiotics of carbon. I next explore some of the dissonances between the free-market ideology underlying carbon markets and the governmental interventions necessary to sustain them, highlighting how demands to "save" carbon markets are a contradiction. I close with some conclusions about the semiotics of carbon and what I consider to be the fallacy of emissions trading. My intention in this contribution to economic anthropology is to challenge these markets' assumptions and constituting principles—starting with the commodity that sustains them—to enable new perspectives about the climate change problem.

During the negotiations leading to the Kyoto Protocol, parties considered several strategies for reducing greenhouse gas (GHG) emissions: the implementation of command-and-control policies<sup>4</sup> to enforce the reduction of emissions, a tax to discourage high emissions, or—inspired by the U.S. experience with cap and trade systems—a

trading mechanism that would function as an indirect form of taxation. The latter would prevail, not just because emissions trading was considered an equivalent to taxing emissions<sup>5</sup> (Baron and Colombier 2005:156) and a more effective means of pricing them but also because command-and-control measures were seen by many of the actors involved in these negotiations as “overly technology-prescriptive and innovation-unfriendly” (Yamin 2005:4). These same actors considered that a market mechanism would also be more effective in defining that price, given the diversity of GHGs, their different global warming potentials, and the multiplicity of emissions sources.<sup>6</sup> With this in mind, and because every market needs a quantifiable, uniform, and recognizable unit of trade, trading advocates decided that all GHGs would have the same value, equivalent to carbon, and that therefore they would be traded under the unit “tone of carbon dioxide equivalent,” or tCO<sub>2</sub>e.

The Kyoto Protocol<sup>7</sup> created three markets, designated as “flexible mechanisms,” to help industrialized countries mitigate their emissions: the International Emissions Trading (IET), the Clean Development Mechanism (CDM), and the Joint Implementation (JI). While the IET is a mechanism for trading emissions allowances assigned to countries under the binding reduction goals defined in the Kyoto Protocol, the JI and CDM consist of project-based offsetting mechanisms that generate emissions reductions—the former with projects implemented in industrialized countries, the latter in the so-called developing countries. The assigned amount units (AAUs) defined by Kyoto for parties with binding reduction targets, and traded under IET, served as emissions credits, which, after being spent, force parties to acquire more. On the contrary, parties that do not need all their credits can sell them in the market. Parties can also resort to emissions credits generated by reducing emissions projects to compensate for their excessive emissions. Thus projects developed under JI generate emissions-reduction units (ERUs) and CDM projects result in certified emissions reductions (CERs), all of which can be traded interchangeably among parties, for compliance purposes.

In a parallel process, the European Union (EU) created its own trading mechanism—the Emissions Trading Scheme (ETS)<sup>8</sup>—tied to Kyoto’s goals and instruments. Following Kyoto’s logic, European authorities assigned each country a certain amount of allowances (EU allowances, or EUAs) having considered the individual economic conditions of each country. They further agreed that countries whose emissions were below the established cap could sell their remaining allowances, while those requiring more could resort to the market and purchase any of the Kyoto units—AAUs, CERs, or ERUs. The linkage between the ETS and Kyoto’s flexible mechanisms was justified by European authorities as a means to achieve the goal of GHG reductions in a cost-effective manner, even though the use of these mechanisms would be later defined as “supplemental to domestic action” (Lefevre 2005:127–128). During the first two commitment periods,<sup>9</sup> the ETS allocated EUAs to energy utilities and other industrial sectors according to their estimated needs and reduction goals, whereas the third period has involved auctioning the majority of allowances. Owing to the link between Kyoto and the ETS, AAUs, CERs, ERUs, and EUAs have the same value for the purposes of compliance (Yamin 2005:18); that is, they are fungible.

During the Kyoto negotiations, the creation of the CDM was mostly advocated by the United States and other industrialized countries, on the assumption that reducing emissions in “developing” countries would be cheaper than doing so in “developed”<sup>10</sup> ones. U.S. officials used, as an argument, the country’s successful cap and trade experience to reduce sulfur emissions and were able to convince European authorities who, given their “regulatory culture,” were less receptive to market instruments (Yamin 2005:5). “Developing” countries’ officials however, were not only against this kind of mechanism but also, referring to the Kyoto principle of *common but differentiated responsibilities*, demanded more resources to develop less polluting technologies. The answer to their pretension was given in the form of the CDM: Because it implies implementing “clean technologies” that reduce emissions in “developing” countries, U.S. authorities argued, they would necessarily benefit from “foreign investment” and “technology transfer” promoted by this flexible mechanism.<sup>11</sup> Furthermore, “developing” countries would not follow the same “development” path of the industrialized nations; instead, they would jump straight from

*dirty* coal, oil, and gas to *clean*<sup>12</sup> renewable energies, sustaining their economic growth on “green” technologies only. The idea of developing carbon reduction projects in poor countries as a cost-effective mode of reducing emissions<sup>13</sup>—instead of enforcing low-emissions technologies in industrialized countries, for instance—places carbon in a situation similar to other commodities throughout the history of colonialism.<sup>14</sup> While establishing global connections between distant countries, these commodities assert and reinforce the asymmetries and power differences between them.

During the UNFCCC meetings, market advocates presented emissions trading as the most *efficient* way of dealing with the problem of climate change, arguing that its cost-effectiveness would be underscored by the parallel effect of promoting *clean development*. Since the beginning of the ETS compliance period, European corporations have been CDM’s main drivers, implementing emissions-reduction projects in poor countries. Yet, despite CDM’s purpose of promoting their “clean development,” the majority of the projects were undertaken in China and India, leaving the poorest countries of Africa and Asia outside of this supposedly *clean development* path.<sup>15</sup> Furthermore, most of these projects concerned HFC-23 conversion, which not only includes no technological innovation but also generated so many controversies that European authorities banned the use of CERs originated by these projects in May 2012.<sup>16</sup> In their first years of operation, the CDM and the ETS registered a significant growth, both in transaction volume and price of emissions allowances, reinforcing market advocates’ assumption that a high carbon price would lead to reductions in emissions. However, this trend has changed significantly since 2008, with carbon prices falling dramatically,<sup>17</sup> driving carbon markets into crisis. Two main trends have defined this crisis: lack of demand and low carbon prices, to which the failure to promote clean technologies in “developing” countries can be added. Indeed, in its 2015 report on carbon pricing, the World Bank acknowledged the “declining market trend for Kyoto credits” registered in 2014 and 2015 and admitted that, “given the lack of demand, supply continues to head downwards . . . preventing any significant price recovery from the historically low prices” (Kossoy et al. 2015:34). Despite the fact that this report never refers to CDM’s failure in promoting new technologies, the data provided are telling: In 2014, the number of projects registered was 53 percent lower than in 2013, and the number of CERs issued was 61 percent lower; also significant is the fact that the number of primary CERs traded was 70 percent less than in the previous year, while the average price of CERs in the secondary market<sup>18</sup> declined more than 50 percent (Kossoy et al. 2015:36). All this means that reducing emissions projects are not being implemented in the “developing” world because there are too many allowances in circulation, leading to low prices. Therefore the ultimate goal of carbon markets is not being fulfilled; there is no price incentive to replace high-emissions technology because it is cheaper to buy emissions allowances.

The choice to elect emissions trading as the key strategy to combat climate change follows from the categorization of emissions as an *externality*. In classic economic theory, an *externality* is something not accounted for when planning an action (cf. Arthur Cecil Pigou cited in Lane 2015:41). Therefore an environmental crisis such as climate change constitutes a failure to calculate the costs of emitting carbon into the atmosphere during human actions. Carbon markets address this failure by *internalizing* GHG emissions—understood as negative *externalities*—rendering the crisis visible to decision makers and defining the appropriate value for these externalities (Lohmann 2009a:500). The choice to internalize emissions through a market mechanism reflects the assumption that markets are more *efficient* (MacKenzie 2006) than public policies, like taxing carbon emissions<sup>19</sup> or enforcing less polluting technologies. Notwithstanding the intuitive use of the term *externality* to describe something not taken into account, nothing is *outside* of social processes, in the same way that there are no *inner* or *external* worlds (Latour 2013). Even if not accounted for when planning an action, carbon emissions were never outside of processes of production, which means that the recognition of this form of pollution as something that needed to be addressed, and its definition as an externality, was a political choice. This externality was thus “invisible” (cf. Fortun 2014), until the political, corporate, and academic actors with policy-making authority decided to render carbon emissions visible (by declaring the need to *internalize* them) and defined the appropriate means to do it: *efficient* markets. The

creation of carbon markets is therefore based on a particular notion of *the environment*, conceived as a balance between inputs and outputs (Lane 2015). A notion that is responsible for how the problem of climate change has been formulated and, accordingly, which choices are available to address it, that is, carbon markets are not only a product of efficiency and cost-effectiveness assumptions but also a reflection of such a notion of *the environment*. Against this backdrop, carbon as the commodity being traded in these markets is the product of a semiotic process, to which I will turn now.

## Atmospheric emptiness

*Carbon markets* is an expression that aggregates several systems of emissions trading, encompassing all GHGs in the unit tCO<sub>2</sub>e. However, and to be more accurate, what is traded in these markets is not carbon *per se* (or any other gas) but atmospheric space—theoretically empty<sup>20</sup>—that can be filled up with polluting emissions. Within the different markets, countries and companies can trade emissions allowances (such as AAUs or EUAs) or emissions reductions (CERs and ERUs) generated through reducing emissions projects. In both cases, *empty atmospheric space* is the notion at their core. Emissions allowances are based on the assumption that there is some space in the atmosphere that can be occupied with more emissions; using estimates of how many parts per million of carbon the atmosphere can *stand* (to maintain the global temperature at a safe level),<sup>21</sup> authorities dictate the amount of allowances that can be distributed according to countries' reduction goals.<sup>22</sup> Emissions reductions, in turn, create *new empty space* by compensating for the not-yet-emitted; that is, emissions-reduction projects create more atmospheric space to be filled up. Whereas allowances assume a relatively stable, "framed" atmosphere in which *empty spaces* are defined through the allocation of allowances, offsetting implies a more dynamic perspective of atmospheric space, one that is constantly "overflowing"<sup>23</sup> with the addition of more *empty space* through emissions-reduction projects.

The idea of carbon trading follows, therefore, from an abstract process of constructing *emptiness* in the atmosphere. This construction is mostly based on two concepts, "baseline" and "additionality," on which all carbon accounting models build. A CER or ERU is based on, first, the idea of a future reduction of emissions before they take place, which implies a *base* from which to define that reduction, and, second, the assumption that the action to reduce emissions is in *addition* to what would normally happen. In other words, the construction of the idea of *emptiness* upon which carbon is produced as a commodity relies on three things: (1) a time gap between a present situation and a future emissions scenario, (2) a speculation<sup>24</sup> about the evolution of emissions and possible actions taken (or not) to address them, and (3) the idea of a boundless atmosphere in which the carbon emitted in one place can be compensated for in any other part of the world,<sup>25</sup> regardless of the problems that atmospheric pollution can cause in specific locations. The "environmental credibility" (Michaelowa 2005:289) of market mechanisms depends on baseline and additionality issues, and that is why the "international community has ... developed a complex international process to determine baselines and have them independently checked" (Michaelowa 2005:290). However, and as market advocates recognize, poor countries and emissions-reduction project developers "have an incentive to overstate the amount of emissions reduction achieved," thereby increasing their revenues<sup>26</sup> (Michaelowa 2005:290).

Time and space exercise an important influence on the ways in which atmospheric *emptiness* is constructed. With respect to the axis of time, an emissions reduction is only validated by the CDM Executive Board once the project developer proves that future emissions (already sure to be higher than current ones) might be eliminated by the implementation of a certain technology. This time gap is a necessary condition to construct a scenario upon which the reductions will be estimated—in opposition to the idea that current emissions can be immediately reduced with the implementation of that technology. There is, therefore, a time gap, which manifests in terms of the fact that the possible saving must be projected into the future and that future usage will already, most likely, be

higher for the system as a whole. In this way, we can see that calculating emissions reductions requires a double act of estimation. This temporal dimension leads to a compounding of symbolic interdependencies, leading some participants to be suspicious. Not only can baselines and emissions scenarios be estimated spuriously but, adding to the symbolic pile-up, the anticipated reductions must then be reintegrated into a present-day market so another industry can buy them and emit accordingly. It is this concatenation of temporal disjunctures and estimates that grounds my claim that these projects act as if they were creating atmospheric space that can be filled up, instead of just reducing emissions in the present.

There is a spatial dimension, too. Because these trading mechanisms assume that reducing emissions in one part of the globe can be compensated in another,<sup>27</sup> it follows that emissions are never addressed at their respective sources but rather where it is cheaper, that is, in the “developing” world. Thus, these projects are not about reducing emissions per se but about creating additional space for industrialized countries. An example of this might be that efficient cookstoves in India would allow a German industry to emit the same amount of GHGs that were reduced by those cookstoves. In the end, no reductions will have taken place—only the creation of an atmospheric space in India and its transference to Germany.

This temporally and spatially displaced atmospheric *emptiness* is too hard an abstraction to be traded directly. It is therefore rendered as carbon, which emerges as a symbol of the pollution that is intended to be eliminated through the workings of the markets. The fungibility between all Kyoto units (a fungibility equally present in the ETS owing to its linkage with Kyoto) follows from the fact that all these units are based on the idea of an *empty space* in the atmosphere that can be filled up. What varies is whether that space was already *there*—based on the accounting of CO<sub>2</sub> concentration in the atmosphere and the binding commitments agreed in Kyoto—or *produced* through “additional” projects. Yet, the idea of space already *there*, is equally produced, because both the amount of safe CO<sub>2</sub> concentration levels and the commitments agreed in Kyoto (or, more recently, in Paris) are political decisions; that is, the limits of the space that can be filled up by emissions are defined by political decisions, even if carbon measurements are presented by authorities, environmentalists, and market agents as belonging to the realm of science.

The constitution of carbon as an exchange unit is thus a semiotic process in which carbon, as a symbol, simultaneously aggregates several meanings. It symbolizes an intangible commodity that I have called *atmospheric emptiness*, it indexes the environmental problem that is intended to be solved through carbon trading, and it incorporates all GHGs through the exchange unit tCO<sub>2</sub>e. This semiotic process not only imbues carbon with different meanings but, more importantly, establishes its value, which is not necessarily monetary. Indeed, despite the extremely low prices of this commodity, these markets continue to be extremely valued by governments, corporations, and some environmental nongovernmental organizations (NGOs) in the context of all climate change policies.

As stated previously, all GHGs are fungible, instead of being individually accounted for by their different greenhouse potentials. These potentials, and how different gases become commensurable, depend on the authority of the IPCC, yet estimates of this commensuration are “black-boxed” (MacKenzie 2009:446) and sometimes “admitted to be gross oversimplifications” (Lohmann 2008:361). The semiotic production of carbon, by partially occluding the conditions of carbon production, impedes this “black-boxing” (or “oversimplification”) of *spilling over* into the market (MacKenzie 2009:446), which, otherwise, would comprehensibly challenge carbon markets’ credibility. The fungibility of carbon—extended to its use as a financial asset, integrating investment portfolios, and serving for hedging and risk management purposes—produces social relationships (Cattellino 2009) among a large group of people: project developers, carbon traders, businesspeople, governments, authorities, scientists, and environmentalists, across the international, national, and local scales of carbon’s circulation as a commodity, and a symbol of the environmental problem that carbon markets are intended to solve. This network<sup>28</sup> of people, through their entanglements, permanently reinforces the semiotic process of carbon production, both

by reasserting carbon's fungibility and by sidelining the process by which *atmospheric emptiness* is replaced by the unit tCO<sub>2</sub>e.

Given carbon's intangibility, and following a classic anthropological critique of the commoditization of nature (cf. Castree 2003; Smith 1984), some authors have viewed carbon as an example of a "fictitious commodity" (Beymer-Farris and Bassett 2012). But carbon is, in fact, produced: physically, as an *externality* of processes of production and as a chemical element in the biology of living beings, and semiotically, through the replacement of the idea of atmospheric space and as the symbol of an environmental problem. Hence, there is nothing fictitious about carbon as a commodity. Criticizing emissions trading based on this type of argument, or that such trading constitutes an example of Polanyi's 2001[1944] *great transformation*, in which markets have subsumed society, only takes us so far. These markets are not separate from politics or society, or even from science (Callon 1998, 2009), in much the same way that the economy is not separate from culture (cf. Sahlin 2005; Latour 2013). Carbon markets cannot be analyzed outside of their own conditions of production, and their emergence should be understood as the product of the cultural inclinations of a community<sup>29</sup> that, first, decided to define carbon as an *externality* and, second, deemed markets to be the appropriate mechanisms for *internalizing* it. These markets cannot be separated, either, from the multiple controversies generated around them (Callon 2009:541), as market agents have responded to critiques addressed to the Kyoto instruments and the ETS.<sup>30</sup> There is thus a process of mutual constitution between all these spheres (Callon 2009:546), and that is why identifying the modes through which carbon is semiotically produced can generate new controversies, opening opportunities to look at the problem of climate change from a different perspective.

Taking carbon as a fictitious commodity, or ignoring the semiotics involved in its production, confines critiques of emissions trading to issues of commodifying nature, while at the same time reinforcing the fetishization of carbon. I understand this fetishization as the obfuscation of the processes through which carbon dioxide is produced as a commodity—a process I have described as being semiotic—and the sort of "power and even dominance" (Taussig 1980:31) that carbon has within a broader set of policies addressing climate change.<sup>31</sup> As stated earlier, carbon comes to be the symbol of the environmental problem that needs to be solved and the centerpiece of a complex assemblage of policies, corporate activities, scientific research, and people involved in these various activities. The *mysterious* (cf. Marx 1990[1867]) character of carbon as a commodity emerges from the elision of its semiotic production and from its constitution as an *externality*, placing it outside of social processes. Its power follows from its constitutive role in the production and portrayal of a specific environmental problem to which there is seemingly only one solution: carbon markets. In other words, the semiotic production of carbon as a commodity and its concomitant fetishization preclude other forms of addressing the problem of climate change and, consequentially, impede the formulation of alternative solutions (eventually found outside of market logics).

## Saving markets from coma

The carbon market is now in a coma, until a clear intervention takes place.

—emissions trader quoted in the *Economic Times*, April 17, 2013

Carbon markets were created based on the assumption that they would be more efficient than command-and-control policies in addressing the problem of climate change, given markets' capacity to self-regulate. This means that once markets are set, little if any regulatory intervention should be needed and, with time, the effects of carbon trading should be noticed in the climate. Despite this assumption, governments and other regulators have often intervened in these markets, mostly to correct their operations, as in the case of financial

frauds<sup>32</sup> or the illicit recycling of emissions reductions.<sup>33</sup> Other interventions have concerned the scope of reducing emissions projects, leading to the implementation of more stringent rules.<sup>34</sup> However, and despite markets' presumed capacity to self-regulate, the prices of carbon have been plummeting since 2008, in some cases by as much as 90 percent, putting the market in a *coma*. Given the seriousness of the situation, European authorities, market investors, and carbon project developers have been debating possible solutions, under the assumption that "saving" carbon markets is imperative to solving the problem of climate change.

### Changing the rules

European climate change policies include a target of 20 percent emissions reduction by 2020, and this goal dictates the amount of emissions allowances granted to European companies. Owing to the crisis that has plagued Europe since 2008, causing a slowdown in industrial activities, the allowances supply pool revealed itself excessive for industry's demands. This meant that the 20 percent reduction goal could be achieved without actually implementing any explicit reduction effort — surely a positive development for climate stabilization. At the same time, however, this industrial slowdown compromised ETS's very existence due to an excessive supply of "empty space." Hence some European leaders suggested increasing the reduction target to 30 percent, generating scarcity, and, consequently, increasing prices. This suggestion has achieved further support as prices have continued to decrease, leading the European Climate Commission to press all member states to support a change in the rules of the ETS. Despite Germany's and Poland's strong opposition to this policy change, market participants continue to insist on its importance to increase carbon prices, forcing technology conversion and reductions in emissions. During a World Bank event where the trends of voluntary carbon markets were being discussed, a legal adviser claimed that more policies were needed to send clear signs to markets, because "markets do not work outside of policy, and policy is what defines the value of markets."<sup>35</sup> Hence, according to this statement, markets are only more efficient than public policies to the extent that public policies open opportunities for markets (and intervene when crisis arise) — even if such interventions underscore carbon markets' ineffectiveness.

### Backloading

If intervening in the market by changing its rules already betrays a certain dissonance regarding assumptions about markets' self-regulation and efficiency, the suggestion of backloading allowances further denotes markets' constant need for regulation. The idea, initially discussed in 2011, consisted in postponing the auctioning of 900 million allowances to 2019–20, generating a short-term scarcity until long-term solutions to save the European carbon market could be applied. This proposal was voted on in the European Parliament in 2012, which rejected it by a narrow margin, leading to new discussions on measures to sustain the ETS. In November 2013, a majority of EU members approved postponing the auction of €900 million worth of emissions certificates, in a desperate attempt to invigorate the ETS ahead of the Warsaw climate conference in December. Even though scarcity is always socially produced (Harvey 1996:146–147), this governmental intervention in a mechanism portrayed as self-regulating was taken even further with market participants and government officials switching roles. Thus, whereas Shell and 40 other companies placed a full-page advertisement in the *Financial Times* the day before the first voting, "saying backloading was needed as a stopgap measure" (*Economic Times* 2013), a spokesman for the British Conservative Member of European Parliament declared,

The EU ETS was established as a market-based mechanism and must continue to operate according to market principles. We are therefore concerned about the impact of commission intervention to adapt the auction timetable in order to manipulate the carbon price. We fear it will only serve to discourage green investments, affect transparency ... and undermine much-needed market predictability as the EU economy strives to find a way out of the economic crisis. [Harvey and Vaughan 2013]

Whereas corporations' leaders expressed their concerns regarding the low carbon prices (which affect investments and profits), some public officers were more concerned with the integrity of the markets' self-regulation.

### The return for Soros

The most original suggestion to save carbon markets came from a consultant group, which appealed “for a player with courage, financial muscles, and experience on how to manipulate a market” (DifferGroup 2013:2)—someone who could take advantage of this opportunity. This player was clearly identified as someone like George Soros, the business magnate who made his fortune in the exchange market. Indeed, “this could be a perfect opportunity for somebody out there with deep pockets, the right experience, and a desire to make the carbon deal of all time—while at the same time doing the CDM and the climate a huge favor” (DifferGroup 2013:3). This player would remove “a substantial chunk of CER supply from the market at the current record-low prices” (DifferGroup 2013:1), developing “a strategy targeting EU ETS” (DifferGroup 2013:3). Moreover, “if there is not real EUA shortage, there is always a possibility for ‘Soros’ to take this even a step further and start buying EUAs. Then we will not only see the return of CDM, but of EU ETS as well” (DifferGroup 2013:5). Reminding us that “financial players usually move much faster than policy decision makers” (DifferGroup 2013:2), consultants from DifferGroup ended their dramatic appeal this way:

Current efforts at propping up CER prices through coordinated public-private initiatives seem to be so politically complex and slow-moving that the CDM and the climate could lose the battle while preparing to do combat. A “Soros” with the necessary capacity and interest could theoretically be the knight in shining armor—and a richer one in that case—setting the cost of carbon at a level that better reflects what is needed for carbon markets to deliver its share of the reductions required to reach the target of limiting the global increase in temperature to 2 degree Celsius. [DifferGroup 2013:5]

These consultants raise no doubts about the efficacy of carbon markets to solve the problem of climate change. They, too, share the assumption that markets need to be saved, but instead of a regulatory intervention, they appeal for a market manipulator who can create scarcity. Creating scarcity is part of all suggestions to save carbon markets, whether the debate is at the governmental level or among market agents. By insisting on the *efficiency* of markets, all these actors take on the mission of saving them, to the point that the environmental issue at their core (climate change) comes to inhabit a secondary place, being replaced by the problem of scarcity. One example of this situation is the World Bank's annual report on carbon markets, where the authors state that the EU has developed “too many” low-carbon initiatives, raising “concern as to whether these mechanisms can co-exist without undermining one another” (Kossoy and Guigon 2012:22), such as the U.K. carbon floor price, designed “to encourage investments in new low carbon generation” (Kossoy and Guigon 2012:22), and the European Energy Efficiency Directive, incentivizing “energy efficiency at several stages of each member state's energy chain” (Kossoy and Guigon 2012:23). According to the World Bank, both initiatives “will create a surplus of allowances that may potentially push EUA prices down” (Kossoy and Guigon 2012:23).

Throughout all these debates, the central question concerns the law of supply and demand, and little attention is paid to the assumptions underlying the constitution of these markets. Nobody claims that there is too much *atmospheric emptiness* to be filled up with GHGs, and yet, the claimed need to produce scarcity reflects precisely this proposition. Because the constitution of carbon as a commodity—specifically, the replacement of atmospheric space into the less abstract idea of carbon—is not questioned, market agents' calls to generate scarcity and save the markets are a contradiction in terms. That is, generating scarcity would imply not only limiting the allocation of emissions allowances but also terminating all project-based trading mechanisms—the CDM, the JI, and, eventually, all voluntary markets—if concerns for “environmental integrity” were to be taken radically.

## Conclusions

Defined as an *externality* that needs to be *internalized*, carbon dioxide is constituted as a commodity through a semiotic process prompted by a certain idea of the environment, encapsulating clear distinctions between what is *internal* and *external*. Markets emerge, thus, as the most efficient intermediaries between these supposedly different realms. Carbon trading emerges also from the idea of atmospheric space that can be filled up: Whereas emissions allowances are based on the idea that there is *empty space* out there, emissions reductions create such *emptiness* through projects that compensate for the atmospheric pollution generated by industrialized countries. The semiotics of carbon is the replacement of this supposed *emptiness* into a less abstract category—tCO<sub>2</sub>e—fungible in terms of the different GHGs and of the different Kyoto and ETS units. This semiotic process has several layers: the replacement of *emptiness* into something less intangible, the fungibility of the unit, and that unit's indexical relationship with the environmental problem that markets are supposed to solve—climate change. Within these different layers, carbon acquires different values. Carbon's fungibility, equally reflected in the assumption that compensating emissions can be carried out in any part of the world, independently of their source, puts carbon in the same position as other commodities throughout colonial history; that is, carbon trading often embodies power asymmetries between the actors involved. The assumptions inherent in the creation of the CDM reflect some of those asymmetries, namely, the moral prescription directing poor countries to pursue *clean development*. This fungibility has been described by other authors as a process of black-boxing; I rather call it fetishization because, besides the obfuscation of its conditions of meaning and value acquisition, carbon also emerges with a certain mystic *power*, sidelining alternative means of addressing the problem of climate change.

Stating that the constitution of carbon as a commodity is a semiotic process does not mean that carbon is a fictitious commodity or that it is less valid than a tangible commodity. Carbon is produced as a commodity by governments, scientists, environmentalists, and all market agents that have rendered it a symbol of atmospheric space and of the problem that needs to be eliminated and that have decided upon its multiple fungibilities. Furthermore, all the carbon accounting methodologies created by scientists and market agents provide tangibility to carbon. But to ignore this semiotics is tantamount to reproducing the assumptions that sustain markets' rationale, thus precluding thinking about climate change in different ways. Since 2008, carbon markets have plunged into a crisis, leading their agents to call for the generation of scarcity. Under the basic assumption that trading mechanisms are more efficient than public policies, market agents have demanded several types of intervention, overriding the problem of how to reduce emissions to focus on a new one: *how to generate scarcity*. In the process, markets' existence has become a tautology: *Carbon markets exist, and if they exist, it is because they work; because they work, they must continue to exist*. Although producing scarcity does not necessarily contradict markets' principles, what is bizarre is that these claims reflect a contradiction: If carbon's semiotics is taken into account, what is at stake is the excessive *emptiness* of atmosphere, from which necessarily follows that saving markets implies eliminating markets, ceasing the creation of additional atmospheric space through emissions-reduction projects. Ultimately, carbon's fungibility needs to be challenged, too, because accepting the different global warming potentials of GHGs would be a way of generating the desired scarcity.

In conclusion, the case of emissions trading shows how such markets depend on semiotic processes and how their existence became an end in itself. But because we are no more *homo economicus* (Callon 1998) than *homo symbolicus*, economic anthropology can help us in understanding these semiotic processes, contributing to ongoing discussions about climate change, offering alternative understandings of environmental problems, and suggesting new solutions.

## Notes

- 1 The IPCC was created by the United Nations Environment Programme and the World Meteorological Organization in 1988 to provide technical and scientific information about climate change and its impacts.

- 2 According to the IPCC, besides carbon dioxide, the other gases with greenhouse effects are methane, nitrous oxides, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and hexafluoride (SF<sub>6</sub>). The first IPCC report calling for the need to limit the emissions of greenhouse gases was released in 1990.
- 3 The UNFCCC is currently constituted by 195 parties and was created in 1992 with the goal of limiting the average global temperature increases as a result of climate change.
- 4 Command-and-control policies (common in the environmental sector) consist of direct regulations targeting specific industries or activities, whose noncompliance may lead to sanctions. These kinds of policies intending a change in behavior are the opposite of incentives, such as subsidies.
- 5 Because the purpose of a tax or of a trading mechanism is to raise the cost of emitting to change behaviors, theoretically, either one fits that purpose.
- 6 Lohmann (2005:205) notes that northern corporations also pushed for a trading solution that, "unlike taxation and auctioning, distributed free property rights in a hitherto 'open access' global dump."
- 7 The Kyoto Protocol was signed in 1997 and ratified by 191 parties, not including the United States. It only entered into force in 2005. The commitment period ended in 2012; thus parties negotiated, in December 2012, a new transitional period (not adopted by all the parties committed in Kyoto) from 2013 to 2020. In the recent Paris Conference (December 2015), the parties agreed to further steps toward a new agreement to replace the Kyoto Protocol.
- 8 The then 15 members of the EU ratified the Kyoto Protocol in 2002, which required that this group of countries reduce "its aggregate emissions of a 'basket' of six greenhouse gases (GHGs) by 8 per cent over the period 2008–2012 compared to its 1990 emissions" (Lefevere 2005:75).
- 9 The first period ran from 2005 to 2007, the second from 2008 to 2012, and the third started in 2013 and will terminate in 2020.
- 10 Although I find this terminology very problematic, I will use the *indigenous* vocabulary when referring to the UNFCCC because it is revealing of the processes and logics underlying the international climate regime.
- 11 Yamin (2005:7) notes that market advocates like the governments of the United States, Canada, Japan, Australia, Norway, and New Zealand were more interested in emissions trading only than in project-based mechanisms (like the CDM) because of their higher transaction costs.
- 12 This kind of vocabulary, including the name of Kyoto's flexible instrument, *Clean Development Mechanism*, begs for a discursive analysis that I cannot develop here. I note, though, that this clean–dirty rhetoric is clearly based on moral prescriptions that intend to define what is wrong and right in the Global South's "development" path.
- 13 Carbon has been compared to other natural resources exploited by industrialized countries, reinforcing conditions of structural poverty (cf. Bumpus and Liverman 2008:133).
- 14 Sidney Mintz's (1985) work on sugar provides an example of this, as well as West 2012 on coffee, Sodikoff 2012 on timber, or Mitchell 2011 on oil.
- 15 Karen Ho (2009:308, 350) explains this same logic for investment banks: Despite their claims of operating globally, "investment banks mainly have offices and 'do deals' in places that have 'mature' financial markets and a sizable number of corporations."
- 16 MacKenzie (2009) addresses some issues concerning HFC-23 decomposition projects, referring to how calculations for these gases' global warming potential are black-boxed.
- 17 European carbon permits, traded at about €30 per ton, were hovering at about €5 per ton or less in 2013 (Reed 2013), whereas primary CERs, traded at around US\$12 in 2007 and 2008, reached US\$0.52 in April 2013, registering a fall of 91 percent from a year before (Carr 2013). The World Bank also recognized that 85 percent of emissions "are priced at less than US\$10 per tCO<sub>2</sub>e" (Kossov et al. 2015:17).
- 18 A primary CER is bought directly from original project owners; when these CERs are resold, these transactions occur in the secondary market.
- 19 Baron and Colombier (2005:156) explain that in economic modeling, a tax is equivalent to emissions trading in terms of efficiency. I believe this equivalence to be a fallacy because the performance, scope of government intervention, and diversity of actors involved vary in each of these instruments, leading to different consequences.
- 20 Actually, there is no such thing as an *empty* space: "In the advanced capitalist world today we all conceive of space as emptiness, as a universal receptacle in which objects exist and events occur" (Smith 1984:95). "Places are never stable, and space is never empty" (Raffles 2002:183).
- 21 Yamin notes, "Although the IPCC has declined to define what a safe level of GHG concentration in the atmosphere should be, it has concluded that stabilization of CO<sub>2</sub> concentration at *any* level requires eventual reduction of global CO<sub>2</sub> emissions to a small fraction of the current emission level" (2005:xxxvii). The NGO 350.org, however, claims that CO<sub>2</sub> has to be reduced from 400 to 350 ppm for a safe climate on the planet.
- 22 The Kyoto Protocol established binding reduction commitments, which were recently replaced by nonbinding nationally determined contributions during the Paris Agreement in 2015.
- 23 Here I am extending Callon's (1998) idea of "framing" and "overflowing" in his inquiry to the *Laws of the Markets*. There is thus a dynamic relationship between the idea of a framed atmosphere and a continuously growing one (through the addition of new *empty spaces*).
- 24 For Bumpus and Liverman (2008:136), additionality criteria rely on project developers describing future scenarios that are open to exaggerated baselines and claims of emissions reductions that have not actually occurred.
- 25 Bumpus (2011:622) talks about a "spatial abstraction because the carbon dioxide reduced in one place must be 'seen' to be the same as carbon dioxide that is emitted in another."
- 26 Lohmann (2009a:511–513) also mentions the "perverse incentives for credit seekers" to define baselines lowest as possible and the "business as usual" scenarios the "highest-emitting possible, in order to make the proposed projects appear to be saving as much carbon as possible."
- 27 This abstraction "obscures the significance of place" and downplays "the different ecological effects that pollution can have in different biomes" (Lohmann 2008:362).

- 28 I am using *network* in Granovetter's sense, as explained by Callon (1998:8): a network in which its agents' identities, interests, and objectives (and their practices) "are variable outcomes which fluctuate with the form and dynamics of relations between these agents."
- 29 This community includes authorities advocating for carbon markets, environmental NGOs, scientists, business corporations, and investors.
- 30 The CDM Executive Board has implemented changes in projects' methodologies, responding to critiques about lack of "environmental integrity."
- 31 Unlike the "black-boxing" concerning the trading unit tCO<sub>2</sub>e, pointed out by MacKenzie (2009) or Lohmann (2005, 2009a, 2009b), I prefer the term *fetishization* because of the *mystic power* this commodity has acquired in discourses and practices about climate change.
- 32 In 2011, the European authorities reported a major VAT fraud on emissions allowances trading that may have cost European taxpayers €5 billion (Inman and Webb 2011).
- 33 Also in 2011, it was reported that the Hungarian government had sold to Japan almost a million CERs that had already been used by European companies, undermining the "environmental integrity" of CDM and ETS instruments.
- 34 Such as the ETS ban on allowances generated through HFC and N<sub>2</sub>O conversion projects.
- 35 Every year, the Ecosystem Marketplace launches its report on the *State of the Forest Carbon Market* in an event open to business investors, carbon traders, environmentalists, and researchers. Attendance to this event was part of my fieldwork within the "carbon-community" in the Washington, DC, area.

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