Performative Equations and Neoliberal Commodification: The Case of Climate

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ABSTRACT: All processes of commodification are different. Some "succeed" better than others. Because the neoliberal era has witnessed an unprecedented expansion in theoretical ambitions for commodification (whether commodification of species, biodiversity, security, public services, water, ideas, genomic information, climate benefit and so forth), paying attention to the particularities and resistances associated with each attempted commodification process has never been more important. Using the example of climate service markets, this chapter proposes and demonstrates one method for breaking down into bite-sized chunks the radical efforts at commensuration characteristic of neoliberal commodification, so that accounts of the relevant actors, methodologies, institutions, contradictions and outcomes can be more easily organized. Applying this tool – performative equations – helps explain why the failures of climate service markets go far beyond those of more traditional markets.

Introduction: The Dilemmas of Theory

Between the insight that current economic and environmental crises are being exacerbated by the new forms of commodification characteristic of neoliberalism, and the detailed specification of what those forms are, lies the work of a hundred lifetimes. Commodification is a many-splendored process, and it has to be. All commodities-in-the-making are different, and so are the series of acts and actors, impulses and resistances, that contribute to, or block, their making or unmaking. The proliferation of ambitious, variously contested commodities that has sprung up in the neoliberal era – from wetland offsets (Robertson 2000, 2004) and collateralized debt obligations to genome information products (Sunder Rajan 2006), public services (Huws 2011) and species (Pawlicek and Sullivan 2012) – only amplifies the diversity. As the work of scholars as varied as Elinor Ostrom (Ostrom, Gardner and Walker 1994), Viviana Zelizer (1995), Colin Williams (2005), Margaret Radin (1996) and Brett Frischmann and Mark Lemley (2006) confirms, the idea that there exists a single, uniform process of commodification operating everywhere on the as-yet uncommodified is as unfounded as the quasi-deistic notion, equally emblematic of the neoliberal era, that everything already is a commodity (O'Connor 1994).

The shorthand "the commodification of nature" is loaded with a particularly great breadth of meanings. If deployed without awareness of the teeming multitude of differing cases, each with their own complexities, the term runs the risk of confusing and clarifying in equal measure. Karl Polanyi (1944) and John Maynard Keynes (1936), following a path opened by Marx, highlighted some of the distinctive features and pitfalls of the commodification of land. In the neoliberal era, Marxist-inspired thinkers, actor-network theorists and others have revealed some of the diversity of the "black boxes" that have to be opened to expose the predicaments specific to the commodification of many other aspects of "nature" (e.g., Kloppenburg 1988; Bridge 2000; Holm 2001; Boyd 2001; Martinez-Alier 2003; Henderson 2003; Robertson 2004; Mansfield 2004; Bakker 2004, Robbins and Luginbuhl 2005; O'Neill 2006) – including those occasioned by various types of what Martin O'Connor (1994) calls "nature's resistance" or what Noel Castree (2003: 285) calls "contradictions between the materialities of nature and those of the commodification process". Continually reminding such scholars of the particularities of individual struggles over commodification is a worldwide spectrum of confrontations at the grassroots over issues ranging from the enclosure of community forests to the expansion of credit involved in microfinance.

Nowhere is attentiveness to the diversity of commodification more crucial than in the formulation of environmentalist strategy. “Our Earth is not for sale” may be a good rousing slogan for Friends of the Earth International, “*tu no puedes comprar el sol*” a felicitous line in a popular anticapitalist anthem by the Puerto Rican group Calle 13, and “Nature™ Inc.” an excellent title for an international conference of critical academics on problems connected with current trends in the capitalization of nature. But without extensive explication, such throwaway phrases are too abstract to give much idea of where to locate the challenges and opportunities that are exercising so many movements and thinkers today, or of where and how to make critical interventions. In reality, Nature (whatever one might mean by this questionable “keyword”) has been Incorporated in one form or another for a good long time, and various bits of Earth have been on the block for many centuries. What, if anything, is really new, and if what is new is as frightening as often claimed, what is to be done about it?

Formal definitions of commodification are of limited help: their concision tends to be in inverse proportion to their applicability. Take, for example, the definition offered by Karen Bakker, one of the subtlest scholars of the commodification of water, who is at pains to dispel what she rightly regards as confusions among commodification, privatization and commercialization. Commodification, Bakker says, is the “creation of an economic good, through the application of mechanisms to *appropriate* and *standardize* a class of goods and services, enabling them to be sold at a price determined through market exchange” (2007: 103; emphasis added). One of the virtues of this definition is that it pinpoints the enduring prominence, in commodification, of ownership, control and measurement. Yet such definitions are considerably less illuminating today, in an era of financialization and a growing “green economy”, than they might have been a century or two ago. For one thing, commodification is not necessarily as closely associated with appropriation, in the usual senses of the word, as it used to be. To take one instance, the commodification of price changes (or, more precisely, of price change certainty and uncertainty) involved in today's vast market in futures does not involve the appropriation of price certainty in any conventional sense. Nor is appropriation *sensu stricto* involved in the widespread practice of short-selling or “shorting”. Rather, securities are only borrowed, to be sold when the price is high and bought back when the price is low, even though not only the securities but also the underlying assets are also thus woven into expanded networks of exchange and thus, arguably, intensified commodification. As a whole, complex financial derivatives are types of commodity that are only tenuously related to seizure or assertion of property or access rights. The special powers they exert over land, water and air are tangible, and attributable in a sense to expanded commodification, but are not achieved through standard processes of appropriation. The commodification of pollution presents another example. To avoid “takings” lawsuits from business that could result from governments' tightening emissions restrictions under cap and trade systems, tradable pollution permits are generally claimed in legislation *not* to be property rights of any kind – in spite of being universally treated as assets and commodities. Hence when European corporations are granted monetizable rights to dump greenhouse gases in the atmosphere or to use foreign vegetation or soil to soak up their carbon dioxide emissions, something is being appropriated, but that appropriation is hedged about and governed in novel ways.

Bakker's criterion of standardization, similarly, falls short of capturing some of the most significant innovations in post-1970 commodification. Standardization is a process best applied to things that, to borrow the useful phrase of Donald MacKenzie (2009), have already been, at a basic level, “made the same”. For example, it was only because wheat was already a universally-recognized classification that the Chicago Board of Trade, in the 19th century, was able to formulate practices

for isolating categories such as “No. 2 spring wheat” as standardized commodities in an era in which grain was being transformed from a product that stayed in sacks from farm gate to final buyer into a “golden stream” coursing through railroad cars and grain elevators (Cronon 1991: 97-147). No such pre-existing classifications exist in the burgeoning post-1970 trend of ecosystems services commodification. The immediate challenge of commodification here is not in standardization but in making things the same in the first place. So-called carbon markets, for instance, despite having been in existence for two decades, have yet to identify an intelligible or universally agreed-upon thing to trade in; the tradable unit is typically defined, as Jillian Button observes, “not in terms of *what* the unit is, but what it entitles the holder to *do*” (Button 2008: 581). Tradable carbon permits allow their buyers to emit greenhouse gases, but whether the permits are to be defined as access rights to global carbon-cycling capacity, whether this or that type of counterfactual reductions (emissions below “what would have happened otherwise”) of different greenhouse gases can be accepted as exchangeable equivalents, whether units from countries with different emissions caps should be treated as the same, and so forth, are matters of unceasing controversy, as will be described below. Indeed, as the markets expand, carbon commodities “created to fit the necessities of a market system” tend to become “increasingly vague” rather than globally standardized (Rosales 2006: 1046; see also Munden 2011). As Jessica Dempsey (2011: 199-203) points out, prerequisites for standardization are even harder to entrench in biodiversity markets, where the relative “clarity” of carbon commodities, ironically, is viewed with envy. Similarly, although wetlands bankers have been trading wetlands certificates since the 1980s, they not only have “not settled upon a system of measurement” but also have “not even agreed upon what the commodity is that they wish to measure” (Robertson 2004: 367). Standardization is also unattained (and probably unattainable) in contingent valuation, cost-benefit analysis and the other types of “proxy commodification” (Castree 2003) that have enjoyed such a resurgence during the neoliberal era, and which attempt to set up replicable and verifiable practices of market-like valuation *ab ovo* in circumstances in which none of the customary webs of market practices, with their constraining and enabling features, yet exist (Lohmann 2009). This is to say nothing of the growing range of commodification processes in which the very notions of commensuration and standardization are problematic, such as in markets for art or the more bespoke range of speculative financial products (Karpik 2010, Cooper 2010).

In an important survey article, Noel Castree (2003) wisely sidesteps many of the difficulties of pat definitions of “commodification” by instead offering a somewhat “thicker” account featuring various conditions seen by scholars of a Marxist bent as normally required for it. Castree's work suggests the fruitfulness of approaching commodification not as a phenomenon to be corralled by a sharply rounded-off dictionary entry, but as a subject of an open-ended, discursive, dialectical effort to grasp the nature of contemporary crises. Castree notes, for example, that the mere quality of being exchangeable has long been, for Marxists, “too thin a basis to specify what is entailed by capitalist commodification” as a process in which “qualitatively distinct things are rendered equivalent and saleable through the medium of money” (2003: 278), with particular use-values commensurated and acquiring the “general quality of exchange value”. Yet even this specification is not nearly enough, for most Marxist scholars, to get a real handle on the subject. Further elements identified by Castree include privatization, which is as much about “control over commodities – prior to, during and after exchange – as it about ownership in the technical, legalistic sense” (279; cf. Bakker 2007); alienability or ‘detachability’ from sellers; individuation against a background of legal and material supporting contexts; functional abstraction, or the separating off of a measurable characteristic of a thing or process from the thing in its original context; spatial abstraction, or the treating of an individual thing in one place as the same as something (ostensibly different) elsewhere, as when wetlands in place A are mobilized to “replace” wetlands in place B (Robertson 2000); commensuration with other commodities in a way that allows a thing or process to function

as one moment in the accumulation of capital; and displacement or fetishization according to which commodities appear as things rather than socio-natural relations. Elsewhere, Castree and others have expanded this treatment still further by linking new types of commodification of nature to neoliberalism or financialization (Smith 2006, O'Connor 1994, Castree 2008; Heynen et al. 2007; Moore 2010). Again, the point is not to arrive once and for all at a “master definition” – neoliberalization and financialization are themselves contested shorthands for complex processes about which controversy is rife – but to suggest practical tools for investigators whose instinct is that the study of commodification is especially important at the current moment. Initiatives such as Castree's thus offer a useful way station or orienting device between, on the one hand, misleading abstractions and, on the other, lengthy “thick descriptions” (Geertz 1973) of particular instances of commodification whose relevance to other cases or to broader historical trends usually requires some effort to tease out.[2]

This chapter is intended as a limited further contribution to the effort to come to terms with neoliberalism's new “nature commodities” by mediating between, as it were, dictionary entries and encyclopedias, abstract definitions and thick descriptions. While concerning itself with a single aspect of the commodification of a single “ecosystem service” – climate stability – it does so by proposing, and demonstrating the use of, a conceptual instrument conceivably applicable to a variety of problematic post-1970 commodities. Focusing largely on the moments of “making things the same” that are crucial for so many such commodities, this instrument consists of summarizing complicated practices of commensuration in thematic *performative equations*, around each of which specific accounts of actors, methodologies, institutions, resistances and outcomes can then be collected. *Equations* are used simply because they are a tidy way of expressing the relations of “sameness” that most commodities require for their operation. These equations are *performative* (Austin 1961, MacKenzie 2006) in the commodification context in the sense that, rather than being true or false descriptions of entrenched states of affairs, they constitute commitments to helping to bring about the equivalences they specify.

The Object of Climate Commodification

The question of why so much effort has been concentrated for the last two decades on making commodities out of climate, and how this was made possible by earlier 20th-century developments, is beyond the scope of this chapter, although it has been discussed elsewhere (e.g., Lohmann 2006, 2011; Lipow 2012: 81-83). The question here, rather, is *how* attempts are made to fashion these commodities. The answer is not immediately obvious. Global warming results mainly from the transfer of carbon from a fossil pool locked underground to a separate pool circulating above the ground among the atmosphere, oceans, vegetation, soils, fresh water, and surface rocks. This transfer is irreversible over humanly relevant time scales. It follows that sustaining – or 'producing' – the use-value of a liveable climate requires keeping remaining fossil fuels in the ground.

To put it another way, given path dependence (Arthur 1994) and the way that fossil fuels have become ‘locked in’ (Unruh 2000: 817) to industrialised societies’ ways of life, it calls for political mobilisation behind immediate long-term investment programmes in new, non-fossil energy, transport, agricultural, and consumption regimes, particularly in the North, as well as in programmes for shifting state subsidies from fossil fuels to existing initiatives defending or constructing low carbon means of livelihood. Above all, it demands widespread alliance-building in support of the social movements that are already directly or indirectly addressing the below- to above-ground transfer of carbon. These include movements working to ‘keep oil in the soil, coal in the hole, and tar sand in the land’ in the Niger Delta, Alberta, Ecuador, South Africa, Appalachia,

and elsewhere; stopping the development of dozens of coal-fired power plants in the US, Britain, India, Thailand, and other countries; fighting agrofuel projects whose effect would be to sustain a transportation infrastructure designed for oil; and working to ban banks from supporting fossil intensive or fossil extractive projects. Increasingly, such movements are aligning themselves with those in support of ecological and peasant agriculture, more democratic public health and energy provision, cleaner air and water, and an end to militarism, environmental racism, and extractivism.

Prima facie, a climate change mitigation commodity would need to support movement-building of this radical kind. Yet how might it be possible to buy and sell contributions toward the long-term political shift away from fossil fuels that such movements are working toward? In a tongue-in-cheek but nonetheless instructive proposal, legal scholar Douglas Kysar suggests that the 'legal and political actions' that have 'dramatic impact' on historical trends would have to be commodified. The resulting products could be sold by, for example, 'indigenous groups that entirely block new exploration activities' or 'forest dwelling communities that successfully fight to stop logging'. Investment banks seeking to craft new financial products would 'devote themselves ... to the identification and promotion of critical political interventions by disempowered voices for sustainability' (Kysar 2010). Accumulation would be a matter of investing in instruments that maximised structural societal change over the long term.

To make accounting, ownership, and capital accumulation possible, Kysar's climate commodity would have to turn the qualitative relations that make up movement building and historical process into quantitative ones. But obstacles would arise immediately. For example, consumers would need to know, and producers to guarantee, what increment of historical change toward a halt to fossil fuel extraction each commodity sale represented. But who would quantify the extent to which each unit of the commodity contributed to undoing the social complexities of fossil fuel path dependence, and how? If different units contributed different increments of historical change depending on the particular pathway they were aggregated into, and the paths were incompatible, how would the units be commensurated, much less standardized? How would the historical effects of private ownership on the dialogue and movement-building comprising the 'labour' producing the climate commodity be calculated? (For example, would street demonstrators wearing corporate logos on their T-shirts lose their effectiveness?) If the expert storytellers (Beckert 2011) whose services would be needed to help price the commodity attached a particular value to rolling back the dominance of a rampant financial sector, would Goldman Sachs sell the associated securities? And so on. The only way of removing such difficulties for accumulation would be to demote the market to being a provider of unspecified and unquantifiable 'climate services' – in which case it would lose most of its usefulness for policymakers and its appeal to other potential customers.

An Alternative Model

The alternative to the immediate, dizzying multiplication of paradoxes of Kysar's whimsical proposal is to construct a commodity based on the enclosure and commodification of pollution sinks, whose extent the state defines in terms of limits on the quantity of molecules that can be emitted. This is what the US's sulphur dioxide trading system instituted in the 1990s did, and it is the model followed by the Kyoto Protocol's carbon market, the EU Emissions Trading Scheme, and all other actually-existing climate markets.

The advantages are clear. Molecules can be counted (in many pollution markets, a metric ton is the unit of measurement). Molecules come 'pre-standardised' in the sense that they are the same the

world over. Molecules – or molecular motions – can also be laid claim to. So, at least in principle, can the sinks that absorb molecules – for example, oceans, trees, or lands that soak up carbon dioxide. Quantifiability and ownability make it possible to buy and sell rights to emit CO_2 – essentially, rights or access to the earth's carbon-cycling capacity in the oceans, the atmosphere, soil, vegetation, and rock. And with quantifiability, measurement and property claims comes, too, the possibility of systematized market exchange and large-scale accumulation. Focusing commodity construction on molecular rather than social movements, in addition, has the advantage of tapping into an existing cultural and political momentum. Even before ecosystems markets became all the rage, the issue of "global climate change" had become identified with the largely molecular "concerns that have guided climate modelers in their daily practices" (Goeminne 2012: 3). Modelers' efforts to build reliable climate knowledge from enormous amounts of disparate data had in turn been enabled partly by a more general postwar institutional movement centered on prediction and forecasting that has also profoundly shaped formal economics (Mirowski 2011). A molecular approach to climate change both reinforces and is reinforced by widespread contemporary "processes of de-politicization" as well as fetishistic and apocalyptic disavowals of the "multiple and complex relations through which environmental changes unfold" (Swyngedouw 2010: 214, 220).

As is the case with the mechanics of any commodification process, however, the flip side of the advantages of the choice of object is a complex set of costs and resistances (Marx 1867: 198). Both these advantages and the "overflows" (Callon 1998) that are their inevitable counterpart can be mapped and analyzed according to the open-ended set of constructed equivalences or performative equations that, along with various technologies, persons, institutions, disciplines and bits of nonhuman nature, make up one part of the infrastructures of markets (Callon 1998, MacKenzie 2006). The particular set of equivalences that symbolize and form part of the infrastructure for climate commodity formation are sketched out in the remainder of this article, forming an analytical backbone around which the logics and resistances associated with climate commodification can then be taxonomized and discussed.

Instead of founding themselves on the premise that action on climate entails keeping fossil fuels in the ground, then, climate service markets are based on the equation

a better climate = a reduction in CO_2 emissions.

An immediate effect of this institutionally and politically convenient choice of object is to entrench a process that continually reframes the climate problem in ways that disentangle it from climate history and the transfer of fossil fuels out of the ground and re-embed it in neoclassical economics, chemistry and a variety of other quantitative disciplines. Eliding the multiple differences between reducing emissions and addressing the climate crisis, the foundational equation above obscures, for example, the difference between stepwise molecule reductions over the short or medium term and actions that integrate into a programme that would result in most remaining fossil fuels' being left in the ground permanently.[3] In addition, it ignores the non-linearity and unverifiability of the relationship – a consequence of the physically "chaotic", flip-flop nature of the atmospheric system – between any given increment of reduction on the one hand and, on the other, any given increment of climate benefit. Also elided is the difference between molecules that can be classified as "survival" emissions and those that can be classified as "luxury" emissions (Agrawal and Narain 1991) – an elision that has climatic as well as class consequences, since "survival" emissions tend to have different causes, dynamics, and historical accompaniments than do "luxury" emissions. In such effects lie the seeds of a whole spectrum of resistances to climate commodification, ranging from

the criticisms of many climate scientists and environmentalists to the opposition of grassroots social movements in the global South.

Molecular Equations and their Discontents

Once molecular flow management is made into the object of political action on climate, then the fact that CO_2 molecules are identical throughout the world implies that the following equation can also be made into a guiding principle of climate policy:

stopping transfer A of *x* molecules of CO_2 into the atmosphere = stopping transfer B of *x* molecules of CO_2 into the atmosphere.

So, too, then, can its corollaries:

stopping the transfer of *x* molecules of CO_2 into the atmosphere in place A = stopping the transfer of *x* molecules of CO_2 into the atmosphere in place B

stopping the transfer of *x* molecules of CO_2 into the atmosphere through technology A = stopping the transfer of x molecules of CO_2 into the atmosphere through technology B

and

stopping the transfer into the atmosphere of *x* molecules of CO_2 of underground fossil origin = stopping the transfer into the atmosphere of *x* molecules of CO_2 of surface biotic origin.

Such equations mark practices that allow firms, investors and speculators to benefit from cost differentials between various investments in reduced molecule flows. If it is cheaper to invest in mandated reductions in place A than in place B, or in reductions that use technology A rather than technology B, then the choice will be obvious for any business; and similarly if it is cheaper to invest in forest conservation than in technologies that use less fossil fuel. Hence the celebrated cost-saving "flexibility" of climate markets in which one "reduction" can be traded for another in what proponents hope will be a maximally liquid trading system.

The molecular focus of the four equations displayed immediately above gives them the rhetorical or mythical (Zbaracki 2004) power of chemistry. Who could deny that molecules of CO_2 are the same whatever their origins and locations? There is, however, once again a flip side: the appearance of indisputability is achieved only by reframing a question of climate history as one of chemistry. In reality, it can make a difference to the trajectory of global warming whether a given reduction in CO_2 flows is attained in place A or place B, through technology A or technology B, or through industrial restructuring or forest conservation. Equating CO_2 reductions that result from different technologies makes it not only possible, but often necessary, to make climatically-wrong choices in the name of molecule prices – for example, to reduce molecule flows through routine, cheap efficiency improvements that entrench coal use and delay long-term non-fossil investment, or to build destructive hydroelectric dams that do nothing to displace coal and oil, rather than to select no-carbon technologies that form an integral part of a long-term program for phasing out fossil fuels (Driesen 2003, Taylor 2012). Equating reductions in place A with place B, meanwhile, obscures a number of geographically specific factors that make a difference to energy transitions, including the greater influence on technology development that a reduction in emissions from a particular

industrial process might have in a high income country, where it is more expensive, than in a low income country (Alfredsson 2009). It can also make a difference whether an identical reduction is achieved through technological innovation or halting forest degradation. The traditional objection both inside and outside United Nations climate negotiations to policies that rely on trees for "reductions" is that they weaken incentives for structural change in industrialized societies. This quality is especially important given two further realities: first, that no increase in biotic carbon on the earth's land surface would be capable of keeping out of the atmosphere and the oceans more than a fraction of the comparatively enormous stores of fossil carbon now being transferred to the surface from underground; and second, that the delays in the inevitable decarbonization of industrial societies enabled by exchanging biotic for fossil carbon make that decarbonization rapidly more expensive, and thus more daunting, over time. In short, as equations of chemistry, the four equations displayed above are true; as equations of climatology, they are false; but as equations that help structure market exchange, they are perhaps best regarded as neither true nor false, but rather as normative expressions of, and commitments to, novel commensuration practices that are unavoidably conflict-ridden and uncompletable. Their truth-value in terms of chemistry is relevant to their performativity in the market context only insofar as it provides them with some moral *cachet* in a context in which the climate issue has already been molecularized. Their truth-value (i.e., their falsity) in terms of climatology is relevant to their performativity only insofar as it tends to undermine their credibility among those who insist that climate markets should be about climate.

The four equations above give rise to other types of "blowback" as well. For example, making cost-per-molecule the criterion of choice between technology A and technology B helps pave the way for land-intensive (and thus socially-discriminatory) programs that attempt, at least ostensibly, to "replace"fossil fuels. Among these are strife-ridden agrofuel schemes in countries such as Brazil, Honduras and Indonesia, as well as wind power projects such as those in Mexico's Tehuantepec isthmus, where indigenous communities have regretted cheaply signing over land to private wind farm developers from Spain and Mexico who profit not only from electricity sales but also from trading the resulting pollution rights in Europe or using them to sustain their own fossil-fuelled installations. By abstracting from the tendency for pollution to be concentrated in what in the US are called "poorer communities of colour," technology- and place-neutrality also help ground future capital accumulation in historical patterns of class and racial discrimination, ensuring staunch opposition to carbon markets from networks of underprivileged communities ranging from the California Environmental Justice Movement (California Environmental Justice Network 2010) to India's National Forum of Forest Peoples and Forest Workers (Mausam 2008, 2009). Equating fossil and biotic carbon intensifies climate class struggle in the same way, since doing so provides additional economic and "scientific" sanction for extensive land grabs from the poor (Gregersen et al. 2010; Leach et al. 2012), whose livelihoods are likely to come into competition with carbon-absorbing projects and who may also see their store of knowledge of low-carbon subsistence livelihoods depleted as a result (another effect which is inconvenient to include in carbon calculations). The 'cost curves' that the equation makes possible also tend to abstract from the difference between forest clearing for commercial agriculture on the one hand and, on the other, rotational forest farming that involves subsequent re-growth of forests and storage of carbon. This abstraction both works against long-term forest conservation and, again, facilitates the deskilling of forest dwellers. As Nathaniel Dyer and Simon Counsell (2010) comment, the "argument that we need a new economic model to account for [climate change] externalities and to put our economies on a sustainable path" has ironically led to cost curves which, with their "hidden costs and partial analysis", are "similar to the narrow economic approach that contributed to the problem that we are now attempting to solve". Thus Aritana Yawalapiti, an indigenous leader in the upper Xingu region

of Brazil, reported in November 2010 that carbon forestry promoters visiting his territory had told his community that they would have to reduce forest burning if they were to be paid for producing carbon pollution licenses. But, Aritana objected,

> "We always burn at a place where we fish, hunt or open a small farmland area ... we open a space to farm, we plant, we collect manioc, after some years everything recuperates again ... the forest grows back, while we plant at another place" (Sommer 2010).

In sum, the cost advantages of "geographical neutrality", "technology neutrality" and "carbon source neutrality" each map onto various aspects of "mission drift" in climate markets as an instrument of environmental policy, as well as a number of other severe market-undermining effects. Of course, contradictory effects following on from the abstraction involved in commodification are nothing new: in the 19th century Chicago grain markets, for example, commodity abstraction, while making futures possible, also engendered possibilities of, for example, market-cripping speculative corners or conflict over profits that elevator operators gained simply because they were located in a position that enabled them to mix grain from many different farmers in order to minimize the quality of each bulk consignment they sold within a standard grade (Cronon 1991: 134ff.). Questions regarding climate services markets' contradictions, however, like those of many other new neoliberal commodity markets, tend to be of far greater scope than those which challenged the new Chicago wheat market of the 1850s onwards. For example, to what extent have the abstraction processes involved in climate commodities' formation undermined their ostensible policy purpose altogether? Can the commodities even be made coherent enough to survive? To what extent can their self-undermining dynamics be brought out of the "black box" in which they are currently concealed in United Nations and neoliberal environmental discourse and in the work of academics and other experts? The more carefully that the performative equations structuring climate commodities are unpacked, the more salient such questions become.

Offset Equations and the Attack on Non-Expert Agency

One further step in this unpacking process involves examining the equations that structure the practices responsible for creating what are known as "offsets". Under the Kyoto Protocol carbon market, as well as the European Union Emissions Trading Scheme and other climate market arrangements, polluters subject to government emissions caps, as well as funds, banks, or other private or public enterprises, can finance carbon saving projects outside the caps and use the resulting extra pollution rights – offsets – in lieu of emissions reduction obligations, or to sell on to third parties, or to speculate with. Thus:

CO_2 reduction under a cap = offset outside the cap

For example, European Union Allowances (EUAs), the emissions permits traded under the EU cap, are exchangeable with Certified Emissions Reductions (CERs), which are Kyoto Protocol carbon offsets generated in Southern countries outside the European cap:

EUA = CER

Offsets thus make possible additional abstractions from place, and widen the scope of possible molecular cost savings from technology choice or forestry. That is, they take the 'spatial fix' (Harvey 2001) of cap and trade (which moves pollution around a 'capped' landscape to wherever it is cheapest to abate) one step further, to territories not covered by caps, especially the global South.

where carbon cleanup is cheaper (Bond 2010). This multiply boundary-crossing function is reflected in the distinctive equation in which offsets are embedded:

reduction under a cap = "avoided" emission outside the cap

This equivalence allows offset projects that emit greenhouse gases (and most do) to license the emissions of still more greenhouse gases elsewhere – as long as they emit less than "would have been released" in the absence of carbon finance. For instance, carbon traders or capped polluters in the UK can purchase carbon pollution rights from highly-polluting sponge iron factories in India, provided the factory owners can convince UN regulators that technological improvements have resulted in less CO_2 than would have been emitted otherwise, and that this saving is measurable according to approved criteria.[4] The cost savings are considerable. In September 2012 the price differential between cheap CERs and more expensive EUAs on the Bluenext spot market in Paris was US$7.52 – a gap that can also be profitably exploited by speculators.

In order to arrive at a single amount of "carbon saved" in India that can be priced and substituted for measured and verified industrial emissions reductions in the UK, however, a single counterfactual story line must be posited as a baseline. Methodologically, then, the offset equation requires that counterfactual history be given the same epistemic status as actual history:

actual CO_2 reduction = counterfactual CO_2 reduction

"What would have happened" in the absence of carbon credit sales must be treated as determinate and quantifiable in the same way that CO_2 reductions under a cap are determinate and quantifiable. These equations commit offset creators and traders to a deterministic modelling of human and nonhuman actors, since only on deterministic assumptions is it possible to isolate the single storyline required for commodity pricing, based on the starting conditions of a counterfactual without-project scenario. This commitment to recasting political debate about alternative futures as disputes about the correctness of technical predictions has affinities with a more general postwar technocratic dedication to ideals of forecasting and apolitical control, with rational actor theory in economics, and with a more recent trend in the financial markets toward "mechanized" storytelling about the future through mathematical models, whether those models are used as confidence-building devices (Beckert 2011), technologies of a new, credit ratings-dominated pattern of investment (Ouroussoff 2010) or actual engines of mass production of certainty commodities (Tett 2009). Not surprisingly, it is subject to similar "blowbacks". One is simply that the methodological ambition is too high. As George Soros (2008) and many others have emphasized for the financial markets, calculative technologies, when pushed beyond a certain point, undermine their own efficacy. Kevin Anderson (2011) of the Tyndall Centre for Climate Change research makes a similar point about carbon calculation:

> "The offsetters' claim to account for carbon leakage over the relevant timeframe presumes powers of prediction that could have foreseen the internet and low-cost airlines following from Marconi's 1901 telegraph and the Wright brothers' 1903 maiden flight. Difficult though it is for contemporary society to accept, ascribing any meaningful level of certainty to such long-term multiplier effects is not possible and consequently offsetting is ill-fated from the start."

This indeterminacy underlies part of the prolonged methodological agony of conscientious offset accountancy experts such as Michael Gillenwater (2012), who asks "What does it mean for an offset project to be real? What would an unreal offset project be? How could we tell if it was unreal, and is

this something we should be concerned about?"

A second contradiction is that, necessary as a deterministic model is for offset calculation, it is also necessary that the technical experts and investors responsible for offset projects be exempted from it: the offset commodity form requires that they be rewarded for making a choice in what otherwise is an unalterable course of history. Offsets, that is, must attribute agency to privileged actors while denying it to every other human or nonhuman agent. This is, of course, a move familiar from the annals of colonial and postcolonial history, as well as of neoclassical economic theory. But the denial of workers' and farmers' capability to create their own history is no more likely to escape resistance in the present case, where it is closely integrated with commodity formation in climate markets, than it is elsewhere. Early on, for example, one group of Brazilian activists denounced the "sinister strategy" of claiming that a pig iron industry was creating emissions reduction "equivalents" by burning plantation charcoal rather than coal:

> "What about the emissions that still happen in the pig iron industry, burning charcoal? What we really need are investments in clean energies that at the same time contribute to the cultural, social and economic well-being of local populations. . . . We can never accept the argument that one activity is less worse [sic] than another one to justify the serious negative impacts . . . . [W]e want to prevent these impacts and construct a society with an economic policy that includes every man and woman, preserving and recovering our environment" (FASE 2003).

CO_2-Equivalence and the Pitfalls of "Efficiency"

Among its many other advantages, climate markets' focus on molecules opens up the cost-saving possibility of using greenhouse gases other than carbon dioxide in the formation of climate commodities. Here market construction has benefited from the work of the Intergovernmental Panel on Climate Change (IPCC), which, prompted by the UN's need for national greenhouse gas accounts as well as its own molecular preoccupations, has attempted to commensurate CO_2 with a range of other greenhouse gases including methane (CH_4), nitrous oxide (N_2O) and various chlorofluorocarbons and fluorocarbons including the industrial by-product HFC-23 (IPCC 1996), according to their relative effects on global warming, or "global warming potential" (GWP). The result is the following equations:

$$\mathbf{CH_4 = 21 \times CO_2}$$

$$\mathbf{N_2O = 310 \times CO_2}$$

$$\mathbf{HFC\text{-}23 = 11{,}700 \times CO_2}$$

These equations can then be used to elaborate a climate commodity in terms of "CO_2 equivalent" (CO_2e) rather than just CO_2. Having abstracted from the climate crisis to CO_2 molecules, in other words, climate service markets now abstract from CO_2 and other gases to posit portmanteau quasi-molecules of CO_2e, which assume and expand the fetish status already accorded to CO_2. In the performative equations previously analyzed in this chapter, accordingly, "CO_2" can often be replaced with "CO_2e" (depending on the particular market's rules), amplifying each equations' scope.

The consequence is to make the trade in climate services enormously more "efficient" and profitable, both for fossil fuel users and for dealers in pollution permits, due to the cost savings

achieved by substituting new molecular “raw materials” for carbon dioxide. For instance, given that burning off just one ton of CH_4 can generate saleable rights to release 21 tons of CO_2 in Europe, it is not surprising that – to take one example – more than two dozen giant hog farms operated by Granjas Carroll de Mexico, a subsidiary of the US-based Smithfield Farms, have sought extra revenue by capturing the methane given off by the huge volumes of pig excrement they produce and burning it, and then selling the resulting carbon credits to Cargill International and EcoSecurities. Merely by destroying a few thousand tons of HFC-23, similarly, the Mexican chemical manufacturer Quimobasicos is set to sell over 30 million tons of carbon dioxide pollution rights to Goldman Sachs, EcoSecurities, and the Japanese electricity generator J-Power (UNEP Risoe Center 2010). Assuming that destruction of HFC-23 can be carried out for US$0.25 per ton of CO_2 e, and that a ton of UN offset pollution rights can command US$3.11 on the EU ETS spot market (at historically low September 2012 prices), both the company and the financial sector intermediaries it sells to can realise good profits. Industrial buyers of the permits can in turn save over US$140 per ton by using the rights in lieu of paying fines for not meeting their legal emissions requirements. Today, the cleanup of HFC-23 and N_2O generates more profit for their manufacturers than the primary products of the processes in question (Pearce 2010), creating perverse incentives to make global warming worse (Szabo 2010, Schneider 2011). Such industrial gas offsets – generated at a handful of industrial installations in China, India, Korea, Mexico, and a few other countries – still account for the bulk of Kyoto Protocol carbon credits. The “CO_2-equivalent” construct also makes possible many other creative climate commodity-producing schemes. Coal mines in China, for example, can now produce and sell carbon credits by burning off some of the methane that seeps out of underground veins, on the ground that by converting methane into carbon dioxide, the projects do less damage to the atmosphere than would have been the case otherwise.

An additional advantage of the GWP construct is that it facilitates the running together, in a seemingly self-evident way, activities with different effects on climate history. Thus ex-World Bank executive Robert Goodland (2010), noting that “domesticated animals cause 32 billion tons of carbon dioxide equivalent, more than the combined impact of industry and energy”, can effortlessly draw the politically-convenient conclusion that “replacing livestock products with better alternatives would ... have far more rapid effects on greenhouse gas emissions ... than actions to replace fossil fuels with renewable energy”.

One of the contradictions of the pursuit of efficiency through CO_2 equivalents, as with that of the fossil-biotic carbon equivalance, is accordingly an inbuilt bias against the rural poor that has already generated criticism from activist networks such as La Via Campesina and the World Rainforest Movement. But the problems and resistances go a great deal deeper. For example, devising the performative equations about different greenhouse gases displayed above requires a great deal of fudging, leading to continung technical disputes. Each greenhouse gas behaves qualitatively differently in the atmosphere and over different time spans, and the control of each has a different effect on fossil fuel use. The IPCC itself winds up revising its calculations of the CO_2-calibrated (GWP) of various gases every few years, and insists on giving gases different GWPs over 20-year, 100-year and 500-year time horizons. But even such token caveats cannot be accommodated by a market that requires a single, stable number in order to make exchange possible. The UN carbon market, for example, disregards the IPCC’s recent revisions in GWP figures, discards 20-year and 500-year figures, and ignores the often enormous ‘error bands’ specified by the IPCC (in the case of HFC-23, plus or minus 5000 CO_2-equivalents). Again, translation and simplification turn out to have heavy “blowbacks”.

Ownership and Deresponsibilization

If there is to be a market in CO_2 emissions reductions, someone must "produce" them, and someone must buy them. To put it another way, if there is to be a market in greenhouse gas pollution dumps, someone must make them scarce, someone must "own" them, and someone must "rent" them. Setting up this apparatus can only be the job of governments, who must impose both the need for reductions (by making pollution dumps scarce) and the means of "producing" or owning them. Governments achieve the former by imposing "caps" or limits on emissions on companies or economic sectors. To accomplish the latter (that is, create a reduction commodity), governments need an equation:

regulated reduction of CO_2 emissions to level *c* within time period *p* = tradeable right to emit CO_2 up to level *c* by the end of period *p*

Carbon dioxide reductions (and by inference, climate action) can accordingly be achieved by the production of tradeable pollution rights, whose scarcity or otherwise is determined by government fiat. Progressive carbon dioxide reductions can in turn be achieved by relying on an additional equation:

reducing CO_2 emissions progressively through regulation = issuing fewer tradeable rights to emit CO_2 in period *p* + *1* than were issued in period *p*

The producers or owners of these rights are, in the first instance, governments themselves. European Union Allowances, for example, are "produced" in preset amounts by the pens or keystrokes of politicians and bureaucrats under the European Union Emissions Trading Scheme (EU ETS). They are then sold or, more usually, given away free to large private sector polluters. Assigned Amount Units (AAUs), one of the climate commodities of the Kyoto Protocol carbon market, are meanwhile "produced" by conferences of the parties to the UN Framework Convention on Climate Change before being distributed, again free of charge, to the national governments of industrialised countries.

In helping to "perform" climate commodities, the above two equations at the same time engender additional severe and contradictory overflow effects. First, equating reductions with saleable property rights once again distances the new markets from their assigned function in climate policy. As fossil fuel use becomes more deeply entrenched through a "polluter earns" system, the preoccupation with price discovery draws emphasis away from the long-term structural change demanded by global warming. All things being equal, corporations will choose cheaper alternatives, but if long-term structural alternatives have not been made available, not even the highest prices can compel anyone to choose them; on the contrary, they are likely to incite revolts against the trading system's design. Nor have low prices ever historically been drivers of the kind of structural change that global warming demands. The EU ETS has not incentivised investment away from fossil fuels even in the one sector, electricity generation, that has been consistently short of emissions rights (see, e.g. Deutsche Bank 2009).

Second, the performative equations above embed, in the institutions surrounding climate markets, a far-reaching capillary system of practices that, at all levels, deresponsibilizes industrial societies with regard to global warming. For example, instead of being fined for exceeding Kyoto Protocol emissions targets (which, as Herbert Docena [2011: 42] points out, implies the commission of an

offense), industrialized country signatories are encouraged to buy extra pollution permits from abroad to compensate for their failure (an action which connotes the acquisition of an entitlement). At the same time, in Nigeria, the Philippines, South Africa, Guyana and many other Southern countries, governments are incentivized by carbon markets not to promulgate or enforce environmental laws (which attribute responsibility for harm to defendants) but instead to allow their societies to remain dirty in order to be able to sell pollution rights from subsequent cleanup programs. Increasing institutionalization of opportunity-cost estimates in the design of biotic offset schemes, similarly, favors the relatively wealthy – those with the means to destroy forests wholesale – over poorer communities who follow a more environmentally-benign approach, thereby further reducing the space for practices that work to recognize and gauge responsibility for destruction or preservation (McAfee 2012, Lang 2011). Tens of thousands of experts, traders, bankers, lawyers, accountants, consultants and bureaucrats working in a US$100 billion-plus global market setting fuel emission proxy factors, commenting on carbon project design documents, formulating schedules and criteria for payments for forest conservation certificates, making submissions to UN carbon market regulators, hedging investments, buying land, tallying molecules, balancing accounts, establishing ownership and discovering prices, continually produce and reproduce deresponsibilization in each of the offices and arenas they work in. Rich nations are thereby "transformed" from climate offenders or debtors into climate leaders or benefactors. Colonialist ideologies temporarily challenged by the early-1990s global debate over climate change have been rehegemonized, not so much through propaganda, moral reasoning, bad science, or outright threats and bribes as through the repetition and accretion of thousands of quotidian technical practices surrounding commodity construction and operation. Accompanied as it is by the erosion of juridical approaches to the environment and the reduction of fines to fees, this colonialist resurgence has, unsurprisingly, provoked strong opposition to the new climate commodities from social movements and activists in both Northern and Southern nations (Osuoka 2009; Docena 2010).

Conclusion: Regulation and Internalization

The strenuous commodifying processes of simplification, abstraction, quantification, propertization and so forth reflected in performative equations constitute the deep structure of the attempted "internalization of environmental and social externalities" that is one face of the market environmentalism characteristic of the neoliberal era. These processes continually reinterpret and transform the challenges they confront; their goals are never exogenous but are incessantly reshaped by the very process of addressing them. This chapter has argued that, with respect to the climate crisis in particular, internalizing externalities through commodity formation, however profitable the result, constantly gives rise to fresh externalities that are so overwhelming that, from an environmental point of view, they invalidate the project.

From this perspective, the commonly-heard appeal to "regulation" as a solution for such failures needs disambiguation. Does regulation mean revising, elaborating and extending the contradictory performative equations that provide infrastructure for the new commodities in question, as is implied by most critical writings on climate markets (e.g., Newell and Paterson 2010, Perdan and Azapagic 2011, Bumpus 2011)? Or does it, rather, mean progressively "deactivating" some or all of the equations? The burden of this chapter has been that, in the case of climate services markets, progressive deactivation will be the environmentally-wiser approach in view of the incessantly-ramifying counterproductivities that any variants of the relevant performative equations are bound to engender.

For example, no additional equivalences, surveillance procedures, or technical criteria for determining when a carbon offset project goes beyond “business as usual” could ever be capable of relieving the contradictions built into the equation:

actual CO_2e reduction = counterfactual CO_2e reduction.

On the contrary: given the equation's commitment to the impossibilities of verifiable counterfactual history, they merely give these contradictions “more room to move”, to quote a resonant phrase of Marx (1990 [1867]: 198). The effect has been to reinforce the supply-side dominance in the offset markets of large polluting corporations that operate in the global South – Sasol, Mondi, Rhodia, Tata, Birla, Jindal, and the like (UNEP Risoe Center 2010) – who are better able than others to devote resources to navigating the growing regulatory and planning mazes that the contradictions feed in the service of gleaning new revenues for activities that reinforce fossil fuel use. That, in turn, signifies another step backward in the struggle over climate change.

One virtue of breaking down the omnibus category of commodification into bite-sized chunks using the tool of performative equations is that to do so gives concrete content to the observation that commodification and decommodification have many forms and degrees, as well as a spectrum of different types of internal structures. To do so also provides a criterion for distinguishing instances of regulation – of whatever motivation or provenance – that contribute toward a goal of decommodification from those that do not. Such a criterion can be useful for climate activists in deciding which tactics to adopt, since even governments that have subordinated their climate policies to a commodity framework are sometimes induced to undertake actions with modest decommodification effects that, if supported, may lead to larger and more constructive changes. For example, the EU decided in 2011 to stop applying the equation

HFC-23 = 11,700 × CO_2

by banning HFC-23 credits from sale as of 2013. The reasons for this move were complex, involving not only scandals over the issuance of a flood of blatantly bogus pollution rights from industrial gas projects (EIA 2010), but also fears that European industries in the sector in question may relocate to the global South to take advantage of offset revenues; a desire to reduce transaction costs in the manufacture of carbon offsets by sourcing them from entire sectors rather than individual projects; and worries that an oversupply of carbon credits will undermine market operations. Nevertheless, the curb does demonstrate the possibility of rolling back commodification rather than extending it, as do environmentalist campaigns to abolish offsets and hence deactivate equations such as:

EUA = CER.

Breaking down specific neoliberal nature-commodification processes using open-ended sets of performative equations, then, is one way of teasing out a core of both analytic and practical strategic sense in reactive slogans such as “our Earth is not for sale” as well as in overly-abstract academic definitions of commodification. In clarifying contemporary struggles over market environmentalism, it may help identify and expand spaces for potential alliances among various movements questioning commodification – whether of climate, water, electricity, health services, ideas, biodiversity or genes – and supporting land and labor rights, alternative energy and transport, food sovereignty, and public control of the financial sector.

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2 One of the best models of such "thick descriptions" remains Cronon's treatment of wheat and lumber in the 19th century US midwest, but there are of course dozens of other valuable studies including Thompson 1990, Thomas 1991, Mirowski 2011, Sivaramakrisnan 1999, etc.).

3 The difference between the two is illustrated by the fact that the industrial slowdown resulting from the financial crisis of 2007-08 resulted in more CO_2 emission reductions than all the world's climate markets put together had achieved [Chaffin 2010], yet has not changed structural dependence on fossil fuels.)

4 Similarly, forest carbon projects can generate carbon credits even if they allow an increase in deforestation, as long as the increase is 'less than would have happened otherwise' (see, e.g., American Carbon Registry 2011).