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Carbon's calculatory spaces: the emergence of carbon offsets in Costa Rica

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Abstract. This paper analyzes the practices of calculation needed to create carbon forestry offsets in Costa Rica, paying special attention to the spaces that are produced through such practices. I argue that the calculations needed to bring a carbon offset into being as a commodity is a process that results in the coconstitution of relational space, absolute Cartesian spaces, and the bounded territory of the nation-state. I develop my argument by drawing on Martin Heidegger's writings on calculation, technology, and the question of being and examine the spaces that result from carbon offset calculations performed by the Costa Rican state. Central to my argument is the idea that the practices of calculation are productive of a technological metaphysics, where the world becomes disclosed to us as an object of orderability. This ontological orientation allows for the objects and subjects of the world, in this case carbon commodities as well as producers and consumers of carbon offsets, to become relationally embedded in the world through the production of bounded Cartesian space. The production of such 'graspable' spaces simultaneously reinforces and undermines the territoriality of the Costa Rican state.

Introduction

Since the mid-1990s the Costa Rican state has implemented a number of reforestation policies meant to transform parts of the nation's territory into sites of commodified carbon storage. In other words, it has attempted to create carbon forestry offsets, a mechanism by which a person, nation, or corporation can mitigate the climatic effects of their greenhouse gas emissions by purchasing a credit that helps fund a carbon-sequestering forestry project. Despite its status as an 'early adopter' of this conservation mechanism (Castro et al, 2000), the Costa Rican state has, to date, largely been stymied in its efforts to develop Clean Development Mechanism (CDM) forestry offsets, the offsets allowed under the Kyoto Protocol. One of the principal reasons for this failure has been the state's inability to successfully develop a methodology that answers the seemingly straightforward geographical question of *where* its carbon will be stored.

Demonstrating the location of additional carbon-sequestering biomass is a critical step for producing an approved CDM offset (as I will explain in more detail below); it also requires a tremendous amount of scientific and technical work. Such work includes measuring and weighing existing biomass in potential areas of carbon sequestration, as well as performing abstract calculations that estimate the additional carbon that will be fixed in specific spaces over time (Andersson and Richards, 2001; Pearson et al, 2006). While most of this work is fairly standard scientific practice, its potential *effects* are nothing short of extraordinary. In short, the abstractions that result from these calculations allow for the element on which virtually all life depends, carbon, to be discursively separated from its surroundings so that an ordering of the global carbon cycle can occur through the exchange of the commodified form of this abstraction.[1]

[1] Although it is arguably carbon dioxide and its equivalents (methane, chlorofluorocarbons, etc) that are being commodified, and it is these gases that come under regulation in the Kyoto Protocol, I reference the more basic element carbon here because the creation of a sequestration offset requires the measurement of the element carbon in the biomass of trees and soils. This figure is then converted to a carbon-dioxide equivalent for the purposes of establishing an offset credit (Penman et al, 2003).

In this way, forestry offsets aim to link, through exchange, the worldwide atmospheric balance of greenhouse gases to the levels of carbon on an individual parcel of land.

How is it that these practices of calculation are able to accomplish such a dramatic potential reordering of the world? What effects do these practices of ordering—which encompass both 'the global climate' as an orderable object along with a multitude of locally specific sites of carbon storage—have for the spaces and territories that ultimately receive commodified forms of carbon? In this paper I address these questions by examining the ontological conditions that allow for such a quantified measurement of carbon to occur and explore the effects of these conditions on the production of space and territory. Drawing on the writings of Martin Heidegger, I argue that these practices of calculation and measurement are productive of an ontological condition where the objects of the world—its places, natures, and spaces—become disclosed to us as objects waiting to be ordered. I illustrate the impacts of this 'ontology of ordering' on the constitution of space and territory by discussing the failure of the Costa Rican state to establish CDM forestry offsets and how attempts to 'grasp' carbon as an orderable object have resulted in the coproduction of both relational and absolute spaces that allow for carbon to be remade as a commodity.

My approach is meant to contribute to ongoing debates over the nature of space and territory in the contemporary moment of globalization. We now live in a world where the carbon content of a farmer's land in Costa Rica is linked to the emissions from a factory in Italy; and in light of the proliferation of such global relations, a number of writers have developed approaches to space and territory that challenge the view of space as a 'container' of social, political, and economic action. Instead, space is conceived in relational terms, an analytic move meant to disrupt our notion of fixed, spatial scales and territories as pregiven ontological entities (Harvey, 2000; Law, 2002; Massey, 2005; Paasi, 2002; Thrift, 1996). This is an understanding where space "is no longer seen as a nested hierarchy moving from 'global' to 'local' " (Thrift, 2004, page 59). Instead, space and its objects are mutually constituted in their own stabilized moments of becoming, where objects and space can only be understood in relation to each other (Marston, 2000; Massey, 2005; Mol and Law, 1994). In these writings, space as a bounded object is replaced by geographic imaginaries of flows (Castells, 1996), folds (Doel, 1999), and networks (Amin, 2002; Thrift, 1996; Whatmore, 2002). Under this purview, space and place are better understood as mutually constituted, fluid, and performed (Callon and Law, 2004). Some writers, such as Ash Amin, have argued that these flows and networks are reconstituting spaces so radically that "the very ontology of place and territoriality itself is becoming altered by the rise of world-scale processes and transnational connectivity" (Amin, 2002, page 385)—where further "processes associated with globalization mark a new ontology of place/space relations that need to be theorized" (page 387).

While some have cast the notion of prefixed spaces, territories, and scales as anachronistic and being radically transformed through processes of globalization, a number of other writers offer a more tempered view of the spaces of globalization in which a bounded understanding of space still has considerable analytic and material purchase. For them, globalization is understood as a process of a reconfiguring and nesting of local, national, and transnational scales (Jessop, 2000), where the expansion of global capital occurs on a terrain where historicized territorial relationships clash with transterritorial developments (Agnew, 1999; Brenner, 1998). Globalization, then, is not so much a process of deterritorialization, or an altering of an ontology of territoriality, but one that results in, as Neil Brenner puts it, "new configurations of territoriality on both sub- and supra-national geographical scales" (1999, page 41). In addition, such an approach recognizes that—despite the many advantages of understanding the world in

terms of relational space—there continues to be a persistent salience to the *idea* of space as an object of enclosure, where the territorial imaginary of space still holds sway, shaping our politics (Agnew, 1999; MacLeod and Jones, 2007; Schlottman, 2008) and economic relations (Allen, 2004; Yeung, 2005).

In this paper, I draw on Heidegger's writings on calculative thought in order to argue that the development of carbon offsets is not an either–or proposition of the unfolding of relational spaces or the reconfiguring of absolute spatial and scalar containers. Instead, I argue that the emergence of carbon offsets is a process where relational space, absolute Cartesian space, and the bounded territory of the nation-state become coconstituted through the practices of calculation needed to bring offsets into being. In short, the relational spaces that become disclosed through calculation *require* absolute space. Central to my argument is the idea that calculation, as culminated in the metaphysics of technology, discloses the world to us as an object of orderability. This is an orientation toward the world that allows for the objects and subjects of the world (ie carbon commodities and carbon consumers) to become relationally embedded in the world *through* the production of bounded Cartesian space. In short, relational space and absolute spaces and territories are not in opposition, but instead, are grounded in the same ontological orientation toward the world and are coconstitutive of each other.

This paper proceeds as follows. In the next section I provide a sketch of how Heidegger's writings on calculation and technology can help us understand the development of carbon forestry offsets as a way of 'the enframing' (*Das Ge-stell*) of the world. I then illustrate the relation between this orientation toward the world and carbon offsets by discussing the unsuccessful efforts of the Costa Rican state to develop CDM offsets due to the state's inability to calculate its own carbon-relation with the world. This is followed by two sections in which I argue that the calculations needed to bring a carbon offset credit into being as a commodity result in the coconstitution of relational space, absolute Cartesian spaces, and the bounded territory of the nation-state. Empirical details in this chapter are culled from my interviews with state bureaucrats, scientists, and other project participants as well as technical and planning documents from these efforts.

Heidegger, calculation, and the metaphysics of technology

In this journal, Mikko Joronen (2008) argued that the current age of globalization can be understood as a result of our conception of planetary space, where the modern technological metaphysics of being allows the world-itself to become disclosed to us as a single orderable object. In other words, the era of globalization in which we live rests on a particular ontological orientation where the world becomes disclosed to us in a way that allows 'the global' to be understood as an object of calculable planetary space. This line of thinking builds on arguments made by Stuart Elden (2005a), who posits that by investigating how 'what is' comes to be we can see how our modern understanding of territory emerges from a political way of grasping calculatory space. I wish to extend these arguments by positing that our modern ontological casting of space is productive of Cartesian bounded spaces that are simultaneously coconstituted by the networks, flows, and folds between actors that constitute the relational spaces of this world, ultimately allowing for the production of carbon commodities. In other words, both the relational and absolute spaces of carbon are coproduced *effects* of our ontological orientation toward the world. In this section I outline the components of Heidegger's thought on calculation, technology, and the question of being that will help us understand how this process unfolds with regard to the spaces of carbon offsets.

For Heidegger calculation rests on a mathematical relation with the world that, since Descartes, has separated the world into *res extensa* (body) and *res cogitans* (mind), where our modern understanding of ourselves and the world has become one in which thinking subjects encounter a world of objects that is divisible, and knowable, through calculation and measure (Heidegger, 1982, pages 96 – 123; see also Elden, 2003).[2] For Heidegger this way of understanding the world has led to a forgetting of the question of being, reflected in a Western metaphysics that fundamentally misreads the relation between being and beings (1973; 1999, pages 78 – 87, 119 – 123). Heidegger regarded metaphysics as a mode of thought that located being, or the fundamental ontology of existence, as the ground of beings (or entities), where being is a fundamental first cause of beings in the world (1987). Heidegger regarded this understanding of the relation of being to beings as a fundamental philosophical mistake, one that understands the existence of beings in terms of a transcendental essence that stands behind being (1973; 1987). For Heidegger, this Western metaphysical view has led to a 'forgetting' of the question of being, and it forecloses on the possibility of understanding beings in terms of a more authentic being (1987; 1999). Instead of conceiving of being as transcendental and ultimately separate from beings, a more fundamental ontology of being sees being as continually constituted by our ongoing openness and engagement with the world.

In this sense, 'the world' should not be confused with the planet Earth, or even the totality of Cartesian space. Instead, 'the world' is the totality of relations and meaningfulness with which we (as *Da-sein*) are engaged (eg Heidegger, 1996, pages 83 – 102; see also Young, 2000). This approach to being means that there is no clean separation of ourselves from the world that we inhabit. Instead, our physical body, the surrounding environment in which it exists, and human consciousness are not separate from each other. Instead, it is all *constitutive of* being. Rather than existing *in* the world, the way that water exists in a glass, Heidegger saw the inextricable relation between humanity and the world in terms of being. In this sense, being is the ongoing event of our worlding of the world, where the world and our being are continually interwoven moments of becoming.[3]

This 'forgetting' of being has culminated in a modern technological perspective, where the way in which the world becomes represented scientifically—as a collection of points on a Cartesian spatial grid and composed of objects to be weighed and measured—comes to be identified with our own place in the world, as subjects that encounter the world as a collection of preformed objects (de Beistegui, 2005; Malpas, 2006). For Heidegger, this all-encompassing perspective conceals a richer reality and is ultimately unsatisfactory for a more authentic way of knowing the world. Instead, the abstract representations that have come to define calculation and measurement are productive of a rationality in which the measurement of the world is not merely a way to *think about* the world but the way in which the world *really is* (de Beistegui, 2005). Thus, a grounded notion of the Earth as an environment whose presence is constitutive of our own becomes replaced by the notion of the world-as-object, something known

[2] Heidegger's understanding of calculation, and its role in his thought, is a complex topic, and one that can only receive a cursory treatment here. For more detailed explication of Heidegger's understanding of calculation please see Elden (2006); on the relation between calculation and space see Malpas (2006); calculation and animals see Haar (1993).

[3] This understanding of being is reflected in Heidegger's vocabulary, where, for example, in *Being and Time*, he speaks not of 'humans,' a word that has become too loaded with the subject-centeredness of modern metaphysics, but rather, '*Da-sein*', a German neologism often translated as being-there, but is perhaps better understood as being-the-there (see Elden, 2005a), where the separation between being and the world collapses and *Da-sein*'s being is constituted by, and constitutive of, the world.

only through measurement, calculation, and experiment (Heidegger, 1999, page 348; 1977b; see also de Beistegui, 2005; Elden, 2003; 2006).

The rationality of calculation is closely related to another concealment of being, which is that of massiveness, or the gigantic (Elden, 2003; 2005b; Heidegger, 1999, pages 94 – 96, 310 – 312; Joronen, 2008). Here 'gigantic' is not merely something big; it is Heidegger's way of expressing a fundamental metaphysical shift, where the calculable is understood as an inherent quality of something, where Descartes's conception of the world-as-extension means that geometric measures of continual space *is* the space that constitutes the world. In other words, giganticism is the folding of calculation into being, where 'what is' is what can be calculated, and the uncalculated is merely that which has not yet been calculated (Heidegger, 1999, pages 88 – 96; see also Elden, 2005b, page 824).

Heidegger's understanding of calculation—where calculation is constitutive of a metaphysical rationality of the concealment of being—animates his questioning of technology, where he argues that the essence of modern technology is a manifestation of this metaphysical orientation toward the world, where the world is conceived as a grid of objects to be measured, ordered, manipulated, and stored. More than a neutral instrument, Heidegger conceives of technology as a process of bringing into being the objects of the world in a way that produces a being-in-the-world for ourselves that obscures the mutually constitutive relation between the world and our own being. Instead, the essence of modern technology is an *instrumental orientation* toward the world, where the world becomes revealed to us as objects to be ordered and made available. This type of revealing is a way of knowing the world in which the world is 'set-upon' to be made available to us and 'challenged forth' as a stock of standing reserve, to be summoned at will:

> "The revealing that rules in modern technology is a challenging, which puts to nature the unreasonable demand that it supply energy that can be extracted and stored as such .... Air is now set upon to yield nitrogen, the earth to yield ore, ore to yield uranium, for example; uranium is set upon to yield atomic energy, which can be released either for destruction or for peaceful use (Heidegger, 1977a, pages 14 – 15).

Heidegger calls this setting-upon the world *Das Ge-stell*, or 'the enframing'. Although the term *Ge-stell* is a noun, it is not meant to connote the static idea of a 'framework'. Instead, it is perhaps better understood in a more active sense, an unfolding metaphysical event where everything becomes objects that are subject to ordering and regulation for the purposes of being ready at hand, subject to further ordering. In other words, the essence of technology today is the culmination of a metaphysical orientation of being, where the world is seen as separate from us and is made available to us in quantifiable units for ordering, regulation, and control.

Heidegger (1997b) also writes that the enframing of technology is productive of a conception of the world as a singular ball, or whole picture. This conception of the world-as-picture is not one in which the 'real' world has somehow been concealed from us through a false representation but rather one in which the world has become conceived as a controllable, orderable object, an orientation in which beings of the world have become ensnared in a system of ordering, in which all beings are 'ready-at-hand' for use (Heidegger, 1977b; 1977c). In this case, objects and subjects do not necessarily stand opposed to each other, as in the world-as-ball as an object in opposition to humans, but rather the relational character between objects and subjects—the world and us—becomes forged through their incorporation into a global standing reserve, where both humanity and the objects of the world itself are made ready-at-hand within a worldwide system of calculable ordering (Heidegger, 1977c; Joronen, 2008, page 605). For Heidegger the enframing that is the essence of technology means that our *relation* with the world is thoroughly transformed and has the effect

of producing a new understanding of ourselves, where everything becomes subject to calculation and measure in terms of productivity, power, resources, and energy, resulting in a thorough transformation of our own being-in-the-world. Here, even humanity itself becomes set-upon in this very way, where we become objects that are subject to ordering and manipulation.

Long before sequestering carbon in trees was even a theoretical idea, Heidegger made a connection between the modern technological orientation toward the world and the demands it would place on forests and those who do their ordering:

> "The forester who, in the wood, measures the felled timber and to all appearances walks the same forest path in the same way as did his grandfather is today ... made subordinate to the orderability of cellulose, which for its part is challenged forth by the need for paper, which is then delivered to newspapers and illustrated magazines" (1977a, page 18).

In this passage, Heidegger's focus is not on the transformation of the forest but on the transformation of the *forester*, where the forester's being becomes constituted through a technological disclosure of the world, and the orderability of the cellulose of trees is constitutive of his own being as someone who orders, ultimately revealing the forester himself as subordinate to the orderability of natural resources.

Notice that the forester's subordination to cellulose does not lie in the trees themselves but in the system within which trees have become ensnared. Their orderability derives from the demands of producing "illustrated magazines". Today, as lowering the 'carbon footprint' of our actions becomes more of a priority, forests are once again set-upon as objects of orderability—only it is no longer cellulose but carbon that is challenged forth; and it is not the newspaper industry, but instead, a global regime of climate management that challenges forth the orderability of carbon, and ourselves as those who order. In the next section, I address the spatial consequences of this challenging-forth by considering how space is produced when the state must place itself as an object under the calculatory logic of the worldwide management of carbon. Understanding how this is done, and what allows for it to occur, offers a way to explore how space is constituted through the production of carbon forestry offsets, and why this is so.

Carbon, calculation, and the state

In 1997 the recently created National Forestry Financing Fund (Spanish acronym: FONAFIFO), a division of Costa Rica's Ministry of the Environment and Mines, began providing payments for environmental services (PES) to land owners for either maintaining existing forest on their land or for planting new trees (Castro et al, 2000). In making these payments, FONAFIFO purchases the rights to a landowner's carbon storage, which allows the agency to resell them to a third party later (Miranda et al, 2006). From 1997 to 2007 FONAFIFO made more than 6000 payments that covered more than 500 000 hectares of land (FONAFIFO, 2008). Despite these efforts at creating a supply of carbon sequestration for the global market, very few of the payments have resulted in international carbon transactions (interview with FONAFIFO employee, November 2007, San Jose, Costa Rica). In fact, they have hindered FONAFIFO's current efforts to establish CDM forestry offsets. Specifically, the Costa Rican state has failed to receive approval for its methodology for calculating a carbon baseline in a way that incorporates the effects of its previously established PES policies.

What is a carbon baseline? Carbon baselines are the business-as-usual level of carbon that will be sequestered in the absence of carbon financing. Carbon offset credits under the CDM are based on the level of carbon that is sequestered over-and-above this baseline (Chomitz, 1998, see figure 1). Calculating the baseline requires not

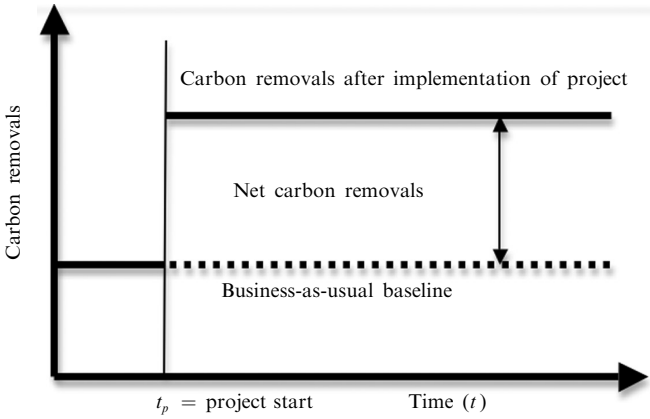

Figure 1. Simplified principle of the baseline (adapted from Bumpus and Liverman, 2008). The net carbon removals that compose the value of a forestry offset is the difference between the baseline levels of carbon removals and carbon sequestered as a result of project activities.

only estimating existing levels of plant growth but also predicting what future patterns of land use would be without the creation of a forestry offset project (Chomitz et al, 1999; Dutschke, 2002). While there are a variety of already approved methodologies for doing this, FONAFIFO developed a new methodology that contained procedures for calculating the impact that previously established state PES policies will have on baseline calculations. This meant that FONAFIFO had to develop a way to quantify the future extent to which state PES policies will be implemented in areas receiving CDM financing. Since PES reforestation policies are considered a status quo driver of land use, the carbon sequestration that resulted from future PES implementation would contribute to a larger baseline (FONAFIFO, 2007a; interview with FONAFIFO consultant, February 2008, San Jose, Costa Rica). For example, if state reforestation payments to farmers under these policies are expected to increase over time within a CDM project area, then so would the baseline, as the new trees from these policies would result in more status quo carbon sequestered in the future (eg FONAFIFO, 2007b). The new methodology that FONAFIFO developed was a detailed document that contained the procedures needed to quantify these potential baseline scenarios (FONAFIFO, 2007a). In this way, the methodology sought a way to calculate how the implementation of a particular CDM project will relate to the future 'carbon impact' of future patterns of state actions.

To date, the United Nations Framework for the Convention on Climate Change (UNFCCC) oversight board has twice rejected the new methodology (UNFCCC, 2007a; 2007b). Both times it was rejected, in part, because the UNFCCC reviewers found a fundamental incongruence between the specific Cartesian spaces that define the boundaries of CDM projects and the more vaguely defined geography of state-led environmental service payments. One of the requirements of CDM forestry projects is that they occur within a precisely delineated project boundary. This boundary consists of the exact, GPS-measured polygons where reforestation activities will take place (Pearson et al, 2006). If, for example, a project includes reforestation that takes place in a patchwork of separate, discrete parcels, the resulting project area is an amalgam of many different, georeferenced polygons. These polygons constitute the project area, and it is with reference to this Cartesian space that baseline calculations are made (Dutschke, 2003).

The geography of state-led forestry payments, however, is considerably more nebulous. The implementation of payments was guided by general geographic directives,

where priority was given, for example, to areas close to national parks (Imbach Bartol, 2005; interview, 2007). These were only guidelines, however, and not spatially quantified quotas. The actual geography of PES implementation was further modified by the welter of legal and bureaucratic hurdles that potential PES applicants encountered. These requirements included having registered land title, an official property survey and identical geographic data points on both documents (Baltodano, 2000; Castro et al, 2000). The cost and time associated with meeting these requirements often exclude potential PES recipients, regardless of whether their land falls within the geographic guidelines. Instead, it has the tendency to encourage PES participation by members of agricultural cooperatives that have experience in taking the necessary bureaucratic and technical steps to enroll landowners in PES programs (Imbach Bartol, 2005; interview with agricultural NGO employee, December 2007, Puerto Viejo, Costa Rica). In sum, environmental service payments are made countrywide, without specific, quantified targets for geographic areas, resulting in spatial patterns of implementation that are hard to predict.

The UNFCCC Executive Board concluded that this lack of specific, spatially defined quotas for state PES payments will ultimately result in 'subjective' calculations (UNFCCC, 2007b, page 3). While the proposed methodology uses historical data to determine the future PES patterns in CDM project areas, the UNFCCC reviewers rejected this rationale. They argued that the lack of specific, spatially delimited quotas for PES policies means that one cannot say with certainty that historical trends would continue into the future (UNFCCC, 2007b). For the UNFCCC Executive Board, it was ultimately an untenable project to make baseline calculations within well-defined Cartesian boundaries while also incorporating state PES policies that have an undefined geography. The failure to develop an approved methodology has resulted in the stalled emergence of CDM offsets. In other words, CDM offsets in Costa Rica have been stalled due to the inability of the Costa Rican state to calculate the future carbon relationship of its forestry policies to the abstract Cartesian spaces that define CDM projects.

Relational and absolute calculations and spaces

Let us review this fairly dense story. In 1997 the Costa Rican state initiated a policy of paying landowners for reforesting their land. Ten years later, in 2007, the state began a separate initiative of creating CDM projects, where they developed a methodology for performing the baseline calculations needed to establish projects in this country. Doing so requires the delineation of specific Cartesian spaces that indicate exactly where carbon-sequestering trees will be planted. They also require that one calculate status quo baseline levels of future carbon storage within these same spaces. To date, the Costa Rican state has been unable to obtain approval for doing this because it has failed to find a way to satisfactorily calculate the extent to which its previously established reforestation policies will contribute to this baseline. This is because these previously established reforestation policies are not geographically determined the way that the spaces of CDM projects are. Instead, they occur through a complex and often ad hoc process involving general geographic directives and the ability of payment applicants to meet specific requirements. Without spatially defined quotas for the state's previously established policies, the UNFCCC claims that the state has failed to show how it can accurately incorporate the future impact of the state's reforestation policies on the carbon baseline of CDM project areas. Because of this, the methodology has been rejected.

At this point, I wish to call attention to the interplay between the Cartesian spaces that define CDM offset projects and the relational calculations that are needed to

determine the baseline, in which the future counterfactual carbon impact of actors within a specific Cartesian space are calculated. The CDM baseline calculations are ultimately done to ensure that carbon offsets produce a particular global ordering of carbon, where greenhouse gas emissions in one area are allowed to continue so long as an equivalent level of carbon is sequestered somewhere else. Under these assumptions of carbon trading, baseline calculations are required to ensure that the sale of carbon offset credits produces *additional* carbon sequestering biomass, and does not subsidize already existing patterns of land use (Chomitz, 1998; Michaelowa, 2005). This provision is critical in order to ensure that the carbon fixed in the ground renders specific emissions 'climate neutral'. Calculating a baseline provides quantified evidence that this criterion is being met.

In this way, baseline calculations help quantify the carbon-relation of one actor to another (producer to consumer) as a way of ordering a global carbon balance. For these calculations to occur, however, future counterfactual levels of carbon storage have to be understood as occurring in a prescribed area over a specific time horizon. And it is through these calculations that the Cartesian spaces of carbon offsets are positioned as a way of grasping the relational ordering of carbon, where the future carbon-impact of offset producers becomes understood in relation to a demarcated 'container' of carbon.

While some writers have argued that our ideas about absolute space, and territorial imaginaries of spatial and scalar containers, affect how relational spaces unfold (eg Agnew, 1999), I contend that understanding this case from a Heideggerian perspective offers an even stronger view of the connection between absolute and relational space. In this case, the ontology of calculation that allows carbon to be understood relationally—where sites of carbon storage and carbon offset consumers become linked—is a condition that *requires* absolute spaces. This is because producing an offset means knowing *where* carbon will be stored. This is a process that is predicated on a calculative understanding of carbon that transforms the *sites* of carbon into *absolute spaces* that hold carbon. To better understand the meaning of this claim—that the production of carbon offsets entails a necessary relation between absolute and relational space because they are both derived from the same calculative metaphysics of technology—I now turn to a discussion of the relation between carbon and the world under the enframing of technology.

Enframing carbon: the world as standing reserve

In the above example a territorially bounded nation-state was unable to produce a mechanism for regulating the global climate (ie forestry offsets under the CDM) because of the state's inability to quantify the carbon-impact of its own policies in relation to specific, abstract Cartesian spaces. These are local spaces that are ultimately demanded by a conception of a planetary-wide orderable space that underpins the logic of carbon trading. My interest is not in why these efforts failed, but instead, why it was necessary to relate the spaces of the state's territory, specific GPS polygons and the singular space of 'the global', in this way. In this section I examine further how this example—the Costa Rican state's efforts to calculate its own carbon-relation to the world—can be understood as a consequence of the enframing of technology. My discussion in this section sets up the following section, in which I link the technological metaphysics of calculating carbon with the persistence of the bounded territoriality of the nation-state, the containerized spaces of 'the global', and the relational spaces of calculation that underpin the current carbon trading regime.

Heidegger argues that the enframing that is the essence of modern technology is no longer a revealing of the world but rather a 'challenging forth' of the world that sets upon beings in the world as objects to be ordered:

> "The hydroelectric plant is not built into the Rhine River as was the old wooden bridge that joined bank with bank for hundreds of years. Rather the river is dammed up into the power plant. What the river is now, namely a water power supplier, *derives from out of the essence of the power station*. ... But, it will be replied, the Rhine is still a river in the landscape, is it not? Perhaps. But how? In no other way than as an object on call for inspection by a tour group ordered there by the vacation industry" (1977a, page 16, emphasis mine).

Here, technology reduces our relation with the Rhine to a stock of power, no different from the energy generated by a windmill or a coal-fired power plant. The challenging forth of electricity production has transformed this river into standing reserve—a resource at hand, ready to be ordered. As the last line in this quote shows, Heidegger is careful to not just limit his conception of technology to science and machines. He also notes that such an orientation toward the world can extend to other realms, where even the beauty of the river becomes standing reserve to be summoned for the 'vacation industry'.

For Heidegger the reduction of beings to standing reserve is not an ordering with fixed ends but rather an ordering that sets aside beings for further ordering: "Everywhere everything is ordered to stand by, to be immediately at hand, indeed to stand there just so that it may be on call for a further ordering. Whatever is ordered about in this way has its own standing. We call it the standing-reserve" (1977a, page 17). In other words, our orientation toward the world has become such that all that is knowable by modern science becomes understood reductively as standing reserve, where the value of a thing is never found in the thing-itself but rather in a reductively understood notion of usefulness. Speaking about an airplane, Heidegger writes: "it stands on the taxi strip only as standing-reserve, inasmuch as it is ordered to ensure the possibility of transportation .... Seen in terms of the standing-reserve, the machine is completely unautonomous, for it has its standing only from the ordering of the orderable" (page 17). In this understanding of technology, the world is set-upon in a way in which it is challenged forth as standing reserve—a collection of objects to be ordered.

We can see how, through climate management regimes like the CDM, the world becomes a stock of standing reserve, and much like Heidegger's airplane, the value of trees comes to be understood in terms of their ability to contribute to a worldwide ordering of carbon. This instrumental relation—in which locally specific spaces and objects are understood in terms of their contribution to a global system of climate management—is an approach that is predicated on a conceptual understanding of 'the world' as a singular, orderable space. Here, an authentic engagement with 'the world' is superseded by a technological one, where 'the world' is no longer the totality of meaningfulness through which our being is constituted; instead, 'the world' becomes a particular conception of planet Earth—an orderable, undifferentiated mass of carbon to be managed.

From this perspective, the calculatory demands of carbon offsets are an effect of this ontological comportment toward the world, a comportment that puts primacy on the makeability of beings and leads to an ever-expanding inclusion of beings within its purview (Dallmayr, 2001). The CDM, and the Kyoto Protocol of which it is a part, is predicated on a conception of a global atmospheric balance of carbon dioxide that can be known, modeled, and managed to some degree. With the rise of forestry offsets within Kyoto, this is a conception that has expanded to include not only the atmosphere but also the soils and biomass of the Earth—including people and animals.

Under the baseline requirements of the CDM, this calculatory conception of the Earth's carbon balance has extended to even the producers of CDM projects, where the people who plant the trees and even the territorial space within which the trees are planted (ie the state of Costa Rica) must be accounted for concerning the future carbon impact within the prescribed spaces of a project. In this way, our technological comportment toward the world as one that puts primacy on the makeability of beings has led to a conception of ordering that is ostensibly about the atmosphere, but has come to include the entire planet as a singular orderable space.

The current managerial approach to climate change, where its purview has come to extend to almost everything, can be understood as derivative of a technological metaphysics, in which the world is challenged forth as a planetary circuit of carbon. This understanding of the world as a global space of orderability can be seen as a self-strengthening circle of manipulative unfolding, in which instrumental ordering begets more ordering (Dreyfus, 2000). Here, calculation is the grounds of this technological comportment, a recursive and self-strengthening unfolding of ordering, in which beings are revealed as information (Davis, 2007; Dreyfus, 1989) units of carbon that are ready for more ordering. Under this orientation toward the world, not only is the atmosphere and biosphere set upon for ordering but we, as humans, are as well. Under this metaphysical logic, we are also carbon. And through calculation, we are 'challenged forth' to be as such—carbon to be ordered.

The technological spaces of ordering: territory, the global, and relational space

In sum, under climate management regimes like the Kyoto Protocol, the world comes to be revealed as an undifferentiated grid of planetary carbon-ordering. Such an understanding of the world is underpinned by a technological metaphysics where all beings—including ourselves—come to be challenged forth as orderable objects: as carbon to be understood and managed quantitatively. To address the central problematic of this paper—the consequences of the enframing of technology on the production of space—I next consider how the self-strengthening unfolding of technology intersects with the calculable spaces that define the nation-state: its territory. I contend that the territory of the nation-state is derivative of the same technological metaphysics from which the global space of the climate has emerged and that the intersection of planetary carbon management and the discrete territorial space of the nation-state intersect in contradictory ways, where territory as a bounded absolute political space is simultaneously undermined and reinforced under the calculatory logics of carbon trading.

Heidegger's conception of the gigantic can help us understand the implications of a technological metaphysics for the challenging forth of a territorially bounded entity like the nation-state under the purview of carbon trading. As I discussed above, the gigantic, refers not to size but rather to a conflation of the quantitative with being, where 'what is' is what is understood solely through calculation and measurement. In this sense, the contemporary moment of globalization can be seen as a symptom of the gigantic, where a calculative understanding of space becomes extended to everything, and 'the world' has come to be understood as a single global, planetary space (Joronen, 2008).

Elden (2005a) explores this notion in his argument that modern notions of territory are underpinned by an ontology in which place is understood as calculable space, and territory is a political manifestation of this ontological grasping of space. Elden posits that globalization is a process that is neither the obliteration of this modern understanding of territory nor simply its unproblematic extension to the global scale.

Instead, globalization can be understood as the product of the same ontological determination of space from which our modern notion of territory has emerged. Making a similar critique of the globalization literature, Brenner (1999) argues against what he calls "state-centric epistemologies" that posit global space as an enlarged version of the territorial containers of the nation-state. Brenner argues that under such a view: "state-centric conceptions of global space mask the territorial state's own crucial role as a site and agent of the globalization process" (page 59).

Although I largely agree with this point, I posit that an understanding of the ontological grounding of calculative space allows us to see how this relation also runs the other way: the space of 'the global' that emerges through calculative thought can be a site and agent of the territorial state's own becoming. This claim can be understood if we consider 'global space' to be an unfolding of the gigantic whereby our understanding of the world is through calculation, and the world thus becomes a singular, global, measurable space. Under this purview, both the unfolding of 'the global' and the territory of the nation-state as measurable spaces is grounded in a technological orientation toward the world. And under the ontology of calculation that underpins the global management of carbon, the singular space of 'the global' shapes the unfolding of the nation-state as a calculable, ontically graspable space.

One can see this claim in action through the Costa Rican state's difficulties in developing a CDM methodology. The process is one in which the state, as a territorially bounded space, is put into a calculative relation with the global space of carbon that has come to define the CDM trading regime. Put in Heidegerrian terms, the global ordering of beings that carbon trading demands challenges forth the territory of the Costa Rican nation-state itself as a stock of standing reserve—an object challenged forth by the orderability of carbon. In this way, both the territory of Costa Rica and the global itself are enframed as carbon to be ordered. This is a technological orientation that derives from efforts to manage the atmospheric commons—efforts that have extended their purview to not just the atmosphere, but to living biomass, humans, and even the space of the Costa Rican state itself.

While the failure of the Costa Rican state's baseline methodology calls into question the ability of the state-as-territory to put itself in a calculative relation to a global space of carbon trading, the state itself as a political unit for managing carbon remains intact. In this case, not only is it a critical actor in producing carbon offsets under the CDM, but it is one whose very territoriality as a space of ordering remains fundamentally unchallenged. The current climate regime of the Kyoto Protocol and the UNFCCC is a process of managing the global climate, whereby 'the world' is imagined as a singular planetary carbon cycle. This is a political framework whose primary actors are composed of the territorially intact spaces of nation-states, where all carbon emissions and points of carbon sequestration become understood as occurring somewhere within the territory of a particular nation-state.

In this case, the calculatory grasping of planetary space that underpins carbon trading is grounded in the same ontological comportment toward the world that is productive of the "political grasping of space", as Elden (2005a) puts it, that results in our modern notions of territory. While the territory of the Costa Rican state became a sticking point in its development of CDM offsets in this instance, the state's very territoriality is also grounded in the same technological orientation toward the world that allows for planetary-wide managerial efforts like the CDM to come into being. In the same way that CDM offsets require the delineation of absolute spaces to mark the sites of additional carbon storage, the territorial 'containers' of nation-states are needed for locating specific sites of carbon emissions and storage under a global climate regime.

While some researchers have speculated about the future of transnational governance under an emergent carbon-trading regime (Bulkeley, 2005; Bumpus and Liverman, 2008), Costa Rica's experience with carbon offsets points to the contradictory effects that these new regulatory configurations have. In this case, the CDM's quantitative orientation requires not only that the carbon 'in the ground' be accounted for but that the future carbon responsibility of all related actors be calculated as well. Here, Costa Rica emerges as an assumed and necessary territorial space of ordering in a way that simultaneously undermines its ability to incorporate itself within these newly emergent spaces of carbon calculation.

Conclusion

In this paper I have argued that the practices of calculation that are productive of a carbon commodity, or at least the CDM version of it, are also productive of particular spaces and territories. In the process, I point to the ontological conditions that allow for these practices to occur. Using a Heideggerian perspective to examine efforts to calculate carbon, I have argued that the commodification of carbon is predicated upon a conception of the world as a single calculable, orderable space and that this orientation toward the world is what allows for a calculatory understanding of carbon that requires the production of Cartesian 'containers' for receiving carbon.

I conclude by highlighting two advantages to using a Heideggerian lens to understand our attempts to manage carbon. First, it calls into question the idea that processes of globalization, of which carbon offsets are an example, result in radically different constructions of space. A number of writers have suggested that the proliferation of relational connections has altered notions of space, place, scale, and territory enough so that an ontology of space needs to be theorized anew (Amin, 2002; Jones et al, 2007; Marston et al, 2005). An analysis of the calculations of carbon offsets from a Heideggerian perspective of being, however, shows that the global flows and networks that constitute carbon-space are not necessarily productive of a new ontology of being, but rather, the spaces that this commodity enables are an *effect* of a modern technological metaphysics of being. As Heidegger has argued, this is an ontological orientation that has been with us for quite some time. Viewing the spaces of carbon in this way shows us that carbon offsets are indeed productive of relational spaces, but these also come about through an ontology of calculation and a metaphysics of ordering that requires the production of bounded, Cartesian spaces and territories. The production of the spaces of carbon can thus be read as an enframing of the world that Heidegger identified as the essence of technology. Viewed this way, relational and absolute spaces require each other, for the connection of one being to another via commodified carbon is predicated on an understanding of beings that *necessarily* places them within absolute space.

This leads me to my second point. Although this understanding of the spaces that result from the worldwide management of carbon may sound abstract, it is an approach with political consequences. Using the facts at hand, I could have told a different story of the Costa Rican state's failed efforts at calculating the future carbon relation of its own policies. I could have highlighted the apparent incongruence of how two different environmental governance bodies calculate carbon—the national state and an international governance body such as the UNFCCC—and speculated on what this means for the future of transnational governance. This approach, in which globalization is understood through the lens of newly emergent scales of governance, has been frequently taken by scholars studying global processes (eg Bulkeley, 2005; Cox, 1997; Jessop, 2000). What is less discussed, and what I have brought to the forefront here, is the ontological grounding that allows for a global technocratic politics to emerge. In this case, the global effort to account for, and manage, worldwide flows of

carbon is predicated on a technological metaphysics, in which the world has become a singular space of orderability. And by understanding the world through the calculation of carbon, the enframing of technology has placed everything related to carbon—that is, everything—under its purview. I made this point earlier but will repeat it here. We are carbon. And our attempts to confront climate change through a technological management of the global carbon cycle runs the risk of reducing ourselves to beings that are little different from other components of the carbon cycle we are trying to regulate.

Heidegger argues that in the essence of technology lies not only a danger but also a 'saving power', where by taking a critical stance towards technology we can understand the effects that it has on us. The danger of a technological perspective on climate change lies in this form of relating to the world becoming the only way of being-in-the-world. Through a Heideggerian understanding of technology, confronting climate change that does justice to an authentic, or proper, belonging in the world necessitates a shift towards a relationship with the world that is no longer technological, but comes from somewhere else (see Irwin, 2008). Before this can happen, however, we must recognize how our current relation to technology, and consequently to the world and ourselves, has come to pass.

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