Realizing Carbon's Value: Discourse and Calculation in the Production of Carbon Forestry Offsets in Costa Rica

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Abstract: This article examines the relation between discourse and value in the production of a carbon forestry offset project among indigenous smallholders in Costa Rica. By analyzing a pivotal cost–benefit calculation that changed the trajectory of the project, this article makes two principal claims. First, the intelligibility of the calculation is grounded in a discursive formation that is emergent from a history of development projects in the region, where particular ways of speaking about the relation between indigenous bodies and agriculture have allowed carbon's commodification to emerge as a desirable project. Second, the calculations resulted in quantified representations of space that were necessary for the offset to become useful within the framework of the Kyoto Protocol. In this case, the forestry offset's use value derived from quantified representations of agricultural space; a process that opened some forms of land use for receiving carbon while foreclosing on others.

Keywords: carbon offsets, neoliberalism, value, development, agrarian change, Costa Rica

Introduction

In 2004, a group that included scientists, economists, indigenous leaders, and state bureaucrats began work on an agricultural development project among indigenous Bribri and Cabécar smallholders in southeast Costa Rica. This project's original goal was to revive cacao agroforestry practices by linking the production of agroforestry landscapes with an emerging global commodity—the carbon forestry offset. Specifically, project developers wanted to create a carbon forestry offset under the Clean Development Mechanism (CDM), where indigenous land users would receive a carbon payment for converting their pesticide-intensive plantain fields to more carbon-intensive cacao agroforestry systems. During the course of implementing this project, however, its goals shifted. After project managers completed cost–benefit calculations of various land use practices, they determined that the opportunity costs of switching from plantains to cacao agroforestry were too high for carbon financing to induce this type of change. Instead, their calculations revealed that carbon credits are better positioned to encourage the

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abandonment of swidden (slash-and-burn) systems of agriculture. In performing these calculations, project managers conceived of recently fallowed land, or *rastrojos*, as agricultural spaces that lack economic value, but which have high levels of carbon sequestration potential. Today, the project's largest single source of carbon storage now comes from allowing *rastrojos* to revert to secondary forest over a period of twenty years (CATIE 2006:80). In short, as a result of these calculations, the project's trajectory shifted from its original goal of *reviving* one form of indigenous agriculture to *replacing* another type.

While the stated goal of the carbon project was to promote ecologically friendly forms of land use in a culturally sensitive way (see Guzmán 2006), this project's calculations helped produce a final result that could potentially run counter to these aims. For example, swidden systems rely on a field rotation where recently harvested plots (*rastrojos*) are allowed a number of years to recover. This form of agriculture is used to grow maize, rice, and beans, subsistence staples that are commonly managed by women and which can provide an important hedge against price swings in basic foods (see Borge and Castillo 1997). Removing *rastrojo* plots from the long-term cycle of subsistence plantings would allow less time for currently utilized plots of maize and beans to recover before the next planting, potentially inducing long-term ecological damage and threatening the food and livelihood security of households. This example seems to follow the pattern found in other cases of commodifying nature, where the articulation between the abstract representations required of commodification and the socio-ecological complexity of locally produced natures result in projects that can produce negative social and environmental consequences in the long run (see Castree 2003; Robertson 2006; for carbon payments see Boyd 2009; Brown and Corbera 2003).

In this paper, I analyze the cost–benefit calculations of this project in order to examine why and how these "failed articulations" between the universal demands of capital and locally complex socio-natures occur. I do so by examining the relation between discourse and value in the production of a carbon offset commodity, where I treat the cost–benefit calculations of this project as discursive statements that enable the creation of value. Doing so, I make two central arguments. First, I argue that these calculations are situated within a wider discursive formation concerning indigenous bodies and their relation to agriculture, where indigenous agriculture can and should be improved in particular ways. This discursive formation allowed for the carbon offset project to emerge as a solution framed by a specific socio-spatial problematic, where the "problem" of indigenous agriculture is posed in ways that call forth the production of commodified agricultural spaces as the rational solution. I posit that carbon offsets emerged within a discursive formation where the "indigenous land manager" and "indigenous agriculture" are spoken

about in ways where the two *should be* aligned in ways that maximize the economic efficiency of the former through the spatial optimization of the latter. This way of speaking about agriculture and indigenous peoples, in turn, gives rise to commodified spaces, such as carbon offsets, as the most desirable way to make such an alignment occur.

Second, I draw on Marxian value theory to understand why these calculations, as discursive statements, were able to open up some spaces (*rastrojos*) for commodified carbon while foreclosing on others (cacao agroforestry). I argue that due to the global climate regime within which this particular carbon offset is situated (ie the Kyoto Protocol), these calculations were necessary to establish an offset's use value. In this case, the usefulness of a spatially bound, carbon forestry offset ultimately derives from its ability to contribute to a globally coordinated management of the world's carbon cycle. This means that a carbon offset's use value is not found in its qualitative characteristics, but instead, is found in the quantitative representations of its spaces. Thus, the project's shift to *rastrojos* did not derive from calculations needed to make these spaces commensurable for *exchange*, but rather, the project's final form resulted from calculations that were needed for these spaces to achieve commensurability with a globally conceived carbon cycle. This is a discursive transformation that is necessary for offsets to become *useful as commodities* within the framework of the Kyoto Protocol. In short, I seek to explain this project's origins and trajectory through the relation between the local discursive formation that allows for these calculations about indigenous agriculture to be understood and taken seriously, and the global orientation of this commodity that required a process of valuation that ultimately altered the specific spaces that were available to be commodified.

My arguments in this paper are meant to help work through a problem that Noel Castree recently identified in geographic scholarship on neoliberalism and nature, where he points out the difficulty of drawing out generalizable principles from the specific case studies of the ongoing "neoliberalization" of the nonhuman world (see Castree 2008a:137–141). Castree himself tries to overcome this difficulty by relating this process to any number of "environmental fixes"—efforts by capital or the state to resolve fiscal, political, or accumulation contradictions through the implementation of market-based forms of environmental governance (Castree 2008a, 2008b). Doing so, Castree theorizes the proliferation of "neoliberal natures" as a global-scale phenomenon, where he seeks to answer the question: "Why are human interactions with the nonhuman world being 'neoliberalised' *across the globe*?" (Castree 2008a:131, italics mine). In contrast, I inquire into how a neoliberal project comes to be desirable at a *specific site*, and point to the universal logics of capitalist value in order to explain the final form that a project ultimately takes.

Doing so, I draw on a wealth of critical research from development studies that has identified the emergence of "development" as a discursive and material project whose contours are constituted, in part, by the process of capital accumulation (eg Ferguson 1990; Gidwani 2008; Wainwright 2008). This is an ongoing process that is productive of development subjects, where "development" becomes a naturalized, and desired, goal for the diverse subjects that fall within the purview of liberal capitalism (Gidwani 2008). This critical approach has been broadly taken up by a number of scholars toward understanding "green development" projects as well, where they have shown how subjectivities become linked with the environment to produce environmental subjects whose interests concerning natural resource management become closely aligned with those of the state (eg Agrawal 2005; Birkenholtz 2009). Under this process not only are the subjects of development produced, but their insertion within processes of capital accumulation and the governance goals of the state means that an ongoing supply of various objects and sites of development are continually produced.

In this paper, I take the commodification of carbon to be a discursive process of development in which specific sites and objects enter into a field of intelligibility in a manner that allows for some ways of understanding them while foreclosing on others. Specifically, this is a process by which value is produced in the spaces of indigenous agriculture through its discursive attachment to carbon. While I broadly agree with the idea that the commodification of carbon can be read as a type of environmental fix, as Castree might suggest (Castree 2008a; see also Bumpus and Liverman 2008), I resist the idea that these spaces have come to be desirable as commodified spaces *because of* the extension of global-scale capitalist processes to local sites. Instead, I ground my analysis in discursive formations of development, and show how nature's continued commodification is a process by which specific spaces, natures, and bodies come to be represented in ways that allow for neoliberal projects to emerge as the logical solution to longstanding development problems, with their final form ultimately conditioned by the requirements of capitalist value.

The paper proceeds as follows. In the next section I first explain the CDM's requirement of "additionality", and how the project's cost–benefit calculations help establish the additionality of a carbon offset. Then, I explore the discursive formation within which these calculations are situated by providing a history of development interventions in the Talamanca region, and the emergence of three discursive objects: the indigenous land manager, indigenous agriculture, and cacao agroforestry. I argue that the rules of formation around how these objects are spoken about have opened a specific socio-spatial problematic of development that carbon is positioned to solve. In the following

section I analyze the cost–benefit calculations that underpinned this specific CDM carbon project in Talamanca, and how project managers came to treat *rastrojos* as atomized spaces of carbon-value potential. In the penultimate section I elaborate on what it means for additionality calculations to be discursive statements that enable value by placing these calculations within a Marxian understanding of value. Specifically, I draw on Kojin Karatani's (2003) interpretation of Marx in order to argue that these calculations can be understood as discursive statements intended to establish an offset's use value. I follow this argument with a discussion of why a carbon offset's position as a local space within a global regime of climatic management ultimately led to the conflation of additionality calculations with this commodity's use value. I conclude by highlighting the analytic benefits to understanding the relation of discourse and value to carbon's commodification.

Development Discourse: The Problem of Agriculture and the Solution of Carbon

The cost–benefit calculations I described at the beginning of this paper were done in order to comply with the CDM requirement of "additionality", a term that encompasses a broad range of evaluative approaches that are designed to ensure that carbon financing will produce a project does not subsidize *status quo* forms of land use (Michaelowa 2005). These calculations were performed in order to show that the project is financially additional, which means that carbon finance is needed for a project to occur (Bumpus and Liverman 2008). To meet CDM approval, project managers needed to demonstrate that certain types of land use changes were not possible under current market conditions, but *would* be possible with the influx of carbon financing. Thus, project managers needed to compare the current rates of profitability of different forms of land use with their levels of potential carbon sequestration in order to show what potential types of land use "switching" would require carbon financing. In this way, the cost–benefit calculations served to quantify an imagined future where carbon finance could potentially change the future decision making of indigenous farmers.

Rather than evaluate these calculations in terms of their claims to truth, I instead broadly follow Foucault's archaeological method (Foucault 1972) and treat these calculations as statements that occur within a discursive formation, where speaking about indigenous agriculture in terms of quantified cost–benefit tradeoffs is an intelligible way of speaking to the diverse subjects that help bring a carbon offset into being: scientists, CDM and state bureaucrats, offset consumers, and indigenous leaders. In other words, I ask about the conditions that allow for such calculations to be taken seriously among these diverse subjects,

and the effects that such a way of speaking can have. While additionality calculations are necessary to meet the requirements of the CDM, the calculations themselves occur within a discursive formation that is, in part, grounded in a local history of development interventions in the region. Thus, I analyze these calculations as discursive statements in order to understand how indigenous agriculture came to be considered as a site of carbon storage at all.

In the remainder of this section, I examine the rules of formation that define the emergence of three discursive objects that have consistently been at the center of development interventions in Talamanca since the 1980s: the indigenous land manager, indigenous agriculture, and cacao agroforestry. These objects have been of special concern since the *moniliasis* fungus (*Moniliophthora roreri*)—microbial spores that attach themselves to cacao pods and render them inedible—swept through the Talamanca region in 1979, which at the time, was the country's largest cacao-producing region (Dahlquist et al 2007). That was an event that, within a few years, transformed the Talamanca region from Costa Rica's largest producer of cacao—a crop that was grown using few chemical inputs and a diversity of shade trees—to a region that primarily produces chemical-intensive plantain monocultures (Polidoro et al 2008). This agro-ecological transformation marked the beginning of a period of state-led and internationally financed agricultural development projects aimed at reviving cacao agroforestry in the area that has continued until the present. This event also marked the emergence of a period of intensive inquiry into a particular conception of indigenous agriculture.

During this time, the "indigenous land manager" and "indigenous agriculture" became increasingly common objects of study. In general, development projects, as well as academic writings during this time, tended to be oriented around two key "problems" associated with indigenous agriculture: the abandonment of ecologically friendly, "traditional" forms of land use such as cacao and banana agroforestry (eg Somarriba and Beer 1999), and the looming specter of unsustainable population growth (eg Borge and Castillo 1997; Vargas Carranza 1985). These two problems were often linked. Writings during this period argued that indigenous agriculture is unable to keep up with the demands of a growing population without recourse to increasingly ecologically destructive, and modern, forms of land use (Borge and Castillo 1997; Borge and Laforge 1995; Castillo 1999). The proposed solutions to these problems were often centered on two things: the importation of new technologies—usually hybrid, monilia-resistant varieties of cacao (eg Beer 1991); and/or increasing the economic value of "traditional" crops. The latter to be done through either better marketing of "organic" products for export (eg Hinojosa Sardan 2002), or by intermixing more valuable plant species, such as lumber and spice trees, within the spaces

of "traditional" agriculture, resulting in a updated form of agroforestry (see Beer 1991; Somarriba 1997).

Projects designed to improve indigenous agriculture were often linked to improving the indigenous body as well. This relation can be seen in the stated objectives of a large Dutch-financed development project in this area in the mid 1990s, Proyecto NAMASÖL, whose goal was to: " . . . try and create a process of technological change within the evolutionary context of the indigenous culture of Talamanca; which means triggering the potential transformation of the *Talamancan producer*" (Borge and Laforge 1996:3, italics mine). This project's overall goal of promoting "sustainable development" was wide ranging, and included strengthening the institutional capacity of the area for managing and protecting a national park (La Amistad National Park), introducing educational and health programs to the area, and introducing new technologies and best management practices for promoting sustainable agriculture (organic fertilizer and pesticide, monilia-resistant trees etc).[1] Below, I examine more closely the consultancy report for this project (see Borge and Laforge 1996) and how it conceptualizes the "Talamancan producer" and its relation to the "agricultural system". I do this to illustrate the discursive relationship between the indigenous body and agriculture and how the two are spoken about within the contemporary context of development interventions in this region.[2]

Co-authored by an agricultural economist and a cultural ecologist, this report advances the following hypothesis concerning agriculture in Talamanca: "there exist two systems of production in opposition:the traditional system and the outside system" (Borge and Laforge 1996:5).[3] The document ultimately concludes that, instead of existing in opposition, these two systems are complementary, and are linked through the rationality of the "indigenous producer". Figure 1 is redrawn from the report, and it illustrates how the two systems are tied together through the cultivation of corn. Under this conceptual scheme, the "indigenous producer" grows corn (a "traditional crop"), which allows him/her to throw work parties, where workers are "paid" by being given Chicha, a mildly alcoholic beverage brewed with fermented corn. Using an econometric analysis, the report demonstrates that such work parties are a less expensive way for the producer to access labor for their cash crops than paying daily wages. Thus, the economic efficiency of this form of communal labor means that traditional agriculture provides an economic subsidy for modern cash crops.

Why has such a delicate balance between traditional and modern halves of agriculture emerged? To answer this question the authors go through great lengths to describe a holistic picture of the indigenous producer, arguing that his or her goal is not merely to maximize profits but to improve one's "wellness", a definition that includes "non-economic" goals such as "good relations with neighbors", "good

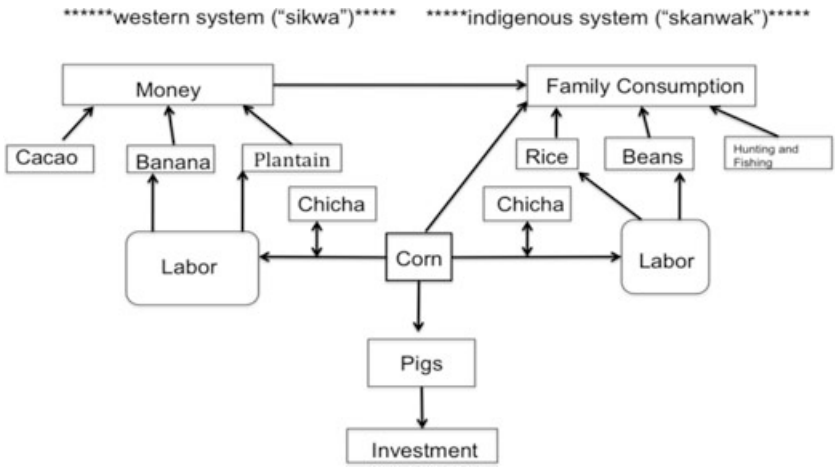

Figure 1: The indigenous agricultural system. Here, Corn (middle) acts as the hinge between the "western system" (left side) and the "indigenous system" (right side) where it allows households to brew Chicha, and throw work parties, which is deemed an economically efficient way to access labor for growing cash crops (source: figure redrawn from the NAMASÖL consultancy report; Borge and Laforge 1996:29)

health", and "cultural expression" (see Borge and Laforge 1996:17). Presumably, this expansive understanding of wellness explains why such a diverse system, with its traditional and modern elements, exists today. Nevertheless, when it comes to explaining how the indigenous agricultural system is able to function, with its simultaneous orientation towards subsistence agriculture and cash crops, the indigenous body emerges in the form of the abstract rational economic actor. In this case, the indigenous land manager's economic rationality toward labor emerges as the critical hinge upon which a complex, and precarious, balance between the modern and traditional parts of agriculture is maintained.

Despite the perceived rationality of the indigenous body, development writings on Talamanca have consistently posited this system as a problem. The "modern" half of the system—plantain monocultures—is often referred to as an ecologically unsustainable system that "demands a lot from the soils" (Borge and LaForge 1996:37), and results in pesticide and fertilizer run-off (eg Polidoro et al 2008). Meanwhile, the "traditional" half is often argued to be insufficiently productive to meet projected population growth trends (Borge and Villalobos 1995; Castillo 1999). In other words, each part of the agricultural system is unsustainable in different ways; where the modern half of the system is unsustainable ecologically, the traditional half is characterized as unable to accommodate the needs of a changing society. While the indigenous producer is posited as economically rational, this rationality has nevertheless produced a two-part agricultural system

that is inadequate to the twin problems of population growth and environmental decay. The report's conclusion follows the implication of nearly all development and extension literature of the last 30 years in this region when it calls for the "improvement" of the agricultural system. Since the arrival of the *monilia* fungus, "improvement" of the agricultural system has almost always coalesced around the revival of a third discursive object that has been critical in the framing of development interventions in this region: the cacao tree.

Cacao and Carbon

The cacao tree has been a critical object of intervention for the Tropical Agricultural Research and Education Center (Spanish acronym: CATIE), a regional agricultural development institution that was responsible for implementing the CDM carbon offset project in Talamanca and an institution with over 20 years of experience working with indigenous peoples in Talamanca. Beginning in the late 1970s, "agroforestry"—understood as the intermixing of crops and tree species—emerged worldwide as a specific object of promotion (Nair 1993; Schroeder 1999). CATIE joined this approach to agricultural development and began promoting agroforestry as a solution to the perceived problems of overpopulation and desertification in tropical areas (CATIE 1995). The perceived ability of agroforestry to solve these problems is captured by Eduardo Somarriba, who was the senior scientist in charge of the Talamanca carbon project. In 1981 he wrote the following in an introduction to a study on agroforestry for CATIE:

> The exponential growth of the population in tropical areas has led to increased demand for food and expansion of area under cultivation. This expansion has put pressure on tropical soils which will not support intensive use. At the same time the local and worldwide demand for forestry products increases and establishes a conflictive situation between land use options . . . An appropriate alternative would be agroforestry systems, which would fundamentally give the moist tropics a forestry vocation (Somarriba 1981:2).

In this passage, agroforestry is posited as a desirable method of rural development because it neatly solves a number of problems at once by being both spatially optimized and economically efficient. While these virtues of agroforestry were being promoted by scientists at CATIE, longstanding cacao agroforestry practices in Talamanca were quickly vanishing because of the spread of the *monilia* fungus.[4]

It is within this discursive and material context that CATIE initiated its first major agricultural undertaking in Talamanca. Its first project began in 1984 and was centered on introducing monilia-resistant, hybrid varieties of cacao trees (Dahlquist et al 2007). In 1987, a second project, a collaboration with the German government, was an effort to

introduce more economically valuable forms of agroforestry practices, such as increasing the density of valuable shade trees in cacao plots and encouraging farmers to plant trees along their property lines (Beer 1991; Somarriba, Dominguez and Lucas 1994). CATIE's third major intervention into promoting cacao in Talamanca began in 2002 and marks a shift away from maximizing the economic efficiency of cacao agroforestry, and instead expanded to understanding and promoting the ecological value of agroforestry in the region. The "Cacao and Biodiversity" project, a World Bank financed project, sought to improve biodiversity conservation in cacao farms in this region (Somarriba et al 2004). While still trying to increase the economic and biological viability of cacao trees through many of the same methods as before (such as introducing *monilia*-resistant hybrid trees), this new project changed its mandate and linked the value of cacao agroforestry to wider ecological benefits in the region.

I provide this brief sketch of CATIE's history of cacao promotion in Talamanca, and the justifications of its work, in order to mark the general discursive rules that have guided how cacao agroforestry is spoken about. As a development tool, agroforestry's attractiveness lies in its dual features as an economically efficient use of space and an ecologically sustainable form of land use. Because of these two characteristics, cacao agroforestry is conceived as a solution to the problems of overpopulation and degradation. Later, cacao agroforestry became a geographically connective space as well; a farming system that promotes biodiversity and can provide an anthropogenic "link" to parks and wildlife corridors (eg CATIE 2006). Nevertheless, despite these advantages, "cacao agroforestry" is a system that requires development interventions if it is to flourish, because in Talamanca it remains biologically and economically unviable. Its susceptibility to *monilia* requires the introduction of resistant varieties of cacao, and its economic non-viability has been the impetus for efforts to make cacao agroforestry more profitable, either through increasing its exposure to organic markets (Hinojosa Sardan 2002) or by increasing the value of the spaces of a cacao plot itself, namely through increasing the intensification of commercially valuable trees (Beer 1991; Borge and Laforge 1996). In short, cacao agroforestry is posited as an ecologically friendly and efficient use of space, but with specific biological and economic constraints that require development interventions for it to spread in Talamanca.

It is within this development puzzle that the discursive objects of the "indigenous producer" and "indigenous agriculture" emerge as key pieces. Recall that while the indigenous agricultural system as a whole follows a particular cultural and economic logic, its reliance on "modern" crops like plantains renders it ecologically unsustainable (eg Harvey, Gonzalez and Somarriba 2006). Promoting

cacao agroforestry can potentially solve this ecological problem. The indigenous producer's economic rationality, however, means that the success of a project requires an increase in cacao's relative value. According to development writings during this time, indigenous farmers, in their role as economically rational maximizers, tend to favor the most profitable crops (eg Hinojosa Sardan 2002). This means that maximizing the relative value of cacao agroforestry was a necessary step towards increasing its use (eg Somarriba 1993). In other words, before cacao agroforestry can solve the "problem" of indigenous agriculture its properties need to align more closely with the economic rationality of the indigenous body. CATIE's efforts to introduce commercially exploitable crops and to promote denser stands of timber trees were efforts to "improve" cacao agroforestry so just such an alignment could occur.

Since the 1980s, the "problem" of indigenous agriculture has been defined in terms of it being ecologically and economically unviable. This is a problem that two decades of agricultural development projects have tried to solve. I argue that both the framing of the problem and its solutions are emergent from a defining problematic, which is understood here as the system of reference points and relations that open some answers and foreclose on others (see Althusser 1979 [1965]). While debates on rural development in this area are complex, and often contradictory, the problematic of development in Talamanca can be read, in part, as the incongruence between these three discursive objects: the economically rational indigenous body, the ecologically unsustainable "agricultural system" and the ecologically friendly yet economically unviable cacao tree. And it is within this problematic that carbon offsets emerged as yet another way to align these three discursive objects. As we will see, once this effort at promoting cacao intersected with the process of creating value through carbon, different spaces altogether emerged as "ready" for development.

Enter Carbon Offsets: The Cost–Benefit Calculations

Like most agricultural development projects in the region, the original goal of this particular carbon offset project was to promote the use of cacao agroforestry. The original idea behind this project was that, with the arrival of CDM carbon offset financing, cacao agroforestry would become an economically viable space; and along with continued efforts to introduce monilia-resistant hybrid varieties of cacao, both biological and economic constraints to planting cacao would be overcome and farmers would be able to make the switch from growing monoculture plantains to planting cacao all while still following their rational economic interests (anonymous interview 2008; CATIE 2006; Segura 2005). In short, carbon payments would make cacao farming more

profitable (thus overcoming the economic constraints) while continued efforts to give away resistant trees would overcome the biological constraints to cacao production.

In order to establish an offset, however, project developers needed to prove that just such a "switching" would take place because of the influx of carbon financing—the "financial additionality" requirement discussed above (Michaelowa 2005; Segura 2005). To help meet this requirement, project planners calculated the opportunity costs of switching from one form of land use to another. To do this, the labor, material, and transportation costs for each form of land use were estimated, along with typical production rates and market prices for each crop. These data were used to establish the net present value of each type of land use. In addition, each form of land use was assigned a carbon fixation rate based on biomass and soil measurements done by the project, which followed methodologies derived from the CDM. Finally, opportunity costs were calculated by comparing changes in the net value of land use after switching, divided by the net change in carbon fixation resulting from the land use switch. The resulting calculations showed the minimum carbon payment needed to induce a farmer to change from one form to the other. Under this reasoning a farmer would need an extremely large carbon payment (US$960/tonne) to cover the opportunity costs involved in a switch from plantain to cacao agroforestry (Segura 2005:34).

Just as different types of greenhouse gases must be made commensurable for carbon markets to function (eg MacKenzie 2009), project developers needed to be able to compare qualitatively different, yet often interconnected, forms of land use in terms of quantified cost–benefit tradeoffs. This meant discursively treating these spaces as separate, standalone forms of agriculture. While a typical *rastrojo* field was once a corn field, and will one day likely become a rice field, each one of these types of land use were considered atomistically separate, and "frozen" in time for the purpose of calculating their value-to-carbon ratio.

Project planners had very good reasons for doing this, since the carbon offsets were meant to induce future changes, so the carbon value of each form of land use had to be considered as they exist at the present moment. As one of the project planners explained:

> . . . [indigenous farmers] have a fallow cycle and a crop cycle, but with this type of system they have a number of options, they have the option of rice, they have the option of maize, they have the option of beans, so we tried to analyze the incomes that each one of these choices generates . . . in order to see the minimum that we would have to pay them if one producer is working with maize and if another is working with rice, that's why we did what we did, although obviously it's a complete cycle (anonymous interview 2007).

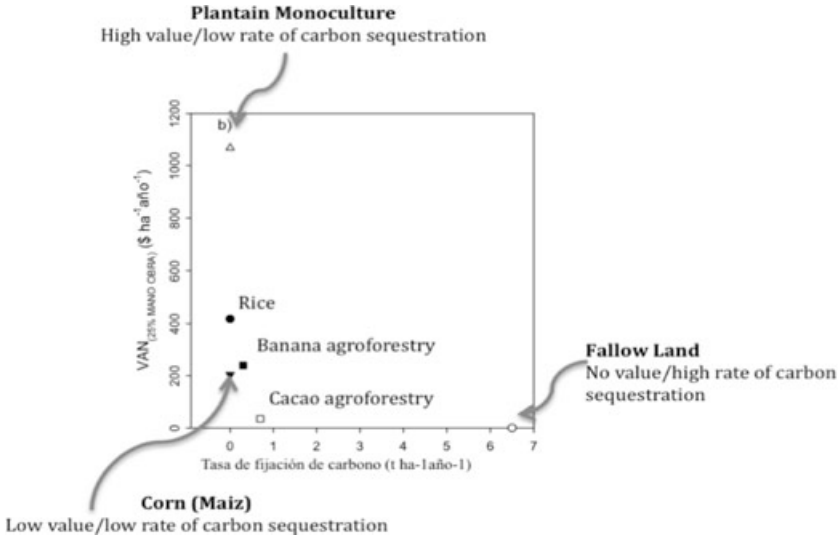

Figure 2: Annotated graph from the final project design document of the Talamanca Carbon Project. Net present values of each type of land use are plotted in relation to their rate of carbon sequestration (x-axis) and their net annual value per hectare per year (y-axis). Net annual value figures assume the household hires 25% of their labor (source: Segura 2005)

In other words, in order to understand how carbon financing would impact the future pathways of individual agricultural spaces, project planners had to bracket the long-term relationship of one space to another and consider the value of each space at the moment of an offset's creation. Figure 2 shows how these spaces were analytically "mapped" by project developers in relation to their value and carbon content, showing where each space falls in relation to the others. In order to show these relationships, each of the steps of the swidden cycle (crop–fallow (*rastrojo*)–secondary forest–crop) are separated so that they may be related to all other forms of land use in the region in order to calculate the ability of carbon finance to induce "switching".

To make this graph, an idealized form of each type of land use was discursively severed from its ecological and economic links to other forms of land use so that these ideal types might be compared with each other in terms of their present economic value and future carbon potential. By discursively marking *rastrojos* as a space all their own, and separating them from their past and future relations with other forms of land use (such as maize or rice), fallow land emerges as the "empty" containers of low economic value and high carbon potential made them ideal for a carbon offset (cf Bassett and Zuéli 2000).

I describe this process in order to draw attention to how this understanding of agricultural space is situated within a wider discursive

formation in which the indigenous body, cacao, and indigenous agriculture more generally are spoken about in particular ways. Similar to the way in which cacao agroforestry is spoken about as a way of optimizing space, each form of land use is posited as a container of value, where the project offers a way to "fill" these spaces with potentially valuable carbon-sequestering biomass. For these calculations to have meaning, however, one must assume that the spaces are "managed" by the rational maximizer of neoclassical economics. This can be read as the application of universal economic theories and assumptions to a local context, a practice that has come under scrutiny of a number of critics of neoliberalism and neoclassical economics more generally (eg Peck 2004; Robertson 2006). I posit, however, that such calculations can only have meaning within a discursive formation where the discursive "work" that makes such a calculation understandable, even possible, in this context has been ongoing for quite some time. In this case, the previous emergence of the "indigenous land manager" as a rational economic agent—the one who "maximizes economic efficiency" of Proyecto NAMASÖL—was a necessary precondition for such calculations to be taken seriously within a context of agricultural development in Talamanca.

In other words, the ability of the carbon calculations to emerge as discursive statements that can be *evaluated as* true or false comes from their relation to a historically embedded set of discursive rules—rules that allow for these calculations to discursively relate indigenous bodies to agricultural space in these particular ways. As Foucault argues, no statement can exist in isolation, but is always understood in relation to a field of similar statements (see Foucault 1972:99–100). Understood this way, these calculations are more than a neutral evaluative tool that was diffused from the regulatory structure of the Kyoto Protocol or the discipline of neo-classical economics. These calculations are also embedded within, and transformative of, past conceptions of the indigenous body, and its relation to agricultural space. Past discursive statements posited the indigenous body as an economically rational manager of discrete agricultural spaces, ultimately allowing for the intelligibility of a cost–benefit calculation where *rastrojos* "open up" as discrete spaces of potential carbon value. The end result was a project that had to re-orient its original goal. Instead of promoting an expansion of cacao agroforestry, these cost–benefit calculations forced the project to look toward sites without an apparent economic value, with the rastrojos as a leading contender for receiving carbon. The result is a final project plan that calls for 30% of the project's carbon sequestration to come from eliminating *rastrojos*, 29% to come from adding additional trees to current banana plots, 26% from additional trees to cacao plots, and 15% to come from reforesting riverbanks (Segura 2005:80).[5]

The Value of Additionality and the Discourse of Value

While the calculations can be seen as part of a discursive formation that helped give rise to a development problematic, I contend that an engagement with value theory is needed to understand why such calculations are needed at all. Using a Marxian approach toward value, I argue that the practices of calculation and quantification at the point of a carbon offset's production are necessary discursive statements for the carbon forestry offset to acquire a use value. I make this argument by drawing on the importance of a commodity's use value at the point of what Marx refers to as the *salto mortale* of value (Marx 1976 [1867]:201)—the moment after a commodity is produced, but has not yet been sold, and must make the fatal leap from production to consumption for value to be realized.

In order to show how practices of calculation and measurement are sources of a carbon offset's use value, I draw on the insights of Kojin Karatani (2003), and his argument that Marx showed that it is only *after* the commodity is sold that the value created in the production process is *realized* [*verwirklicht*], and it is only from this *ex post facto* perspective that one can see the commodity's form as a synthesis of both use and exchange value:

> A certain thing—no matter how much labor time is required to make it—has no value if not sold . . . Classical economists believe that a commodity is a synthesis between use value and exchange value. But this is only an ex post facto recognition. Lurking behind this synthesis as event is a "fatal leap (salto mortale)" (Karatani 2003:8).

The *salto mortale* that Marx describes in *Capital*, Vol I (Marx 1976 [1867]:201) is the moment when the capitalist puts a commodity into the exchange relation—when the commodity object enters into an equivalence relation with money. It is in this moment of the *salto mortale* that the use value of a commodity takes on a special importance. This is because the production of value at the *point of production* is merely the production of *potential* values, and the critical synthesis between use value and value that embodies the commodity form does not emerge until the commodity crosses the threshold from production to exchange, and the commodity is purchased and the use value of this object is realized. Marx writes:

> All commodities are non-use-values for their owners, and use-values for their non-owners. Consequently, they must all change hands. But changing of hands constitutes their exchange, and their exchange puts them in relation with each other as values and realizes them as values. Hence commodities must be realized as values *before* they can be realized as use-values (Marx 1976 [1867]:179, italics mine).

And yet paradoxically, this exchange (C-M′), where money is advanced and a commodity becomes a use value (and then also results in value for

the producer) cannot happen unless the commodity *already has* a use value before the exchange occurs. Marx continues:

> On the other hand, they [commodities] must stand the test as use values before they can be realized as values. For the labor expended on them only counts in so far as it is expended in a form which is useful for others. However, *only the act of exchange* can prove whether that labor is useful for others, and its product consequently capable of satisfying the needs of others (Marx 1976 [1867]:179–180, italics mine).

In other words, the producer of a commodity must produce use values for others for their commodities to have value; however, a commodity only *becomes* a use value after it is sold and is useful for the consumer of a commodity. The producer must accept a leap of faith that the commodity will have a use value for someone and the value congealed in the commodity (measured in abstract socially necessary labor time) may be realized.

Though abstract, Marx's analysis of the value form shows how additionality calculations enable a carbon offset to have a use value. In theory, the usefulness of a carbon offset is to allow a person or industry to emit carbon dioxide (and other greenhouse gases) in a way that does not adversely impact the climate. Additionality calculations are needed to ensure that an offset consumer knows that the project they are financing results in additional carbon in the ground, rendering his equivalent emissions as "climate neutral". Under the framework of the CDM, a forestry offset is dependent upon its demonstration that it "really is" contributing to this worldwide mitigation of carbon. If money advanced for a carbon offset were subsidizing already-existing trees, an offset would fail to neutralize someone's greenhouse gas emissions, and would not be useful in this sense. To avoid this, a forestry offset must demonstrate that the space of an offset project will one day be occupied by a complex system of trees, soils, hydrology, and so forth, and that this assemblage of carbon-sequestering biomass will be there *because of* the sale of a carbon offset credit. In other words, an offset must be put in an exchange relation before it can become useful for someone; however, this offset must be *shown to be useful* before it can be exchanged. Here, additionality calculations fill this role. Through these calculations, the commodity's use value is demonstrated, the *salto mortale* of exchange can be completed, and value can be realized.

I contend that an understanding of use value from the perspective of the salto mortale can explain why the carbon forestry offset assumed the form that it did. Seen from the perspective of consumption, a carbon offset requires that a consumer calculate its carbon relationship with the world, where one determines a quantified level of carbon dioxide that needs to be "offset". By quantifying one's climatic impact, a specific carbon-emitting action in one location can now be made commensurate

with a level of carbon stored in the ground somewhere else. In this way, the quantified relation between a potential offset consumer and her carbon dioxide emissions allows for the carbon storing capacities of a forestry offset to become useful. For example, a potential offset consumer in Belgium may have a vague idea that her factory's emissions are contributing to climate change, however the carbon sequestering properties of a *rastrojo* field in Costa Rica are of no use to that owner until her factory is put into a relation with a global regime of climate regulation (ie the Kyoto Protocol). Thanks to emissions cuts that are mandated by Kyoto, the carbon dioxide externalities of this owner's factory have now been quantified and found to be above the regulatory limit. Now the owner has costly emissions reductions she must meet. By quantifying her factory's emissions, and by putting these emissions in relation to a global management of the atmosphere, the carbon that is sequestered in an abandoned *rastrojo* field has now become useful for the factory owner. In other words, it is through a consumer's quantified relation to a global climate management regime that a particular ordering of carbon is needed, and it is through this coordinated ordering of carbon that a carbon offset project in Costa Rica becomes useful to someone on the other side of the planet.

Such usefulness, however, cannot help overcome the *salto mortale* of value until similar calculations are performed on the production end, and offsets are demonstrated to be useful. Simply put, a CDM offset's usefulness within the Kyoto Protocol is centered on its contribution to a worldwide coordination of the global carbon cycle, where carbon dioxide emissions in one place can have, in theory, a neutral climatic impact due to an equivalent level of carbon sequestration that occurs somewhere else. For such a geographically dispersed management of the climate to occur, however, various additionality calculations are necessary so that offset consumers can be assured that money advanced from a credit sale will materialize in new forms of carbon storage. Such calculations provide assurances that forestry offsets will help, for example, a corporation or nation meet the requirements of the Kyoto Protocol. And for the factory owner in Belgium, offsets are only useful to her to the extent that they help her meet her emissions requirements. Without calculations that demonstrate an offset's additionality, it is not useful in either sense.

In other words, under the precarious choreography of the global carbon cycle that has come to define the Kyoto Protocol, it is not the carbon-in-the-ground that gives an offset its use value. Instead, it is the relational ordering between the spaces of carbon storage, the carbon dioxide emitter, and the atmosphere itself that ultimately makes a forestry offset useful. Furthermore, I contend that in the context of this management of carbon, these practices of calculation do not merely *represent* the ordering of carbon that occurs within this framework, but

rather, the calculations themselves and the relational ordering of carbon become effectively inseparable. This inseparability can be seen through the function of the concept of additionality. Under the Kyoto Protocol, it is only the carbon forestry offset's *demonstrated* additionality that counts towards that project's value (Chomitz 2000). A particular project may be *de facto* additional, but if it is not demonstrated to be such, it cannot be useful to the factory owner trying to meet particular emissions reduction standards. Thus, additionality calculations are more than abstractions that *represent* an offset's use value, but rather, the calculations are needed to demonstrate a project's usefulness, and allow for the *salto mortale* of value to be completed. Thus, under the overdetermined framework of carbon offset trading, an offset's materialization becomes inseparable from its representations, and the calculations themselves become the useful thing.

This folding of quantification into use value results in particular discursive transformations of space. To conduct a cost–benefit calculation that would show additionality, each space was treated as a discrete space of carbon-value potential. To do so, the indigenous body's relation to space becomes discursively transformed. No longer is he managing a complex, interrelated series of agricultural spaces, but instead, atomized containers of carbon value potential. Here, the spaces of the *rastrojo* have emerged not as a hinge that links other agricultural spaces (as with the Proyecto NAMASÖL report), but instead, as a valueless space of carbon sequestration potential. While this was a process that was conditioned by previous discursive formations of the indigenous body and space, it also transformed these objects in new ways through framings of space that are necessitated by the calculatory demands of creating value in a carbon offset.

Conclusion

In this paper, I have analyzed how specific spaces become opened up as sites of commodified carbon storage by treating the cost–benefit calculations of a carbon forestry offset as a discursive statement that is needed for this commodity to have value. Doing so has led me to argue that the intelligibility and significance of these calculations derive, in part, from their connections with other statements within a wider discursive formation of agricultural development. In the process, I have demonstrated that their impact as statements derive from their embeddedness within a history of development interventions in this area, from which a sedimented discourse about the indigenous body and its relation to agricultural space has emerged. In other words, these calculations are able to occur, and be taken seriously, through the emergence of the indigenous body, and indigenous agriculture, as discursive objects that are spoken about in particular ways. Such a

"local" discursive formation helps to explain how carbon offsets were able to emerge as the solution to the problem of indigenous agriculture.

Understanding this context, however, does not explain why such calculations need to occur. Thus, I have also analyzed these calculations in their role as facilitating the production of value. I have argued that the calculations themselves are the offset's use value. This is a condition that derives from the paradoxical and uncertain position a commodity is in before it is sold, and value is realized, where the commodity is not realized as a use value until this moment, but yet must still be a use value before the *salto mortale* of value occurs. I have demonstrated that, when confronted with the exigencies of producing a commodity with use value in the context of the Kyoto Protocol, the indigenous body, and its relation to agricultural space, becomes discursively transformed in significant ways, allowing for particular agricultural spaces to be seen as "ready" for the production of carbon value, and foreclosing on other possibilities.

A number of writers have shown the difficulties of commodifying nature, difficulties that emerge when the accumulation and circulation demands of capital are confronted with the materiality of the non-human's physical properties. This uneasy marriage can mean that some natures are "uncooperative" (Bakker 2003) and extremely difficult to fully commodify, or that other natures need to be understood in radically simplified ways so they can be "read" by capital (Robertson 2006). With this case, I extend these insights by showing how the properties of particular natures come to be desirable as commodities in the first place, and how the exigencies of value condition how some natures and spaces can become commodities. As Castree (2008a) suggests, such a case can be seen as a type of environmental fix, one that is not immune to the problems that other writers on nature's commodification have explicated (eg Bakker 2003; Boyd 2009; Robertson 2006). I show here, however, that the question of why some spaces become commodified cannot be reduced to the global process of capital's contradictions alone, even if the demands of realizing value ultimately condition how a project may unfold. Instead, my approach seeks to problematize the relation between the global and the local in the production of a commodity. In this case, the project is simultaneously situated within a "local" development context—a position by which the project has become desirable—and a global project of regulating a worldwide carbon cycle. This is a position that, when combined with the requirements of value, requires specific quantified representations of the spaces of an offset, and ultimately conditions the kinds of spaces that are available for carbon commodification. In this case, *rastrojos* became a site of commodification through a process by which this space came to be understood as a "valueless" space of carbon potential.

Thus, my aim in this paper has not been to show how globally emergent "neoliberal" processes such as commodification become applied to a local context. Instead, my goal has been to show how a particular discursive formation allows for specific neoliberal interventions to arise (cf Boyd 2009). By evaluating the cost–benefit calculations as discursive statements that enable the production of value, however, I have shown that the properties of the commodity form require an opening-up of different spaces entirely. In this case, local complexity did not alter the implementation of abstract neoliberal ideas, but rather the process of value conditioned the manner in which this specific project was able to unfold. This is particularly significant because this was not a case where calculations were done to provide a commensurability needed for exchange, but rather, a quantified commensurability between producers, consumers, and the global climate was required for the offset commodity to become useful, and for value to be realized.

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Endnotes

[1] The agricultural extension component reached approximately 64 different households (Bodegom, Sanders and Brenes Castillo 2000). This is smaller than agroforestry projects undertaken by CATIE (described later), which usually involve anywhere from 100 to 500 farmers. To my knowledge, no systematic study of the long-term success of these projects has been undertaken. However, field observations, anecdotal evidence, and the fact that very similar agroforestry improvement projects have been ongoing since the early 1980s suggest that the long-term efficacy of these projects is questionable.

[2] While the report that informs the NAMASÖL project is remarkably consistent with other development projects, I note here that the goals of the NAMASÖL project differed from the projects carried out by CATIE (described later) in important ways. The external practitioners were different even if local indigenous liaisons and participants were the essentially the same. In addition, agriculture was only one component of a broader capacity-building focus of NAMASÖL while CATIE's projects were more centrally focused on promoting sustainable agriculture.

[3] One of the authors of this report, Carlos Borge, is frequently employed to write consultancy documents for other development and state agencies working in this region, and has contributed to consultancy reports for a number of CATIE's projects as well.

[4] Cacao cultivation still exists in Talamanca, albeit at a drastically reduced scale. One of primary challenges for households to switch from plantain to cacao is the four to five year lag time it takes for newly planted cacao trees to begin bearing fruit.

[5] Currently, the project is stalled in the development stage because of lack of further World Bank funding for project implementation. Project managers were currently looking to turn this project into a voluntary offset, but at the time of publication, have yet to do so successfully (anonymous interview 2008).

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