Title: Carbon forestry in West Africa: The politics of models, measures and verification processes

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More details/abstract: In a context of neo-liberal environmental governance, imperatives for global climate change mitigation are motivating a new round of policy initiatives and projects aimed at carbon forestry: conserving and enhancing forest carbon stocks, and trading these values in emerging carbon markets. In this context modelling and measurement, always significant in framing and justifying forest policy initiatives, are of renewed importance, with a growing array of protocols focused on counting and accounting for forest carbon as a commodity. This article draws on perspectives from science and technology studies and environmental discourse analysis to explore how these modelling and measurement processes are being co-constructed with forest carbon policies and political economies, and applied in project design in local settings. Document analysis and key informant interviews are used to track and illustrate these processes in a pair of case studies of forest carbon projects in Sierra Leone and Ghana. These are chosen to highlight different project types – focused respectively on forest reserve and farm-forestry – in settings with multi-layered histories of people-forest relations, landscape change and prior project intervention. The analysis shows how longer established framings and assessments of deforestation are being re-invoked and re-worked amidst current carbon concerns. We demonstrate that measurement processes are not just technical but social and political, carrying and thus cementing particular views of landscape and social relations that in turn make likely particular kinds of intervention pathway, with fortress style conservation or plantations becoming the dominant approach. In the process, other possibilities – including alternative pathways that might treat and value carbon as part of complex, lived-in landscapes, or respond more adaptively to less equilibrial people–forest relations, are occluded.

Carbon forestry in West Africa:
The politics of models, measures and verification processes

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1. Introduction

Contemporary trends towards neoliberal conservation, and emerging markets for ecosystem products and services, have attracted much recent academic and policy attention. Critical debate has focused variously on the causes and consequences of new forms of valuing 'nature' as a commodity (McAfee 2011, Arsel and Büscher 2012); the effectiveness or otherwise of market mechanisms and offsets for addressing environmental problems (e.g. Bohm and Dabhi 2009), and the ways schemes and projects are experienced on the ground – including new forms of resource distribution and appropriation (e.g. Fairhead et al 2012).

In this broader context forest carbon schemes, including REDD and REDD+ , are a particular focus of policy attention. As international agencies, governments, funders and private companies work to create 'REDD readiness' and design and implement schemes throughout the world, vibrant and growing research attention is exploring the feasibility and effects of this particular form of market environmentalism. A rapidly growing literature addresses the governance of forest carbon and REDD+ schemes (e.g. Corbera and Brown 2008, Corbera and Schroeder 2010, Schlamadinger et al 2007), and their distributional effects.

This article focuses on a hitherto neglected aspect of the debate about neo-liberal environmental governance: the politics of modelling and measurement. Market-oriented environmental schemes have developed along with complex measurement and monitoring, review and verification (MRV) procedures to legitimate the production of commodities such as carbon. Seeing MRV as a technical necessity, international attention has focused on designing and refining 'better' procedures, and building the capacities of governments and other organisations to operationalise them, while others focus on the practical and funding difficulties of MRV in resource-poor settings. Yet here we analyse measurement and modelling as not just a technical exercise, but a process shaped by and carrying social, political-economic and even moral implications. Drawing on perspectives in science and technology studies that address the mutual construction (Shackley and Wynne 1995) or co-production (Jasanoff 2004) of science, policy and social order; the sociology of modelling (Magnani and Nercessian 2009; Morgan and Morrison 1999, Morgan 2009), and the politics of policy processes (Keeley and Scoones 2003), we suggest that modelling and measurement processes have social and political lives (Leach and Scoones 2013) – referring to the ways they are developed, shaped and applied in interaction with – or co-constructed with – the politics of policy. In the context of environmental and forest carbon governance, we therefore ask: How do particular forms of modelling and measurement emerge in interaction with the politics and political economy of carbon markets? How do they frame the ways environmental problems and human-environment interactions are assessed? Which project pathways and associated social and moral values are thus promoted, and which are excluded?

To explore these questions, and illustrate the social and political lives of measurement and modelling in operation, we focus on the case of forest carbon projects in West Africa. This is an apt focus not just because of the plethora of contemporary REDD-related initiatives there, but also because it enables us to build on earlier analysis (Fairhead and Leach 1998) to show how current forest carbon assessments build on and reinvoke the layered legacies of earlier rounds of mutually-constructed forest science and policy. West Africa's forest zone has long been a focus of scientific and policy concern about deforestation and its consequences. The moist and semi-deciduous forests that stretch across Sierra Leone, Liberia, Cote D'Ivoire and Ghana have attracted particular attention as the assumed remainder of a once extensive Upper Guinean forest block, progressively reduced through farming, logging and fire-related savannisation. Since early colonial times convictions of rapid and ongoing forest loss have driven policies to halt deforestation and conserve what are assumed to be remaining forest fragments, whether to safeguard hydrology, agro-ecological productivity, timber or biodiversity 'hotspots' (Bakarr et al 1999; Conservation International 2008). Global climate change mitigation now adds a new layer to these imperatives. Widely-cited views that 'Africa's tropical forests are an important store of carbon... [yet] Africa's forests are being lost at around three times the world average' (Mercer et al 2011) are motivating a new round of policy initiatives and projects aimed at carbon forestry: conserving and enhancing forest carbon stocks, and trading these values in emerging carbon markets.

Modelling and measurement have always played central roles in framing and justifying forest policy initiatives in the region. While techniques, technologies and underlying theories have varied, Fairhead and Leach (1998) identified key continuities in the production and use of 'forests of statistics' in West Africa. Portrayals of forest cover and quality as declining, linearly, rapidly and recently, from an earlier 'baseline' state of 'intact' forest repeatedly construct deforestation as an urgent problem requiring external intervention. Widely-circulating figures suggesting that only 13% of West Africa's 'original' forest cover remains (Sayer et al 1992) or that countries have lost 70-90% of their 1900 forest area (e.g. Gornitz and NASA 1985) are joined by recent versions: for instance 'Around the turn of the century, West Africa had some 193,000 sq. miles (500,000 sq. km) of coastal rainforest but today [they]...have been largely depleted ......Now ... only 22.8 percent of West Africa's moist forests remain, much of this degraded' (Mongabay 2012). Such views support local and national measurements similarly suggesting accelerating deforestation.

Yet as Fairhead and Leach's (1998) detailed exploration revealed, such modelling and measurement and its broader assumptions are partial, ignoring and occluding insights and perspectives from, inter alia, history, non-equilibrium ecology, anthropology, and local forest users' experience. In many instances statistics have thus exaggerated the extent and rate of forest loss while obscuring more complex, non-linear people-vegetation relationships, including anthropogenic woodland and forest expansion. Local forest users have sometimes suffered stigma, blame, coercive policies and loss of resource control for supposedly causing deforestation that has not actually happened – while alternative landscape and policy pathways are neglected. This analysis and subsequent supportive debate (e.g. Grainger 2007, Munro 2009) thus underlined how forest measurement and modelling is shaped by and carries social, political-economic and even moral implications.

Today, it is the new policy context and political economy of carbon that now dominates forest models, measurement and verification of change, in West Africa and beyond. A new round of production of forest statistics is underway, shaped not just by up-to-date remote-sensing and measurement techniques, but also by new protocols focused on counting and accounting for forest carbon as a commodity. Extending Fairhead and Leach's (1998) analysis, we explore how longer-established assessments, shaped by earlier forest policy imperatives, are being re-invoked and re-worked amidst current carbon concerns. We argue that forms of forest carbon governmentality (Gordon 1991) or environmentality (Agarwal 2005) are thus emerging in which certain pathways of intervention and landscape change are enabled and others excluded. This brings risks of negative implications for local forest users – sometimes despite the best intentions of project proponents.

In the following section, we introduce the social and political lives of forest carbon measurement and modelling procedures. We then illustrate the application of these procedures in forest carbon project designs in Sierra Leone and in Ghana. Neither project has yet been implemented, and indeed our analysis raises questions about implementation feasibility as well as form. Our methodological focus is therefore not on project enactment in practice, but on project design: Through document analysis and key informant interviews we analyse the assumptions and exclusions in assessment, modelling and measurement procedures, the ways particular occlusions are manifested in project documents, and the ways these shape possible pathways of project direction, landscape and social change. The particular methods we focus on, as used in the two case studies, are two of a growing array of such accounting procedures, used across the world in forest carbon projects. Our aim is not to critique the details of these particular methods, but to raise and illustrate a broader conceptual point - about the ways that methodologies frame problem definition, project design and exclusions – that all who apply these methods globally should be more aware of.

2. Carbon political-economies, policies, values and measures

The context for current political and policy interest in forest carbon is the central challenge, in mitigating climate change, of devising mechanisms so that less carbon is released into the atmosphere. As an alternative or complement to strict regulation of polluting nations, the creation of a market for carbon, putting a tradeable value on emissions reduced, offered a seemingly neat solution. Through successive climate change negotiation rounds this became embedded in the Kyoto Protocol mechanisms through the Clean Development Mechanism (CDM), and was subsequently extended to voluntary schemes, operating in private markets and with some overseen by standard-setting organisations such as the Verified Carbon Standard (VCS). In relation to forests, carbon market solutions became part of so-called REDD (Reduced Emissions from Deforestation and Degradation) and REDD-plus schemes (Angelsen et al, 2011). A vast plethora of forest carbon schemes has now been developed by private companies, NGOs, governments and donor agencies, and – supported by academics and consultancy firms – an associated industry in carbon valuation and assessment has developed. Numerous standards and protocols have been created, and methodologies devised.

Yet in their social and political lives, these methodologies have been co-constructed with a common set of policy imperatives and disciplinary expertises, creating commonalities across the array. In order to link finance – either private or public – to climate investments, clear monitoring, review and verification (MRV) systems must be in place to avoid fraud and diversion, and to ensure, ultimately, that carbon is not released, and climate change mitigation actually occurs. Underlying this is the broad view that carbon can and must be seen as a commodity: be given financial value and be tradable. Carbon sequestration in one place can be paid for by emitters in another place in order to deliver a global good. These people and sites thus become connected through the market, and the carbon in them must be viewed as commensurable (Lohmann 2009) – with one measure of carbon in an African forest equivalent to one emitted from a smokestack in Europe. This argument can be traced to the work of climate modellers in producing ideas around global carbon cycles and raising the profile of climate change as a public policy issue (Shackley and Wynne 1996), linking with longstanding economic arguments for monetary valuation of the environment to account for externalities due to pollution (Pearce et al 1989, Barbier 2007). To enable markets and trade to emerge, accountancy techniques were incorporated while in the forestry and land use arena, biologists were further deployed to produce clear metrics for carbon in different settings, and ways of measuring these. Through such interactions, by the 2000s a new market had been created for a commodity that previously had little or no value, operating on a global scale. In this context, thousands of projects of varying scales have emerged in nearly every country of the world.

In important ways, this is a remarkable achievement. Yet as others have pointed out, the creation of carbon markets is part of a wider political economy of carbon with implications for both equity and longer term sustainability (Newell et al 2012, Mitchell 2011). The commoditisation of carbon, as part of broader processes of neoliberalisation and revaluation of nature, has distributional consequences, both intended and unintended (Fairhead et al 2012; Buscher et al 2012; McAfee 2012, Peluso 2012, Robertson 2006). Our focus on measurement protocols in forest carbon projects offers a particular contribution to this debate.

The schemes we address fall within what the CDM calls 'agriculture, forestry and other land use' (AFOLU) approaches. These are part of the CDM itself, but also central to the UN's REDD+, a nationally-led approach to addressing climate mitigation through forestry and land use interventions (UNFCCC 2013, UN-REDD 2013). Projects may sit formally under a national or sub-national UN REDD umbrella, or be only loosely linked, and privately developed. However any project wishing to access climate finance by selling certified carbon credits must be approved under an agreed methodology. Routes include the CDM (allowing projects to produce credits for Kyoto compliance markets) the Verified Carbon Standard (VCS) scheme (for pre-compliance markets), and a range of others including the Climate, Community and Biodiversity standards (CCB 2013) and Plan Vivo (2013). The VCS has emerged as the dominant standard for forest carbon accounting in developing countries, covering more than half the volume of forest carbon contracted by 2010 (VCSa 2013). Both the VCS and CDM stipulate particular methodologies and tools for use in planning, developing and verifying project activity under a range of project categories. These – and the requirement that projects must operate for at least 30 years, be monitored and reported on for at least 20 years and consider risks for over 100 years - all respond to the political and policy need to link carbon market imperatives with local level forestry and land use interventions. They have been developed by a particular constellation of climate modelling, environmental economics, biological, accountancy and project management expertises – as represented on the AFOLU committees for both the CDM and the VCS advisory groups (VCSb 2013).

AFOLU project categories and associated methodologies include 'Afforestation and Reforestation' (AR) under CDM, or the VCS equivalent 'Afforestation, Reforestation and Revegetation' (ARR). This involves planting trees or otherwise converting non-forest to forest land, or increasing carbon stocks in woody vegetation (CDM 2013a). By contrast REDD-type projects involve avoiding 'unplanned' conversion of forests to non-forest areas (deforestation), or reduction of carbon stocks (degradation) (VCS 2013c). If the project involves avoiding otherwise planned logging or farming, it counts instead as Improved Forest Management (IFM) or Agricultural Land Management (ALM). Finally, there are specialist categories, such as Peatland Rewetting and Conservation (PRC). To date there are numerous VCS methodologies approved under a range of project categories. The VCS uses many CDM methodologies and tools, but project developers are also allowed to develop their own and submit these for approval, so methodologies are continuously evolving, being replaced and updated. The respective websites have plenty of documents and guidance sheets to download, but these are not for the faint hearted given their multiplicity, and sometimes obscure terminology and technical requirements. The CDM's booklet runs to 264 pages (CDM 2013b) while each of the 12 VCS methodologies has around 200 pages of guidance notes (VCS 2013c).

Thus:

> Developing forest carbon projects is complex and often daunting for project proponents....Successful project development requires complying with rigorous standards of analysing and documenting carbon benefits, working through an array of legal, business and community relations issues.... (as well as actually carrying out the work) (Olander and Ebeling, 2011:1).

In response NGOs and consultancy firms have produced a large array of guides and manuals to help project developers navigate these challenges (e.g. Calmel et al 2010, Ingram et al 2009, Pearson et al 2009), while opportunities have blossomed for consultants to conduct project development operations.

Project development involves multiple stages. First a scoping study or Project Idea Note (PIN) may be drafted. This is not formally required by VCS or CDM, but is often prepared to engage national governments, donors or investors. The World Bank's BioCarbon Fund has developed a PIN format that is commonly used. A PIN includes preliminary characterisation of the baseline, estimates of forest carbon stocks and benefits, assessments of additionality, and evaluation of social and environmental impacts. It also includes a financial feasibility assessment, balancing project costs with prospective carbon revenues. Many carbon projects are abandoned at this stage, deemed infeasible as the sheer complexity of development combines with lack of profitability. Moreover carbon prices are currently very low, having dropped dramatically from their peak in mid 2008 and nearly halving in 2012 (Financial Times 2012), undermining the economic viability of many schemes without external subsidy from aid donors. In the absence of an international regulatory framework, and with continued disputes over monitoring and verification hindering an agreed mechanism for public project financing (Moss and Kovacevik 2012) the voluntary market remains fragile and uncertain, with limited revenue flows.

The next stage is the development of a Project Design Document (PDD) or Project Description (PD). It is at this point that rigorous, approved methodologies must be chosen and applied. These must respond to the project context, and carry implications for how many carbon credits might be claimed, and the particular data collection requirements for verification. It is no surprise that the advice industry has focused efforts on this crucial yet technically demanding stage. Finally, the PDD must be independently validated and later – once the project is up and running - verified for the issue of certified carbon credits.

While approved methodologies vary considerably in their details, all share a set of basic elements:

1. *Demarcating the project boundaries* and their spatial extent.
2. *Ensuring land eligibility* – in relation to vegetation and tenure.

3. *Establishing a baseline* - including a change scenario in the absence of project activity, and a reference area.
4. *Demonstrating additionality* - providing assurance that the claimed carbon effects would not have happened without the project.
5. *Quantifying carbon emission reductions* through new project activities
6. *Assessing leakage* that might occur through displacement of activities from the project site
7. *Evaluating non-permanence* - assessing the risk that the project's carbon effects will not last.

As we go on to show, these generic methodological elements themselves carry with them a set of assumptions: about forests, land use and carbon as a commodity. Equally, their application necessarily relies on particular practices in collecting and interpreting data. We argue that these assumptions and practices, have a major impact on the way forest carbon projects are framed and designed, with implications for how they stand to be created on the ground. These are therefore not just neutral, objective scientific methodologies – although they are of course rigorous in their own terms - but carry with them a set of social, political, and moral implications with far reaching consequences. These are often invisible to the proponents of carbon forestry projects, whose backgrounds and intentions often align genuinely with the plentiful rhetoric about pro-poor benefits and sustainable development that enwraps forest carbon schemes. Yet as we argue, the sequence of moves from creating carbon as a globally tradable commodity to the detailed tools and methods used to verify carbon benefits, have a series of layered framing effects, promoting particular visions of a carbon landscape and potential pathways of change while excluding others.

In the next sections we illustrate these processes and their implications through two forest carbon projects in West Africa. Our aim is not to critique the implementation and outcomes of these projects – neither is yet further than the design stage. Nor do we critique the intentions of project developers, who in both cases aim to be 'pro-poor'. And our aim is certainly not to dismiss the idea of climate mitigation and forest carbon interventions, but to raise questions about the path dependency and forms of governmentality created by a set of methodologies whose assumptions and practices have not been sufficiently interrogated.

3. Carbon forestry in West Africa: two cases

3.1 Sierra Leone: WAPFOR

In Sierra Leone carbon forestry is still at a relatively early stage; in early 2013 just seven projects were being planned or implemented (Fong-Cisneros 2013). However government staff, NGOs and timber and mining companies are enthusiastically embracing the envisaged new opportunities of carbon finance. As a senior forestry official put it 'the future is bright... those are funding sources for the forest conservation and sustainable management that we need, but the government cannot provide' (interview, Freetown, 15 March 2012). Our case study focuses on the Western Area Peninsular Forest Reserve (WAPFOR) whose dense humid forests cover about 17,600 hectares of the hills bordering the expanding coastal capital city of Freetown. This was Sierra Leone's first forest reserve, declared by the British colonial administration in 1916 with the original imperative of protecting the watersheds supplying the city's population from the supposed ravages of the timber industry and shifting cultivation, and later for biodiversity –

declared a non-hunting forest reserve in 1972 to safeguard globally-valued bird and ape species. Visibility from Freetown brings the forest symbolic and political capital: as a government official argued 'WAPFOR is very, very critical, the Western Area forest is vital in so many ways, so it is very important that we protect it' (interview, Freetown, 15 March 2012).

A five-year 'Conservation of the Sierra Leone WAPFOR' Project was established and commenced operation in 2009, implemented by the German NGO Welthungerhilfe (WHH) in partnership with the government Forestry Division and National Forum for Environmental Action (ENFORAC) comprising environmental NGOs. The project initially took an established 'conservation with development' approach, re-demarcating a strict reserve to protect water supplies and biodiversity, developing a 150 m buffer zone, and providing alternative livelihood activities and conservation education for key communities in the 30 surrounding villages. Under the slogan 'wata en forest na life' ('water in the forest is life'), the project's central aim is to alleviate what are seen as intense deforestation and degradation pressures both from urban expansion at the reserve's western end, and from small-scale farming, fuelwood harvesting and stone quarrying by rural communities (Moninger 2011). This contemporary project discourse echoes longstanding views that Sierra Leone's forests are threatened by rapid deforestation, with poor people as its key agents. Views that a once more extensive forest cover is under accelerating decline extend back to early colonial times and have been updated by successive analysts (Fairhead and Leach 1998, Munro 2009). Sayer et al (1992: 944), for instance, suggested that '50 per cent of the country has conditions suitable for tropical rainforest, but less than 5 per cent is still covered with ....closed forest. Deforestation is mainly a result of the rapidly increasing human population requiring more agricultural land and fuelwood'.

With the WAPFOR project's main funding source from the European Commission due to end in 2014, WHH has been developing a REDD+ project geared to voluntary carbon markets as an alternative source of financing. The Austrian consultancy firm Osterreichische Bundesforste (OBF) was commissioned to conduct a series of scoping studies. Their detailed report and annexes (OBF 2011) included a Project Idea Note (PIN) that recommended proceeding with the development of a REDD+ project, and took many of the steps in methodology choice and application towards the eventual development of a Project description for external validation by the VCS. WHH are currently seeking funding and partnerships to finalise a Project Description and progress towards implementation of what is intended to be a pro-poor carbon forestry scheme.

3.2 Ghana: Vision 2050 Carbon Credit Project

In Ghana there is a well established national REDD programme, which has undertaken a variety of assessments, but the planned projects have not yet been established on the ground (Forest Carbon Partnership 2012). Outside this framework a number of smaller, private-led initiatives have taken off. One of the most prominent was the Vision 2050 project which operated across six regions in Ghana, claiming to involve 300,000 people, over land areas of 350,000ha. It aimed to develop a combination of forest protection and planting, both in farmers' fields and on private land banks (Hashmiu 2012). According to the project website by 2013 100,000 ha of land banks had been acquired for tree planting, of which 38,000 ha had already been planted (Vision 2050 2013) – although other project documents give different estimates.

In late 2010, the company running the project commissioned a feasibility study by the Swiss Forest Carbon Consulting, on behalf of Forest Carbon Traders, a company interested in selling carbon credits. This clearly stated the project rationale: 'Rates of deforestation in West Africa are among the highest in the world. Ghana's tropical forest cover has decreased from 8 million hectares at the beginning of the 1900s to about 1.6 million hectares in 1990, and the deforestation rate is high: nearly 65,000 hectares per year. Virtually all forest currently left is located in forest reserves' (TREES 2010:10). It concluded that 'the project faces several high risks for denial of registration' due to ambiguities about changes in land cover and additionality. It recommended going ahead only with a clearer definition of baselines.

The project did go ahead, and was launched with great fanfare across a wide area in Brong Ahafo region. Baseline studies were commissioned, and a network of tree nurseries established to provide 'carbon trees' to project participants who handed over rights to the trees for a 20 year period on the promise of an up-front payment, plus a regular if small revenue. In addition to private farmers who planted on their land, other farmers offered land areas for small plantation planting by the project. These areas were leased by the project and trees planted which were in turn sponsored by outside investors, including individuals, church groups and professional associations, who paid an establishment and regular maintenance charge with the promise of future carbon revenues. In some villages the project took over several hundred hectares, involving upwards of 50 families (Hashmiu 2012). However, the project's up-front finance, provided by the project developer from his personal teak plantations, soon ran out, and attempts to source funds from donor agencies and other private sources failed. Thus despite thousands of agreements with local people having been signed, and transfers of land and trees made, no revenues or even start-up funds were forthcoming. Local people, and their chiefs, who had earlier welcomed the project as a source of much needed funding in the area, became seriously disgruntled. Political dimensions intervened and the project developer was accused of fraud, and eventually arrested, with a court case pending (Hashmiu 2012). Following a review, the company concluded that the original project plan, involving hundreds of farmers, was too costly and elaborate, and so unlikely to get registration through a carbon credit scheme. Instead, the small and medium-scale private plantation project was retained. This plan has yet to be fully financed, and by late 2012 a carbon broker was still being sought (Carbon Credit GH 2012).

In neither Sierra Leone nor Ghana are these new carbon forestry projects arriving on a blank slate. Contemporary concern with climate change and carbon is merely the latest layer in long histories of interventions to protect, control, manage and extract from forest areas. In many instances local forest users have lost out through imposed restrictions on their livelihood activities in projects justified by discourses that they are forest destroyers. Calls to develop genuinely participatory forest management activities that build on local perspectives, priorities and knowledge of often non-linear, more complex people-vegetation relations have long been made, and indeed are echoed to some extent by current project developers, but their uptake in policy circles is hindered by entrenched discourses that case deforestation as one-way and local people as forest destroyers (Fairhead and Leach 1998, Mayers and Kotey 1996, Amanor 1999, 2004).

As we explore in further detail below, central aspects of longstanding deforestation discourses in both countries are now being revived under the label of forest carbon. This partly reflects direct continuity between earlier interventions and new carbon forestry, with carbon money representing an opportunity to revive or expand longstanding plans. Indeed the projects presented as carbon forestry today look very similar to what went before: the REDD+ project in WAPFOR as currently proposed appears as an archetypical forest conservation-with-development project, aiming to create a buffer between pressures from local people and the conserved forests, while in Ghana, Vision 2050 is a classic forest conservation and tree planting effort typical of many in the area. Yet the focus on carbon as the forest 'value' to be conserved and traded brings an important difference, with projects now framed explicitly by a commoditisation and marketisation approach. The models and methodologies that are so central to carbon project development flow from this, and as we now go on to show, are applied in ways that do not merely recycle and repack established discourses about forest loss and blame, but actively strengthen them, cementing them into proposed institutional and political-economic arrangements. This has important implications for what may eventually happen as these projects are implemented, and for who will gain or lose.

4. Measuring and valuing forest carbon in project development practice

We now unpack the seven generic elements of CDM and VCS methodologies introduced earlier in relation to the two case studies. In the relatively simple Sierra Leone case, the VCS methodology VM0015 ('avoided unplanned deforestation') (VCS 2013d) was used for the scoping study and project development documentation prepared by OBF (2012). In Ghana no formal methodology has yet been used, but VM0009 ('avoided deforestation') (VCS 2013e) was suggested for assessing areas to be protected, or alternatively VM0006 (for mosaic deforestation). This could have been combined with CDM A/R and IFM methodologies for new tree planting (CDM 2013c). With such a complex project, a 'grouped project' approach would have been required to capture carbon benefits through the VCS. Nevertheless, for both cases the same seven elements were required and these are explained and discussed in turn below, focusing on VM0015 and VM0009 as illustrative examples, and examining their application, assumptions and exclusions in practice - as revealed in project preparation documents, key informant interviews and other literature.

4.1 Demarcating project boundaries

A first step involves defining the extent of the project area. In Sierra Leone, the project boundary was defined to coincide with the boundary of the forest reserve itself, as re-demarcated in 2011 to cover existing areas of 'intact' forest (OBF 2011, Moninger 2011). In Ghana, a huge area of some 350,000ha was proposed, but in several non-contiguous sites, and confusion arose as to what was under the project and not.

The definition of spatial boundaries is significant for several reasons. First, it is central to the business model, defining the area from which carbon credits can be sold, and so the potential revenue stream. In Sierra Leone, coincidence with the existing reserve left little flexibility for expansion, but in Ghana there were plans to expand the project significantly to wherever individuals were willing to sign up and lease land and trees. Second, the project boundary exists in relation to the 'reference area' where baseline carbon levels are calculated. This is supposed to be nearby and similar, so like is being compared with like at project inception. In Sierra Leone, that no high forest existed outside the reserve created difficulties in identifying a suitable reference area. In their scoping OBF used the whole Freetown Peninsular, but acknowledged that as this was under highly diverse forms of land use and socio-economic change, a different approach (including leaving part of the reserve itself outside the project boundary) would eventually be needed for VCS compliance. Meanwhile as we show below, this choice of reference area was instrumental in shaping a baseline scenario of rapid deforestation. In Ghana, reference areas were specified areas including nearby forest reserves where longitudinal satellite data on deforestation were available. Again, it was unclear quite how similar these were to the project area, possibly disqualifying any submitted PD; yet this somewhat arbitrary specification – in effect an artificial line on a map - carried consequences for the treatment of resources and people. Outside the project area carbon is supposed to be depleted at a rate specified in the baseline scenario, and people are not supposed to benefit, whereas those inside are supposed to share in carbon benefits, and reductions in carbon loss are supposed to result in line with projected targets. Thus the seemingly arbitrary act of demarcation implied real consequences, both environmentally and socio-economically.

Finally, the spatial boundaries of the project also define ownership, as the project area, or at least the carbon within it, must be shown to be under the control of the project developer. In the Sierra Leone case this did not affect the status quo, as the entire WAPFOR was already under state land ownership and the expected project proponent would be under Ministerial mandate. Nevertheless the tight VCS definition of ownership does not recognise the forest use rights currently held by local people, implying that special provisions would need to be added to if they were not to lose these. In contrast in the Ghana case the VCS methodology requires the project to transfer carbon rights over the full 30 year project duration to the developer, implying that this is a straightforward legal process. The feasibility study thus argued: 'For the registration and implementation of the carbon project, the land tenure legislation and governance are essential. Long term control of the project land and activities must be established for a successful project and corruption activities linked to the project must be prevented' (TREES, 2010: 12). Yet in Ghana, like many African rural settings, tenurial claims over land, trees, soils and so carbon are complex, multiple and overlapping. Chiefs notionally hold the land, but in interaction with diverse and often politically contested claims from the state and individuals (Ubink and Amanor 1999). Residual claims associated with identity and histories of residence, as well as ongoing negotiations over access, control and the 'politics of possession' (Sikor and Lund 2009, Peluso and Lund 2011) are likely to disrupt any transfer, risking ongoing dispute.

Methodologies and project development practice tend either to favour settings where rights over resources are clearly defined and held by already-powerful actors (as in Sierra Leone), thus avoiding inconvenient disputes associated with ambiguous property rights, or, as in Ghana, to proceed as if ambiguity did not exist, opening the way for ongoing tenurial disputes which similarly tend to favour the contextually powerful. In this way, the commodification of carbon linked to boundary-creation methodologies encourages the promotion of particular forms of state or private property and control.

4.2 Ensuring eligibility

In order to fit relevant project classifications, projects have to show that the area complies with an accepted definition of 'forest'. Under the CDM this is defined in relation to minimum area, minimum tree crown cover and minimum tree height, and under VCS, any internationally accepted standard. Countries may submit their own national standards. Ghana has defined a minimum area of 0.1ha, a minimum tree cover of 15% and a minimum tree height of 5m (CDM

2013d). Sierra Leone has not made a submission, so uses the default FAO national forest definition (0.5ha, 10%, 5m).

Such measures and metrics come from standard production forestry, with static, uniform tree stands – yet most forest landscapes are not like this. In Sierra Leone, according to the national definition the entire WAPFOR constitutes forest and so is eligible for VCS crediting. But the definition excludes land under bush fallow cycles and village agroforestry management, such as exist today on the forest fringe and which were part of the peninsular forests' history (Fairhead and Leach 1998). Thus definitions link carbon forestry exclusively with currently 'intact' high forest devoid of people, excluding any potential for generating carbon credits from currently lived-in landscapes. In Ghana, Vision 2050 is in the forest-savanna transition zone, yet definitions overlook cyclical and longer-term forest-savanna dynamics. In Brong Ahafo, there was a dominance of savanna grassland early in the twentieth century (Fairhead and Leach 1998). By 1983 the area was heavily forested, with cocoa interspersed with large shade trees. A dry period and a build up of grass in savanna patches then enabled a massive forest fire, radically transforming the landscape back to a much more open form with 'forest islands' associated with past settlement sites and sacred areas. Thus over time the areas that could be deemed 'forest' according to the standard measures have changed dramatically.

Of course forest carbon projects are not restricted to contiguous forest areas of a standard form, and methodologies allow for mosaic or grouped projects. Nonetheless the difficulties of fitting real, dynamic forest landscapes into eligibility criteria often means constructing a simplified image of a forest – as spatially distributed patches or a block - and a pattern of landscape change – through frontier or mosaic deforestation – in ways that fit the eligible categories. Such classificatory categories in turn easily invoke certain assumptions about how the pattern emerged, often reinforcing established narratives. Thus in the Ghana case, the scoping study's satellite analysis highlighted the mosaic nature of forest cover and the potential for high levels of inter-annual variability: 'Today's situation in the project area...shows a small scale patchy structure of different vegetation types. This patchy structure has increased since 1986...and includes more areas with no or very little vegetation. Generally the intensity of active vegetation appears lower than in the 1986 reference, though this could be due to inter-annual weather differences, e.g. draught (sic) effects' (TREES 2010: 22). Yet struggling to interpret such dynamism, mosaic forests were assumed to represent 'remnants' of past extensive forest areas, rather than created forest islands associated with settlement and past use. In Sierra Leone, the image of frontier deforestation assumes an external threat of encroachment on a broad front, usually by local inhabitants, rather than the picture suggested by social science analyses and key informants – of speculative real estate land grabbing in particular places, with rural peoples less interested in land expansions than forest access for collection of forest products (Munro 2009, interviews, Freetown, March 16 2012). Thus in both cases, embedded in the classifications are particular narratives about cause and effect, as well as designations of response and solution, that obscure key aspects of local circumstance and context.

4.3 Establishing a baseline

This is a critical step, defining the 'business as usual' situation against which any additional value to a carbon project is measured. There are two elements: the baseline reference area, and the baseline carbon emission scenario – what would happen if no project intervention took place. Where deforestation is 'unplanned', constructing baseline deforestation scenarios involves extrapolating from past historical data, usually based on satellite imagery, in ways informed by particular methodologies.

In Sierra Leone, VCS's VM0015 methodology requires three satellite images over 10-15 years, one within the last two years. The OBF study compared satellite data from 2000 with that from 2006 and 2011, producing a set of land and forest change maps. From this they concluded a significant (9%) loss of forest cover on the peninsular over the period, including some encroachment of the old forest reserve (4% change) at the urban end, but most outside the forest reserve, consisting of changes from medium high forest to 'shrub' and 'other' vegetation. They note that deforestation 'doubled from 3% from 2000-2006 (0.5% annually) to 6% from 2006-11 (1.2% annually)' (OBF 2011: 12). They then projected forward to 2031 by linking this historical baseline deforestation to the assumed 'major driver of deforestation which is urban expansion due to population growth and urbanisation' (OBF 2012: 4), by extrapolating from apparent trends in published population data for the years 1985 and 2004 (Koroma et al. 2006). They thus produced two alternative baseline deforestation scenarios, assuming relatively faster or slower deforestation, both suggesting a sufficient level of 'avoided deforestation' for the project to proceed.

In the mosaic forest setting of the Ghana case, VM0009 was chosen: a methodology in which 2000 random point samples are required from the reference region, and each is classified as forest or non-forest. This is complemented by satellite imagery for at least five time points over a 10-15 year reference period. The baseline assessment estimates conversion to permanent cropped area – but notably does not allow for shifting cultivation and fallow areas. However problems with the availability of satellite imagery meant that the full analysis was never achieved.

In these methodological applications, uncertainties are conveniently downplayed. Thus in Sierra Leone the OBF team struggled to distinguish between secondary forest and shrub in their satellite imagery, noting that this has important implications since secondary forest counts definitionally as forest, but shrub does not. They therefore called for detailed ground-truthing, but it is unclear whether this was followed through. Taken to the extreme, if all the shrub land were redefined as secondary forest, there would have been no 'deforestation' at all. Moreover – and not acknowledged in OBF's analysis – their map shows forest expansion in some rural areas south of the reserve; a process perhaps linked to villagers moving out of relatively unprofitable farming in favour of fishing and ecotourism. Yet attention to such trends would undermine the picture of rapid deforestation outside and threatening the reserve which is so central to the justification of the REDD+ project.

Assuming that future trends can be inferred from past practices is also problematic given that changing supply patterns may affect demand, and forest use and its drivers are not necessarily linear. On the Freetown Peninsular, for instance, deforestation has not reflected steady 'population growth and urban expansion' but booms and waves of clearance for urban settlement, associated with returnees at the end of the country's civil war in 2002-3, and the more recent construction of enormous US Embassy and EU compounds. Most houses being built on the forest edge are by Freetown elites looking for space and views on the city's periphery, not by poor, growing urban masses (Munro 2009).

Thus in getting round the inevitable uncertainties involved in the estimations of baseline scenarios, assumptions are brought to bear which often rejuvenate the established deforestation narratives of the past, and also support contemporary carbon commodification – while occluding alternative, non-linear people-forest dynamics.

4.4 Demonstrating additionality

VCS methodologies require Project Descriptions to present a tight, clear argument for ‘additionality’, suggesting an analysis with several elements (VCS 2013f) including the identification of alternative land-use scenarios if the project is not implemented, investment and barrier analysis to show that the proposed activities would not occur without the project, and analysis of ‘common practice’. The CDM rule book elaborates: ‘Project participants in an SSC A/R project must demonstrate ... that the project would not otherwise be implemented because of one of the listed...[including] Barriers relating to local tradition, *inter alia*: a. Traditional knowledge or lack thereof, of laws and customs, market conditions, practices; b. Traditional equipment and technology’ (CDM 2013e). Existing practices are thus deemed ‘barriers’ to be surmounted by an approved project, implying that they are causing the problem to be addressed. Here again, arguments became enwrapped in discursive assumptions about patterns and processes of land use change, and the assumed consequences of inaction – so reinforcing the image of benefits from the proposed project activities.

In the Ghana case, Vision 2050 argued for additionality by deploying the standard narrative around deforestation in the area, evoking an image of a past pristine forest area threatened and savannised, especially by ‘slash and burn’ agriculture. Any intervention to protect so-called ‘remnant’ forest tracts or plants trees to replace assumed lost forest is thus seen to reverse the trend. This narrative is so familiar as to have become accepted ‘fact’ in Brong Ahafo and beyond, despite challenges to its evidence and assumptions (Fairhead and Leach 1998, Amanor 1993). Yet the feasibility study’s satellite analysis was more uncertain, finding that ‘the natural forest and the teak plantations within the project area are not identifiable, and the project area vegetation cannot be distinguished from the outside project vegetation. This leaves room for some interpretations which would negatively impact the feasibility of a carbon project’ (TREES, 2010: 23). The study also questioned whether project activities were really distinct from the ‘common practice’ of tree planting, community forestry and agroforestry projects in the area, dating back over decades.

In Sierra Leone, OBF summarised arguments for additionality as follows: ‘The assessment shows that the WAPFOR is currently under severe pressure, especially from rapid urban expansion/encroachment into the reserve. The business as usual scenario is characterized by low levels of law enforcement, little staff capacity, little human resources, little financial means for effective protected areas management. Consequently, there will be limited means to mitigate emissions without the project. The project has funding by EC and Welthungerhilfe only until 2014, therefore the financial sustainability is currently not secured. => YES the project is additional’ (OBF 2012: 8). Again, this argument reworks long-established narratives about ongoing deforestation problems that can be ‘solved’ only by external intervention – in this case the imposition of strengthened forest protection mechanisms. Impetus is thus given to long-tried conservation approaches, to be implemented now with greater force and carbon funding. Yet this fails to question why protectionist approaches might have failed in the past, underplaying reasons that have more to do with conflicting Ministry of Lands policies and elite corruption, than with incapacity in the forest service (interviews, Freetown, March 15 2012). Moreover if a forest has been reserved for many decades as WAPFOR has, in effect 'removed' from the cycle of settlement, bush fallow and wood use, it is questionable whether a new justification for the same reservation in the name of REDD is really 'additional.'

By ignoring such questions, however, additionality justifications help lock in to a particular narrative and pathway that casts existing practice as bad and proposed intervention as both additional and good. This, in turn, is central to earning carbon revenues, according to the terms of the VCS and CDM methodologies.

4.5 Quantifying carbon emission reductions

A bottom line comes in the carbon numbers - will the emissions reductions through the proposed project interventions generate sufficient carbon credits to cover project costs? This crucial step in the project design and verification process requires considerable data, and the presentation of a careful calculation that assesses the baseline against the reductions through project activities, less the leakage and adding in a buffer for non-permanence risk (see below). Different methodologies include different carbon pools – above and below ground biomass, soil carbon and so on; some require intensive field sampling, forest inventories and measurement while others accept estimates from literature.

VM0015, which the WAPFOR project developers used, allows literature values. By combining a published biomass map of Sierra Leone (Saatchi et al 2011) with satellite imagery and default carbon conversion factors supplied by the IPCC (OBF 2012 Annex 3), they produced a preliminary analysis suggesting 'a mitigation potential of the project that ranges from 124,000 tCO2e to 57,000 tCO2e per year' (OBF 2012: 1) – although acknowledging the eventual need for a more detailed, ground-truthed forest inventory. VM0009, as suggested for Ghana, by contrast requires the establishment of permanent fixed sample plots. Following initial verification, monitoring, involving the measurement of all pools claimed for every five years, is required to assure the flow of carbon credits are in line with the initial estimates of reductions. The challenges and costs of such efforts in AFOLU projects help explain why there are so few in the overall CDM and VCS portfolio. The Ghana project found start-up costs for this sort of measurement effort prohibitive, so only preliminary estimates could be made based on the basis of initial tree surveys. These suggested that even with generous assumptions credits of only 2 tCO2e per hectare per year were likely to be realised; approximately 40,920 tons of CO2 for a crediting period of 20 years from the 1138 ha study area (TREES 2010:23).

Despite the elaborate and systematic approaches required by the currently approved methodologies, many judgements are involved – which carbon pools to include? Which literature based estimates to accept? For methodologies such as VM0009 requiring random sampling, and in a highly patterned landscape such as Ghana's forest-savanna mosaic, questions arise about the extent to which sample sites can be fully representative. Given measurement and verification challenges, approaches involving farm forestry and community management are often rejected as too complex and costly. In Ghana, the project failed on a number of fronts, but it was clear that the originally-proposed community approach would require insurmountable measurement costs and fail to yield sufficient carbon credits. This helped drive the project towards its eventual plantation model. A protection model for a reasonably uniform forested area represents an even more straightforward option, reducing measurement and establishment costs, and likely to generate the maximum number of carbon credits by area. Protection measures on a frontier boundary are also relatively simpler to implement, keeping 'agents of deforestation' (people) out, and the carbon protected inside. This represents a reworking of long-established 'fortress conservation' models, widely used (and critiqued) in the 1980s and 90s and adapted into 'conservation with development' through the addition of buffer zones and alternative livelihood activities (e.g. Adams 2004). This is essentially the model that WAPFOR has long used and that is now being (re) promoted through REDD+. OBF's financial analyses showed the approach to be financially feasible even at low carbon prices. However, significantly, it questioned whether enough carbon revenue could be generated to fund community projects, as well as forest guards: 'the most profitable scenario did not include pro-poor measures' (OBF 2012: 1) – an implication that deeply worried the NGOs proposing the project, who genuinely wish to develop a pro-poor approach.

4.6 Assessing leakage

Leakage involves both activity displacement and market leakage. Most AFOLU methodologies focus on the former, requiring assurance that if a carbon emitting activity is prevented in the project area it is not simply displaced to nearby areas, resulting in no net decline in emissions overall. Methodologies require this to be assessed by reference to a 'leakage belt' around the project area (as in VM0015) or a leakage area not necessarily even contiguous with the project area (as in VM0009). VM0009 for example requires the establishment of large 2ha plots in the leakage area. Observations and estimates derived are supposed to be used to shift the cumulative deforestation model according to the level of leakage through activity displacement.

In practice, however, verification approval tends to be based not on hard data, but on a good argument, and a sense that the project document has looked at the options and sensibly tried to tackle them. In this vein the WAPFOR scoping study argued plausibly that the leakage potential from the project is limited and will be addressed, as 'leakage caused by stopping urban expansion will not be a major factor as there are no other forest areas in the vicinity of Freetown. There are indications that the majority of energy demand for Freetown is supplied from up-country, i.e. not by woodfuel harvested in the forest reserve. Alternative livelihood measures for the poor using the forests are foreseen as well as leakage management areas' (OBF 2012: 9). Yet it is relatively straightforward to make the case for leakage limitation in a project involving a large contiguous forest area under project control, such as this. It is much more difficult in cases like the Ghanaian example, involving mobile people, multiple livelihood activities including trade, and unclear and unenforced project boundaries, likely not even known to local people. In such circumstances, 'displacement' of activities and so leakage is inevitable. Awareness of this fed into the Vision 2050 project's shift to a more controllable, plantation approach.

4.7 Evaluating non-permanence

Finally, VCS and CDM methodologies require projects to address the risk of 'non-permanence' over the (usually 30 year) project period (CDM 2013f, VCS 2013g). A variety of factors are listed which might affect 'permanence', including internal factors (such as project management failure), external factors (such as land tenure) and natural risks (such as fire).

Such risks are clearly very real, in West African landscapes and political-economic contexts which – if the last 30 years are any guide - are thoroughly dynamic and 'non-permanent'. In Brong Ahafo for instance landscapes and livelihoods have been radically transformed since the great fire of 1983, which decimated cocoa and encouraged a shift to open field maize production in the area. With the changing production landscape came changing economic and social relations, with new tenure arrangements around maize fields compared to forest cocoa plots. In-migrants not linked to the chiefly lineages gained land and increased income, clearing new areas. And with the maize boom in the area came new investments, including tarred roads and the growth of small towns and businesses (Afikorah-Danquah 1997; Amanor 1993). Meanwhile fire is an ongoing part of a complex and ever-changing forest-savanna mosaic. In Sierra Leone, the last 30 years have seen massive environmental and socio-political change linked to the 1989 – 2002 civil war and its aftermath, related migration dynamics, mining, and a recent wave of large-scale foreign land investments for food and biofuels (Leach 2012, Richards 1996). 'Permanence' is just not a feature of such non-equilibrial ecological, social and political systems, in either country.

Nevertheless, project risk analyses tend to portray stasis as the norm, and risk factors as operating gradually and incrementally. For WAPFOR, for instance, OBF's assessment concluded that 'There is a risk that the current high political will and interest to preserve the remaining forest is weakened over time... Another risk to the success of the project is prevailing poverty and ineffective alternative livelihood measures which force the poor to exploit forest resources unsustainably. However, the preliminary standardized risk analysis as required by VCS has been clearly passed' (OBF 2011: 8-9). For Vision 2050 the feasibility assessment was more circumspect, pointing to a number of risks including tenure dynamics and so unclear, and challengeable 'carbon rights' (TREES, 2010: 27).

Internal factors around 'political will' and project management should certainly not be underestimated. In the Ghana case, after all, the project folded and the director ended up being arrested for fraud, all within five years, let alone 30. While this case may be an outlier, however, long-term reliance on external funds – so often necessary for project viability – can never be assured. Donor funds are rarely committed for more than 3-5 years, and the dynamic nature of donor policies as well as national politics may mean that project funds dry up, threatening project permanence in more fundamental ways than risk analyses account for.

While the logic of assuring permanence is clear in terms of the imperatives and methodologies of carbon accounting, this again pushes project design in particular directions. The VCS and CDM stipulate that as much as 60% can be withheld from carbon credit revenues if non-permanence risk is deemed high. This criterion thus also favours apparently stable and controllable landscapes, with clearcut state or privately-controlled protection or plantation forestry once again trumping any lived-in carbon landscape with multiple users. It also provides a disincentive to endogenously defined development. For instance, if the carbon had been controlled by an external project at the time of the great fire in Ghana's Wenchi district, the incentive would have been to re-establish the forested area and cocoa production, despite the period of drying and shift to savanna that had occurred – possibly undermining forest sustainability. This in turn would have prevented the substantial and more widely shared economic growth that occurred with the growth of maize as a key commodity. Now carbon projects are encouraging a return to cocoa and the reestablishment of shade trees, but will the sought-after stable forest carbon landscape really prove achievable in the face of ongoing ecological dynamics? And are there not other ways of reducing carbon emissions more compatible with economic development and poverty reduction? These may exist, but are not being sought as long as methodologies push projects in particular directions towards (perhaps illusory) images of permanent carbon forests.

5. Conclusions: Pathways and the politics of carbon forest measurement

In a review of CDM projects, Thomas et al (2010:880) noted that of a total of 1600 approved projects, only four were focused on afforestation and reforestation and none of these were in Africa. Investigating these cases, they argued that four factors encouraged successful CDM approval: initial funding support from large donors to cover up-front costs; design and implementation guided by large organizations with technical expertise; establishment on land associated with secure property rights (private or state land); and where most of the revenue from certified carbon credits was returned to local communities neighbouring the project.

With the exception of the last requirement – community-benefit sharing – our analysis supports these conclusions. Yet we have gone beyond empirical observation of which kinds of projects do (and do not) get approved, to explore why. In particular, we have argued and illustrated that the very ways in which CDM and VCS methodologies, protocols and requirements are constructed and applied – the social and political lives of models and measurements - tend to create path dependencies that push project design in particular directions. Almost by default, and often against the wishes of project designers, 'fortress' forms of conservation forestry in reserves, or uniform plantations, under clear state or private control, become the only way that carbon value can be appropriated through these mechanisms. In the Ghana case, the project appears to have failed at the first hurdle because of the fundamental mismatch between more complex, dynamic, mosaic realities and the requirements of MRV methodologies. The result has been a shift from a community-based project, protecting and planting trees on farms, to a plantation style alternative. In Sierra Leone, WAPFOR offers greater prospects of successful approval given its longstanding basis in a conservation forestry reserve, but it will prove challenging to reconcile local stakeholders' desire for a 'pro-poor' project and ongoing socio-political dynamics around land with the push for a strict reserve approach suggested by measurement protocols, and likely limited carbon revenues to fund poor people's livelihoods. In both settings, commodified carbon and the institutional and methodological infrastructure co-produced with it, are thus co-constructing particular landscape pathways, with fortress style reserves or plantations likely to become the dominant approach. And in both settings, despite rhetoric to the contrary, it is poorer and already marginalised land and forest users who are most likely to lose out. Fortress forestry and conservation, deeply critiqued on equity and sustainability grounds (Brockington 2002, Adams 2004, Dressler et al 20010, Fletcher 2010), appear to be on the rise once again in today's carbon forestry era. Pointing this out is not an argument for abandoning carbon forestry altogether, but for linking it more firmly to social justice for forest communities. Greater awareness of the roles of methodologies in this is crucial.

As we have shown modelling and measurement processes are not just technical but social and political, bringing with them and thus cementing particular views of landscape and social relations that in turn translate into project pathways that bring real material consequences. In the process, other possibilities – including alternative pathways that might treat and value carbon as part of complex, lived-in landscapes, or respond more adaptively to less equilibrial people-forest relations, are occluded. We have, in particular, highlighted how methodologies invoke landscape stability and control (deeply questionable given ongoing socio-political and ecological dynamics) in establishing project boundaries, eligibility and permanence. Equally, methodologies and applications reproduce and reinforce (also deeply questionable) views of one-way deforestation, in constructing baselines and additionality, filling data gaps, and justifying project urgency. As these cases reveal, long-established deforestation narratives, and the imperatives of the new political economy of carbon, are now interacting in ways that strengthen both.

This co-construction of methodologies and politics has involved a particular constellation of expertises which frame methods in particular ways, excluding other considerations. VCS and CDM methodological debates are dominated by climate modellers, environmental economists, forest and soil biologists, accountants and business project managers – but notably not anthropologists, sociologists, political scientists, ethicists or moral philosophers. Perhaps even more significantly, local ground level perspectives have been excluded. These methodologies were developed for an imagined neat world of carbon cycle models and finance, from which the difficult complexities of real-life settings could be excluded. They were also developed to treat forest carbon as a commodity, tradable on global markets; a view that contrasts sharply with how local people in West Africa value and experience their landscapes. As participants in projects, expected to be 'beneficiaries' of carbon finance, and ultimately the drivers of carbon mitigation, their perspectives have often been sidelined, or at best marginalised to a separate arena of 'social safeguards' in projects designed by others.

In the seemingly technical world of MRV assessments, there is therefore a much deeper, but often not explicit and discussed, exercise of power on-going, with distributional consequences. This can happen even in the most well-meaning project, run by the most noble and committed people. It is this inadvertency, almost blindness to consequences, that is perhaps most worrying. Surely any effort to mitigate the potentially catastrophic consequences of climate change must be a good thing, some say. But in our enthusiasm to do something and to tap potential flows of climate funds, that danger is that we draw with insufficient reflection on methodologies that lock us into narrow carbon pathways that may prove neither sustainable nor socially just. Globally, reworking forest carbon pathways towards sustainability and social justice thus requires more critical reflection on their fundamental framings and the roles of methodologies in these, in turn enabling genuine space for forest users' perspectives and priorities to shape projects in practice.

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