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# Contested mappings in a dynamic space: emerging socio-spatial relationships in the context of REDD+. A case from the Democratic Republic of Congo

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## Abstract

This paper adopts a processual understanding of mapping to empirically explore the workings of satellite-based forest visualisations and maps within the REDD+ process in DR Congo. Our analysis approaches maps as ongoing contingent practices and highlights the recursive interplay between maps and the socio-natural world. We first show how REDD+ (mapping) assemblages enact a uniform portrayal of community-induced threats to nature, which in turn legitimises a monoculture of abstract space often to the detriment of communities' authority over land and their particular socio-ecological relationships. However, these mapping attempts at reordering forest landscapes are locally met with and reshaped by ever-emergent socio-spatial practices, ways of seeing and appropriating landscape. Complexity, fluidity, and ambiguity are indeed rendered absent by these seemingly immutable and complete representations although they are essential for understanding struggles over resources. We conclude that adopting a processual understanding of maps opens up ways of enacting socio-environmental justice.

**Keywords:** Mapping, Geospatial knowledge, REDD+, Socio-spatial relations, Socio-environmental justice, Performative assemblage, Emergence

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## 1. Introduction

In 2009 the Democratic Republic of Congo (DRC) initiated the Reducing Emissions from Deforestation and Forest Degradation 'Plus' (REDD+) global environmental policy process. Despite the very limited data on forest cover change then available, the country's annual gross deforestation was estimated at 0.23% for 2000-2010; substantially lower than the rates of Malaysia, Indonesia or Brazil (DRC-MECNT, FCPF, & UN-REDD, 2015; Ickowitz, Slayback, Asanzi, & Nasi, 2015). One of the first major goals of the REDD+ readiness phase was to gather scientific data to inform a 'national consensus' on the main drivers of deforestation. These data would

serve as input for building the country's REDD+ strategy and monitoring actions (UN-REDD & DRC-MECNT, 2012). The expert-based 'national consensus' was grounded almost exclusively in the use of Landsat remote sensing satellite maps and geospatial expertise, despite a range of critiques on the quality, validity and reliability of the data yielded in four REDD+-sponsored studies (see Ickowitz et al., 2015; Moonen et al., 2016) and despite the absence of local voices and on-the-ground research as denounced by several international activist NGOs<sup>1</sup> [e.g. Rainforest Foundation UK, interview 23/04/2018]. The 'national consensus' posits shifting cultivation and population growth as the main direct and underlying drivers of forest loss, with industrial logging and mining activities having only limited impacts, though they are recognised as potential future threats to forests (DRC-MECNT et al., 2015).

On the basis of this consensus, the REDD+ strategy in DRC has largely evolved towards what is labelled as jurisdictional or integrated landscape approach<sup>2</sup> in policy discourses (McCall, 2016). The landscape approach broadens the climate-, forest-, carbon- and performance-based initial emphasis of REDD+ towards the integration of multiple stakeholders and multiple productive land-use types –such as agriculture and mining– with a larger range of environmental and developmental goals at a wider landscape scale. While the landscape approach is called 'innovative', some regard it as yet another discursive commodity to ensure a continuous flow of finances to programmes that leave previous conservation and development approach challenges largely untouched (Lund, Sungusia, Mabele, & Scheba, 2017; McCall, 2016). As Clay (2016) argues, landscape approaches reproduce uneven power relationships by promoting a particular vision of conservation coexisting with productive and extractive activities. The use of zone-based, static land use models either disregards or completely depoliticises local social-environmental dynamics; in part due to an increasing need for expert knowledge and to the overly geospatialised interpretations of these dynamics (Clay, 2016; McCall, 2016). The selective use of data, and the oversimplification of the messy world by employing 'neutral' scientific language, risks further exclusion of the poor (Ferguson, 1994; Li, 2007). With technological advancements in satellite imaging and remote sensing tools 'never-before-seen' geo-visualisations of forests have become more ubiquitous for studying deforestation and for policy design and monitoring –making particular 'realities' visible while hiding others.

Building on insights from political ecology, Science and Technology Studies and critical cartography, this paper empirically looks at the role, use and contestation of geospatial environmental visualisations and maps in producing 'integrated' green economic landscapes under REDD+ strategies in DRC. We adopt a processual understanding of mapping (Kitchin & Dodge, 2007) to understand how maps within DRC's REDD+ assemblage

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<sup>1</sup> International environmental NGOs (like Greenpeace, Rainforest Foundation UK (RFUK) or Global Witness) much more than Congolese environmental civil society organizations are contesting these studies and the framing of the REDD+ programme in DRC. While a detailed analysis of the heterogeneity of opinions among NGOs/CSOs would exceed the scope of this paper, it is important to note that their views on the REDD+ process, forestry reforms and industrial logging are sometimes divergent.

<sup>2</sup> In REDD+ literature, both terms are used and refer to the same model for aligning multiple land-use types with administrative jurisdictions and coordinate multiple goals, initiatives and stakeholders. In the remainder of the paper we only refer to 'landscape approach'.

reify particular socio-spatial relations and identities while simultaneously being destabilised and recrafted in diverse spaces and times. After discussing our conceptual, epistemological and methodological approach (**section 2**), we then analyse how a putative reality that blames local communities for deforestation is framed through an assemblage of geospatial imageries, maps and discursive practices (**section 3**). Subsequently we examine how such a framing legitimises so-called inclusive REDD+ programmes that largely privilege a *monoculture* (Santos, 2004) of abstract spaces managed through privately-held concessions (Clay, 2016) to the detriment of communities' authority over land and over their specific socio-spatial identities. **Section 4** turns to the concrete implementation of such a rational spatialisation that tries to mould a socio-ecological system to a given representation of what it should look like, through geospatial and participatory mapping technologies (Pickering, 2013). Specifically, we analyse how these mapping attempts are continuously reshaped by local dynamic socio-spatial practices, ways of seeing and of appropriating *landscape* somehow rendered absent on the maps (Law, 2004). We conclude that the continuous reliance on modernist technocratic framings and epistemologies and their purely representational way of understanding the world denies both complexity and performativity; thus always failing to account for *emergence* and multiple ways of being in and knowing the world –often resulting in the perpetuation of socio-environmental injustices.

## **2. Mappings, power and emergence: a processual understanding**

Political ecological scholarship on forest governance (e.g. Fairhead & Leach, 1996; Forsyth & Walker, 2008; McElwee, 2016; Robbins, 2001) has provided valuable insights into the ways in which Western techno-scientific knowledge often lead to simplistic and largely 'misread' narratives of deforestation that help constrain the livelihoods of local communities while availing space for more powerful capital interests. Complex society-environment relationships are distilled into seemingly apolitical abstract categories and reconfigured within a global environmental space and a unitary political-economic rationale. Igoe (2013) specifically emphasises how scientific and aesthetic visual articulations of nature have contributed to its abstraction, unitarisation and formation as a monolithic eco-functional object of intervention, optimisation and commodification, while concealing and marginalising opposition and alternatives to this vision. Similarly, Forsyth and Sikor (2013) show that the use of remote sensing data for defining and measuring global REDD+ objectives might encourage both large-scale reductions in deforestation rates and industrial selective logging rather than shifting cultivation and improvement in forest quality/biodiversity that could locally be more beneficial.

Critical cartography (e.g. Harley, 1989; Pickles, 2004; Wood & Fels, 2008) has long analysed the relationship between mapping and politics, the kinds of knowledge that maps produce and with what effects, arguing that they do not simply represent the world but also produce it. Maps are propositions about the world and are hence always political and ideological artefacts, embedded in regimes of claims that construct meaning and ultimately behaviour. While this scholarship makes indispensable contributions to our understanding of the

power-laden character of geospatial environmental knowledge production, Kitchin and Dodge (2007) argue that it still tends to consider maps as immutable and ontologically secure inscriptions. What has been less explored is an epistemological approach to assess 'lines of becoming' and the multiple lives of mappings, tracing out how they emerge time and again 'in the entangled meshwork [...] of their creation, use and unfolding of everyday life and space' (Kitchin, Gleeson, & Dodge, 2013, p. 3; Pickering, 2013). From this perspective, maps should be understood as a set of unfolding practices to solve relational problems (e.g. spatial distribution of deforestation drivers) constantly in the making, contingent, relational and ontologically unstable; they are always *mappings*. This necessitates a significant shift 'from ontology (what things are) to ontogenetic (how things become)' (Kitchin et al., 2013, p. 15).

The ontogenetic nature of maps invites us to see them as assemblages that are imbricated within other and/or larger assemblages, such as REDD+ in our case. From a Deleuzian and post-representational perspective, the assemblage approach emphasises the constitution of a contingent provisional unity between heterogeneous human and non-human components that include material, discursive and social artefacts (Anderson & McFarlane, 2011). It is the assembling processes of these components, in specific time and place, that are performative, i.e. they contribute to enact pre-existing social and material contexts (Yeow & Faraj, 2014). Assemblages can hence produce different ontologies (e.g. counter-maps) and often follow unintended routes as they are contingent on the fostering of new relations and the entrance of new elements (Anderson & McFarlane, 2011).

Our starting point then is the contextually contingent (re)crafting of maps using specific data, within DRC's REDD+ assemblage of people and discursive regimes. Since a single coherent story of deforestation is required for such a policy exercise, a single reality will necessarily emerge. We concur with Wood and Fels (2008) that key here is the articulation of the *map* and the *paramap*, i.e. the verbal and nonverbal discourses that surround the map to position it and through which argument and authority are conveyed. The *paramap*, in turn, consists of the *perimap* and the *epimap*. The former refers to the physical map: title, legend, colours, graphs, etc. The latter refers to the discourse surrounding the map, that shapes reading and perception of the map. Although these maps are given an appearance of immutability and predictability –their knowledge and message fixed, and their emergent aspects edited out– they are in fact continuously recrafted, interpreted and translated in many unpredictable ways every time they are engaged with (Kitchin & Dodge, 2007; Pickering, 2013). As section 4 illustrates, maps are constantly remade and re-inscribed by people's everyday socio-spatial practices and bodily actions, as well as by the emergence of previously invisible elements.

Our adopted approach thus refocuses (critical) cartographic research as 'sciences of practices, not [(un)truthful] representations' (Kitchin & Dodge, 2007). This conceptual entry-point gives a more active and political role to cartography. Most notably it reveals *how maps emerge*, within wider contingent knowledge and discursive fields and forms of praxis, to enact some realities and solve relational problems and to analyse

the recursive interplay between maps and the socio-natural world. The power of maps is relational rather than fixed and complete. Thus we aim to develop a better understanding of the workings and work of mappings of Congolese forests and their people from their genesis and unfolding within the REDD+ assemblage to some of their 'multiple lives' in the world. Such insight highlights the sociality of maps, i.e. how mappings differently affect various actors and social relations such that technoscience and crucial issues of environmental justice are and should be woven together.

### ***Methodological approach***

The empirical material informing this analysis draws on five months of ethnographic field research carried out by the first author between May 2015 and June 2018 in DRC, combined with a desk study of REDD+ policy documents. The field research included 64 semi-structured expert interviews and also informal conversations with international and national forest experts, technical advisers and consultants from REDD+ lead implementing organisations, government agencies, representatives of international and national environmental NGOs and civil society organisations plus private actors engaged in REDD+ discussions. Complementary qualitative fieldwork was undertaken in the intervention areas of four REDD+ programmes in the hinterland of Kisangani: 96 semi-structured and informal interviews focused on understanding local processes and meanings of land tenure and resource use. In order to assess socio-spatial relations the fieldwork also included five low-tech participatory mapping exercises combined with focus group discussions. Far from using maps from a positivist/realist epistemological stance that emphasises the ontological security of maps, we used mapping as a contingent, relational discursive process that can produce different ontologies. Maps in this view are 'merely a reflection of land use [and tenure] at a particular time under a particular set of circumstances' (Roth, 2009, p. 222) and a product of specific negotiations. We also asked four land users to draw individual sketch maps – hand-drawn cognitive maps of their land use spaces. Although participatory (counter-)maps were seen by the communities as a powerful way to claim land rights, both of our low-tech mapping exercises also revealed their limitations in understanding a complex and dynamic tempo-spatiality. We thus complemented the counter-maps with four transect walks guided by the same four above land users, allowing us to highlight movement and flexibility.

### **3. Performing the green economic abstract space in DRC**

DRC's REDD+ assemblage has given primacy to remote sensing satellite mapping –largely seen from a positivist perspective as detached global knowledge par excellence– as an entryway to solve the problem of deforestation. Simultaneously, local and socio-political understandings of socio-environment relationships have largely been relegated. In recent years, the American-based initiative 'Global Forest Watch' (GFW) has been highly reinvested by REDD+ and forestry practitioners in DRC to monitor forests. This 'near-real time' online forest monitoring system initiated by the 40+ partner World Resource Institute (WRI) is often praised as 'the' technical feat finally offering reliable, objective forest data. The assemblage of GFW partners –whether

users or funders is never made clear by WRI— comprises conservation non-profits, major environmental organisations supporting and employing ecosystem/landscape approaches, and multilateral cooperation agencies funding REDD+ programmes as well as blue-chip private corporations which include two of the world’s largest agribusiness industries/palm oil buyers. As WRI’s CEO asserted, thanks to GFW ‘[f]rom now on, the bad guys cannot hide and the good guys will be recognised for their stewardship’ (WRI, 2014, para.2). However, GFW does not mention who the ‘bad’ and ‘good’ guys are; this is left to each user, as GFW presents itself as a neutral actor, supporting sustainable management of human-environment relationships.

### ***A seemingly neutral and disconnected representation***

Using an assemblage of GFW’s analysis of thousands of geospatial images, spatial demographic datasets and administrative data, (para)maps were created by DRC’s REDD+ policy makers to simplify perceptive judgements and act as reference objects to assign blame and spatially plan REDD+ actions (Ehrenstein, 2014; Wood & Fels, 2008). One map-paramap assemblage can be found on the website of the main REDD+ investment programme Central African Forest Initiative (CAFI)<sup>3</sup>. It includes a section with 29 frequently asked questions (FAQs) about ‘CAFI and the forestry sector in DRC’ (CAFI, 2017a). Among the 29 FAQs, one question/subpage claims that it seeks to provide ‘proven’, evidence-based facts on the main drivers of deforestation and land degradation. The subpage starts with a short and straightforward text –the epimap– stating and emphasising in bold script that the expansion of subsistence activities (slash-and-burn agriculture, and fuelwood collection and harvesting) is the main cause of deforestation and forest degradation and is hence closely correlated to the spatial distribution of population. The text also highlights –as the other 28 FAQs uniformly do– that ‘contrary to popular belief, [industrial] forest exploitation is not systematically a driver of deforestation and degradation’ (CAFI, 2017b, para. 2, own translation). As such, the FAQs seem to largely defend and legitimise the highly contested<sup>4</sup> *Sustainable Forest Management Programme* (PGDF) that supports logging companies in developing their forest management plans.

Then comes *the* map (**Figure 1**) and its perimap. They appear on all of the three FAQs’ subpages dealing with deforestation drivers. The map displays four carefully chosen human and non-human elements: forest cover loss, population distribution, roads and ‘forest’ concessions. The map draws on three spatial data sources: GFW (forests), WorldPop (population) and the DRC’s Common Geographic Reference System (roads and administrative limits). The map highlights forest cover loss for the period 2000–2014 in a bright red colour and superimposes it on population density explicitly suggesting a direct causal link. Logging concessions –framed as ‘forest concessions’– are represented in non-threatening green, the traditional colour of trees and forests, suggesting the absence of deforestation in those spaces. The (para)map design, with its particular use of map

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<sup>3</sup> CAFI and its related fund FONAREDD (National REDD+ Fund) is a partnership between DRC, multilateral and bilateral donors, for the implementation of the REDD+ investment phase. It acts as a coordinating body of the REDD+ process in DRC. Its website has become one of the main references regarding the REDD+ overall strategy and programmes in DRC.

<sup>4</sup> PGDF was and still is contested by some international activist ENGOs and some Congolese civil society organisations.

colours and bold characters in the text, distracts the reader from the forest fragmentation that appears within these concessions. Similarly, the (para)map only refers to undefined forest cover loss and silences different categories of forests and deforestation. It also does not refer to forest degradation –an explicit REDD+ concern regarding forest quality– nor to biodiversity or any alternative local definitions of forest (use).

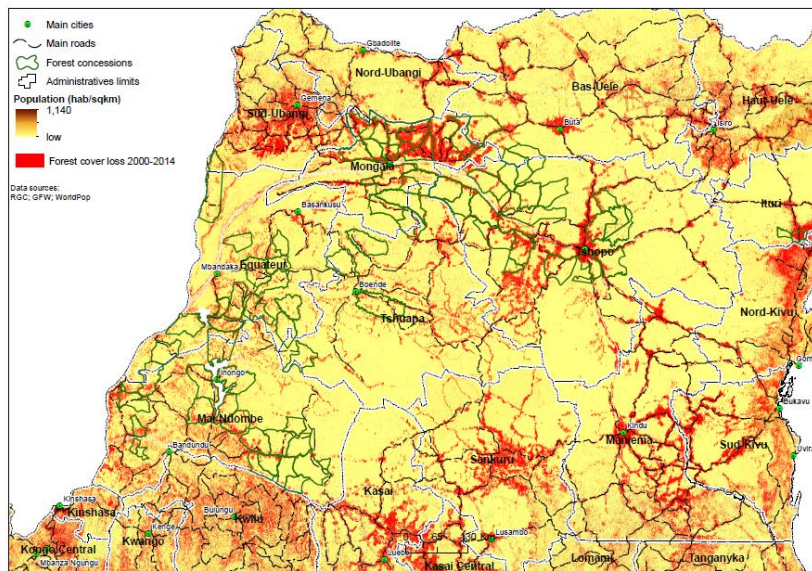


Figure 1. Main map on the CAFI REDD+ investment’s programme website (CAFI, 2017b)

Yet, if we focus on cover loss, some GIS scholars –among whom some contribute to GFW– increasingly argue that in DRC, ‘the majority of tree cover loss [...] is accounted for by shifting cultivation onto previously farmed lands rather than new deforestation’ (de Araujo Barbosa, Maschler, Bonfils, & Molinario, 2018, para. 5), hence showing different interpretations of land use change. In the same way, the generic definition of forest in DRC’s REDD+ official documents is an adaptation from the definition provided by FAO and the Clean Development Mechanism, which can include (industrial) tree crop plantations (UN-REDD & DRC-MECNT, 2012). ‘Forest’ in that discourse is understood as a unified category of carbon stock, as is also made clear by another map (Figure 2) –the only one in the REDD+ national investment plan (CAFI, 2015). In Figure 2, remote sensing maps are transformed into a rough cartographic representation that performs *the forest* as scarce carbon stocks, i.e. simultaneously as a threatened and a possessable resource (Wood & Fels, 2008), while rendering all other elements invisible.



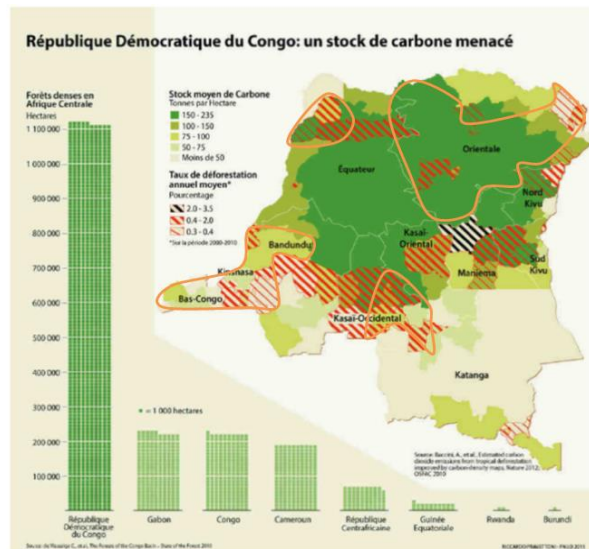


Figure 2. 'Democratic Republic of Congo: a threatened carbon stock' (CAFI, 2015)

Returning to **Figure 1**, population –just like forest loss– is not qualified. While the (para)map refers both to 'population density' and 'spatial distribution of population' other parts of the website, as well as the REDD+ studies on deforestation drivers and strategy documents, use the term 'population growth'. These concepts have very different meanings and implications. The REDD+ strategy makes things clearer: the lack of family planning and education leads to uncontrolled population growth that 'poses huge problems in terms of environmental and natural resources preservation, for forestry ecosystems among others' (DRC-MECNT et al., 2015, p. 77, own translation). The strategy does not provide a further explanation for this causality. Similarly, **Figure 1** only tells us that human presence and forest cover loss are correlated. No political-economic or historical contextualisation is provided regarding the resettlement of population around roads during colonial times or conflicts forcing relocation, or about unequal access to resources, distribution of wealth or market access. In section 4 we show that such information could lead to very different understandings of deforestation drivers. However, REDD+ synthesis of deforestation drivers in DRC acknowledges that defining underlying drivers is very complicated and direct observation of these underlying drivers is impossible (UN-REDD & DRC-MECNT, 2012); meaning, in the document's vocabulary, that it is impossible to observe/represent them with geospatial technology from an office in Kinshasa or from elsewhere in the world. 'Population' is the exception: it appears to be easily represented (geo)spatially, and is largely depicted as a technically manageable matter of family planning. Heterogeneous dynamics of resource use among a seemingly homogeneous 'population' remain hidden.

So, REDD+ (para)maps and documents simultaneously co-produce homogeneous categories of forests and users that are driven by implicit norms (Forsyth & Sikor, 2013). **Figure 3**, for instance, shows the REDD+ priority zones of the CAFI *Programme Intégré Oriental* that were determined on the basis of 'deforestation hotspots', a.k.a. 'zones with high population density' (FONAREDD & UNDP, n.d., p.13). In reality, densities largely differ

from one zone to another: from more than 400 people/km<sup>2</sup> in Kisangani to an average of 6 people/km<sup>2</sup> in more remote regions. The legend points out that the hotspots correspond to livelihood activities, i.e. slash and burn agriculture (in red circles), fuelwood production, artisanal logging and mining. Industrial activities in the area are not identified, e.g. in the Tshopo province, 16 logging concessions (occupying 21,5% of the province's territory) and 2 palm oil tree plantations; neither are protected areas (4% of the Tshopo Province; 31% of Bas-Uélé Province). However, as our fieldwork revealed, the presence of logging concessions and roads attracts 'migrants' seeking livelihoods as well as many high-ranking political and military elites who start cash-crop plantations or engage in artisanal logging. This suggests much more heterogeneity than the category 'population' reveals. Also the omissions in the map hide the fact that the presence of concessions or protected areas often forces increasing numbers of peasants to encroach other forests for their livelihood activities, as explained by several of our informants.

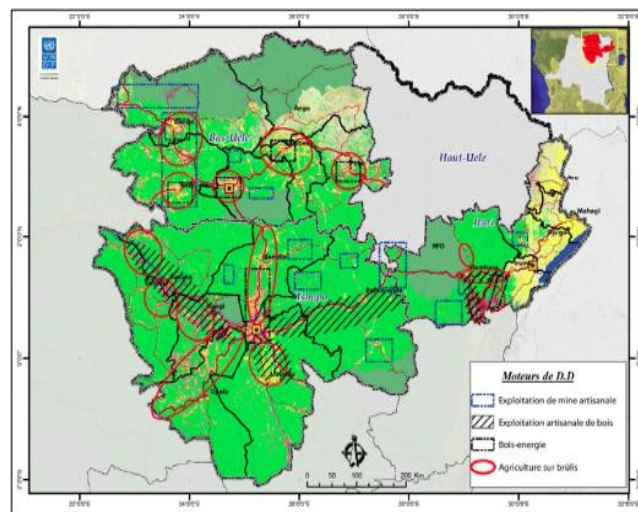


Figure 3. Priority zones of the CFI Programme Intégré Oriental, in 3 provinces (FONAREDD and UNDP, n.d.)

### A 'successful' discourse

The (para)maps' propositional logic of a community-induced deforestation was continuously restated – especially at central level in Kinshasa– during our interviews with national and international REDD+ consultants in DRC and with various other state and non-state actors involved in or targeted by the programme. Our analysis of these interviews and of programme documents shows a constant use of essentialising discursive binaries such as *artisanal* versus *industrial*, *artisanal* versus *formal*, *subsistence* versus *productive*, *slash-and-burn* versus *intensive*, *collective* versus *individual*. 'We have never seen that the collective can manage anything correctly', one of the REDD+ national coordination's main (international) Technical Officers told us [25/02/2016]. In an attempt to explain the reliance in the hinterland of Kisangani on traditional subsistence agriculture that causes deforestation rather than on cash crop/productive agriculture, a Provincial Coordinator of REDD+ programmes told us: 'here people are passive [...] they are less dynamic, entrepreneurial than in

other regions<sup>5</sup> [01/03/2016]. Our interviews with government actors and with national civil society organisations (CSOs) in Kinshasa –whose representatives are typically urban elites– revealed a similar strong prejudice against those who are seen as primitive peasants with age-old practices. While CSOs constantly challenge state institutions’ legitimacy to make decisions regarding forest policies and REDD+, the large majority of them never question the mainstream narrative of deforestation precisely because it appears as scientific and depoliticised, as neutral and normatively superior. Typically, CSOs recognise that REDD+ design in DRC is not perfect but they do not question the foundations of the programme and its continuation, unlike international environmental NGOs [President of the Congolese civil society platform for REDD+, 28/05/2018]. In turn, as a high-ranking official at the Tshopo Provincial Ministry of Environment told us [11/05/2018], for state actors, assigning logging or agricultural concessions can represent much larger financial gains for ministers at central level (rent-seeking behaviours) compared to supporting local livelihoods. In the areas around Kisangani targeted by REDD+ programmes, the well-oiled discourse about communities’ ‘behavioural problems’ was also repeated by local opinion leaders trained and informed via REDD+ communication and awareness plans. In contrast, the impact of industrial companies was rarely mentioned except when the president of one of the (trained) local Agricultural Administration Councils, asserted that ‘even if an agricultural plantation deforests, it stays in a limited space while [local] population, they, are always on the move’ [21/03/2016]. ‘Subsistence agriculture, that one, is insatiable’ [one REDD+ national coordination’s Technical Officer, 25/02/2016].

While these actors’ justifications for REDD+ orientation are different, these binaries can fundamentally be understood as embedded in a socio-tempo-spatial monoculture of productivity (Santos, 2004). This monoculture normatively privileges a linear, sequenced and bounded time-space associated with the rationality of formal industrial and commercial activities. It corresponds to what is seen as a productive time-space that is legitimised by the different actors we interviewed through its economic significance for the country’s green growth. This uniform discourse simultaneously creates the non-existence of periodic, discontinuous and unbounded time-spaces by describing informal artisanal and subsistence activities as irrational. It is perceived as an incidental time-space in a double sense: as backward and secondary for national growth, and as unplanned, disordered and uncontained in relation to the natural environment. On this basis rights to land and forest resources and legitimacy to deforest (or not) are distributed. Clearing trees appears acceptable as long as it is planned and bounded in space and time, like continuous and linearly growing industrial exploitation, something the same REDD+ national coordination’s Technical Officer referred to as ‘accompanying deforestation’ [25/02/2016].

The overall goal of DRC’s REDD+ programme is to ‘supervise’ and incentivise local rural communities to settle their ‘harmful’ activities and maintain forest cover in order for DRC to be able to support increasing private

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<sup>5</sup> Quotes from interviews have been translated from French as literally as possible by the authors.

and international demand for commercial and industrial agricultural land, timber and minerals (DRC-MECNT et al., 2015). The involvement of the private sector and, in particular industrial timber corporations, has gradually increased as the perspectives of REDD+ in DRC entering the investment phase became clearer, allowing them to both define and benefit from the REDD+ agenda (DRC-MECNT et al., 2015; Mpoyi, Nyamwoga, Kabamba, & Assembe-Mvondo, 2013). The REDD+ CAFI programme, as one of its stakeholders told us, is ‘really a rational approach, to reinforce control’, it is a ‘big zoning and land use plan for development’ [19/04/2018]. In other words, it is about spatialising what Igoo (2013, p. 43) conceptualises as an ‘eco-functional nature [...] amenable to technological re-orderings that will optimise economy and ecology, or at least accommodate putatively inevitable growth with minimal disruption to ecosystems and human well-being’. In this logic, the model of the privately-held, sustainably managed and zone-based scaled concession acts as a socio-spatial reference institution. The demarcation of land-use zones (e.g. permanent production forests, conservation zones, subsistence agriculture zone, large-scale agricultural land), advocated by the REDD+ spatial-based approach to landscape operates with the same practices of industrial logging for delimitating territory and resources and negotiating the circumstances of extraction, production and social benefits’ distribution (Clay, 2016). REDD+ in this case can be seen as a scaling up of the model of the forest management plan to a larger landscape. The approval of a highly contested US\$18 million PGDF programme in the REDD+ investment plan is a striking example of this approach. CAFI justifies the programme by appealing to the definition of REDD+ activities adopted by the conference of parties in 2010 under the Framework Convention on Climate Change, that indicates ‘sustainable management of forests’ as one possible activity (CAFI, 2017a). In practice, PGDF mainly supports the logging sector to develop forest management plans to organise their production more ‘rationally’, profitably and ‘ecologically’ while increasing control over community and artisanal activities within the concession boundaries (FONAREDD, 2016).

#### **4. Unfolding mappings of the hybrid eco-functional landscape**

In the hinterland of Kisangani the case of the establishment of the forest management plan (FMP) of a foreign company’s timber concession (ITC)<sup>6</sup>, whose entrance is situated just 20km from the city, provides a good example of a codification and mapping of a smaller scale *integrated landscape*. It relies heavily on geospatial mapping technologies but also on participatory mapping as ‘means of translating the community’s land [use and] tenure system into spatial information, which will be technically accepted and understood by [all landscape stakeholders]’ (Astuti & McGregor, 2015, p. 2285). While the example raises important issues of ownership and authority over landscape, it also emphasises the ontological insecurity of the dominant abstract representation of space and its seemingly immutable and predictable categories of forests and population as we described in the previous section. In fact, maps and space ultimately emerge in context and are constantly (re)made in a dialectical relation with everyday socio-spatial practices and with people who engage with this

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<sup>6</sup> For reasons of anonymity, we refer hereafter to the fictive acronym ITC (International Timber Company).

type of dominant spatial representation (Kitchin et al., 2013; Sletto, 2002), leaving planners with unexpected challenges and outcomes.

Two elements of the FMP directly impacting communities are key. One concerns the mapping of boundaries of ethnic subgroups' lands on which a concession is installed so as to distribute the benefits of the social responsibility contract, i.e. the part of the FMP that establishes specific socio-economic investments by the company for local communities. This is done on the basis of maps and decrees from the colonial Belgian administration and by the use of GPS coordinates collected by a team composed of a company's representative, local communities' representatives, provincial administration and a GIS expert from the provincial forest administration. A second element concerns the spatial organisation and delimitation of the concession into four broad use categories: industrial timber production area, rural development zone (for community activities), conservation and protection zones. The demarcation of these land-use zones is mainly premised on two socio-ecological categories that allow estimation of community forest conversion rates: density of forest cover and existing road networks as identified by satellite imagery. The size of the Rural Development Zone (RDZ) was estimated for a 25-year period. However, in 2017, about two years after the plan's approval, the RDZ's boundaries were already reached and activities involving tree clearing (agriculture, charcoal production or artisanal logging) were taking place even within the limits of the production zone, i.e. outside of the RDZ. This completely 'remapped' the zone (**Figure 4**). As two consultants involved in the establishment of the FMP told us with consternation, 'everything is moth-eaten in this concession' despite the communities having approved the limits of the RDZ in a participatory way [29/05/2018]. The astonishment suggests a lack of understanding of (and/or willingness to engage with) socio-political dynamics shaping access to land and the complex and multiple land use dynamics in this peri-urban area.



**Figure 4.** Landsat 8 satellite map of a part of ITC's concession, from 10/05/2017. The mapped RDZ was reshaped as it extended outside of its foreseen boundaries (we highlighted some of these extensions by red circles).

The participatory nature of the mapping of community land tenure and use boundaries was intended to legitimise the FMP. Through the participatory process the FMP assigned bounded areas of the concession to four ethnic subgroups with the idea that as customary land owners they would regulate access to forest and have customary power and control over the RDZ. Similar to colonial land administrators, the FMP assumed that people living together in one space are part of a same homogeneous ethnic subgroup and are governed by one common chief, thereby ignoring the heterogeneity within so-called 'communities' and different interests at local level. Indeed, the FMP and the demarcation of the RDZ was signed by chiefs of the four ethnic subgroups. However, the land ownership based on a first occupancy status by one of these ethnic subgroups (the *Bevenzeke*), was strongly contested by other groups who were not recognised in the plan. This conflict was fuelled by political deputies who had clear interests in enlarging their constituencies.

As expected, our numerous conversations with different groups never provided an answer to the primary occupancy question, nor did the historical maps of the region. While the FMP seeks to fix boundaries between different groups and to record permanent customary ownership, for a long time such ownership and authority were fluid in this part of the concession. This was due to a historic absence of road infrastructure that meant forests thrived because of a relative lack of competition for resources. By definition, this was a non-prescriptive space characterised by fluid appropriation, diversity and disorder. In this specific space –identified as vacant land during colonial times– boundaries were continuously negotiated in time and space rather than being permanent and static. Tenure and also land use were flexible rather than defined in a comprehensive way. The ones who are now identified as 'migrants' by the *Bevenzeke*, created villages and even became customary chiefs who could grant access to land and allocate (very open) user rights to newcomers. Land use activities of the different 'migrant' groups were effectively unregulated as resources were plentiful. They could (and still can in practice) freely cut trees for opening a diamond quarry, for agriculture or for charcoal production. However, with the extension of ITC's permanent logging road, large plots of land have been easily acquired by urban elites or alienated forcefully by military or political players for land speculation or for establishing cash crop plantations, charcoal production, or artisanal logging. The urban elites' impact on forests is in fact often much higher than local communities' who have less means to exploit extensive resources.

These heterogeneous communities resist the mapped production of a bounded ethnic space through their everyday dynamic land appropriation and use thus defying the official representation of space. Our participatory and sketch mapping exercises revealed the difficulty of delimiting fixed categories of occupation and use. Rather, the discussions these exercises raised and the transect walks we carried out highlighted a spatial epistemology based on movement (Roth, 2009). Socio-spatial practices, characterised by periodicity and extension, often lead villagers to install small temporary camps in the forest that are used for several weeks to carry out diverse agricultural and forest activities, then abandoned for years and then re-used. The landscape, far from being separated into units of agricultural lands and forests is envisaged in a much more holistic way: fallow swidden lands are interrupted by denser secondary forests in the middle of which one can

find a small field of plantain banana or a stack of logs waiting to be transformed into charcoal. New villages and land use activities settle along new logging roads, leaving some more remote areas (sometimes temporarily) unoccupied. The sporadic maintenance of former logging roads leaves a fragmented forest structure with varying levels of cover and degradation; these patterns mostly do not appear on maps, since small logging roads are usually not detected by satellites. As such, various categories of forest cohabit through continua, successions, cycles and change (Robbins, 2001). Additionally, often hidden from the main road, powerful elites alienate large areas of land and resources, sometimes in the production zone of the logging concession, to install cacao or palm oil plantations, or for artisanal logging.

This 'dwelling space' is thus in a constant state of becoming, imprinted by non-bounded socio-spatial identities and practices, culture and power relations rather than 'already formed, ready to be occupied' (Roth, 2009, p. 210). It highly contrasts and challenges the abstract space that zone-based planning aims at producing through an assemblage of mapping and boundary-making practices. Our case study illustrates the constant state of transformation such an assemblage is always embedded in. While it aims at reordering a landscape that would bear the imprint of (desired) homogeneous categories (new codes) of community and forest circulating within REDD+ communities, this attempt is constantly contested and destabilised by local socio-cultural and political relationships. Remote sensing and participatory GIS maps produced as part of the FMP were in this sense socially and politically reshaped when they were engaged with by heterogeneous communities. The maps' apparent ontological security allowed the *Bevenzeke* to claim formal rights to land and to benefit from ITC's social responsibility contract while jeopardising the possibility of managing a changing reality in more dynamic ways –as was previously the case– hence fuelling conflicts between different groups. At the same time, the maps' ontological assumptions were highly challenged as they revealed their *truthfully* capture communities' tempo-spatiality.

## 5. Conclusion

Through the application of a processual and performative understanding of mapping we have, in this paper, challenged modernist and purely representational conceptions of maps and socio-environmental phenomena. We have argued that the usual way of governing the planet solely on the basis of supposedly true and complete representations (Pickering, 2013), not only fails to account for emergent and complex socio-ecological problems but also denies alternative ways of knowing and being in the world. In the context of DRC's REDD+ process we have shown that satellite-based maps act as reference objects –secure representations within an epistemic regime of claims and meanings that is deeply rooted in a monoculture of linear and bounded socio-tempo-spatiality. While these maps appear as 'natural arbiters' for defining landscapes, in practice they reflect an 'already settled dispute about the nature of [...] landscape[s]' (Robbins, 2001, p. 175). As such, they reveal particular embedded values about desirable productive, formalised and privatised landscapes inherent in carbon forestry (Forsyth & Sikor, 2013). Dominant mappings in REDD+ assemblage contribute to produce a

unified spatial ontology (*this is there*) (Wood & Fels, 2008) of deforestation that blames the livelihood practices of a homogeneous and apolitical category of 'local population'. Simultaneously the complexity of land use and power struggles over resources are obscured. Through these processes, the REDD+ landscape approach continues to push Western techno-scientific knowledge to arbitrarily create green economic and 'rational' socio-spatial identities and practices despite a purported holistic way of looking at land use with special attention given to local, native and marginalised groups.

As section 4 above showed, environmental planners and cartographers are faced with constant challenges and unpredicted outcomes as maps continue to be thought as ontologically secure and purely technical rather than relational. Our argument illustrates that while satellite-based and participatory maps in REDD+ governance are used for providing certainty and control over a seemingly neutral environmental space, they are reappropriated in different ways for solving relational problems and are thus contingent and never stable. Rather, these maps (as any map) enact some realities rather than others and thus always contain uncertainties and traces of exclusion –whether there are excluded communities, categories of forest, land use activities or spatial identities– that open them to contestation, reinterpretation and assignment of new meanings. To paraphrase Pickering (2013), the usual way of governing human–environment interactions that assumes a chain of causes and effects too often ignores temporal and spatial *emergence* in this (too) lively world. 'We can interfere performatively with it, and it will respond, but there is no guarantee whatsoever that the response will be what we expect' (Pickering, 2013, p. 19).

To be clear, we are not advocating against any uses of geospatial knowledge in REDD+ environmental governance. We rather argue for maps' re-socialisation, that is accounting for their performativity and their partiality, as well as their provisional and emerging character. It is about imagining other ways of approaching mapping that pays much more attention to how and why decisions are made, to the diverse context-dependent ways maps can emerge, and how maps and the world are always co-constituted. This type of mapping rather than enframing is much more open to negotiation and debate, and to performative interaction with more elusive dimensions of existence. More importantly –as it is impossible to disentangle the world from procedures to report on it, as the power of maps is relational rather than inevitable– such a cartography can bring in socio-environmental justice concerns. It indeed opens up to enacting what was rendered invisible or marginalised by dominant representations of the world, and to a willingness to account for what 'surprises' modernist science such as different socio-spatial identities and ways of inhabiting the world.

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### **Disclosure statement**

No potential conflict of interest was reported by the authors.

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### List of figure captions

**Figure 1.** Main map on the CAFI REDD+ investment’s programme website (CAFI, 2017b)

**Figure 2.** ‘Democratic Republic of Congo: a threatened carbon stock’ (CAFI, 2015)

**Figure 3.** Priority zones of the CAFI Programme Intégré Oriental, in 3 provinces (FONAREDD and UNDP, n.d.)

**Figure 4.** Landsat 8 satellite map of a part of ITC’s concession, from 10/05/2017. The mapped RDZ was reshaped as it extended outside of its foreseen boundaries (we highlighted some of these extensions by red circles).