forests

Supplementary Materials 'National REDD+ Implications for Tenured Indigenous Communities in Guyana, and Communities' Impact on Forest Carbon Stocks'

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S1. Socio-Economic and Ecological Factors Behind Indigenous Carbon Impact.

Our estimate of 39% lower biomass in mature forests surrounding indigenous communities appears large. The impact of commercial logging, for example, is half as much (Pearson et al. 2014). There are however a series of factors to be considered. First, apart from being an imperfect estimate, perhaps most important is that FDP obtain virtually all their livelihood needs from the surrounding land, in contrast to other forest users.

Second, the 39% carbon impact was confined to a fifth of the titled forest area, meaning 80% has been left intact over time. We point out that this does not mean that 80% of the titled forest area is not used, since hunting, gathering, fishing areas and "spiritual landscapes" extend well beyond the titled areas (Read et al. 2010, Indigenous Peoples of the South Rupununi 2012), as do territories of healthy game populations (Iwamura et al. 2014, 2016).

Third, a large part of the biomass in tropical forests is contained in bigger trees (e.g. Chave et al. 2003, Slik et al. 2013), which are very rare, due to slow growth and high mortality rates (e.g. Lieberman and Lieberman 1987, Overman 2001, Bennett et al. 2015). For example, based on a 50 ha inventory of undisturbed moist tropical forest in Panama, Chave et al. (2003) found that 41% of the live biomass per hectare was contained in just 17 trees with a dbh >60 cm (a quarter of biomass was stored in 4 trees >80 cm, half of it in 27 trees >50 cm, and 75% in 82 trees >30cm).

Fourth, harvesting wood from forest is accompanied by 72% collateral damage (Pearson *et al.* 2014, excluding infrastructural damage), and by an additional 56-81% carbon loss converting logs to lumber by chainsaw (Kerrett and Wit 2009, Trevin and Nasi 2009), i.e. an overall efficiency of just 5-12% (19-44% * 28%). Put differently, for each produced board, 8-19 boards went up in CO_2.

Fifth, good quality wood exposed to the elements (and people) lasts a maximum of about ten years (Overman, 2001). Other possible factors of unknown magnitude are, for example, possibly lower carbon density in natural forests bordering on savanna, area of fallow forest, cases where neighboring communities use the same forest area.

Given these factors and circumstances, the estimated 39% lower carbon density around villages does not appear excessive for villages with 80+ forest-dependent households (range 33-248) that are 75 years of age (range 35–105, Iwamura et al. 2014. Before that, people did not live in fixed villages (Myers 1993, Luzar and Fragoso 2012)).

S2. Some Pending Aspects of Guyana's Land Titling and Opt-in Mechanism Strategy

Although Guyana's recognition of FDP rights is much advanced compared to many other countries, it is not perfect in all parties' eyes. Below is a list of issues, not necessarily exhaustive, that would still need to be addressed.

First, the size of community land titles is left to ministerial discretion (Dooley and Griffiths 2014). Often however, titled areas are smaller than needed for resource use extractions, let alone match with ancestral land claims (e.g. Read et al. 2010, Indigenous Peoples of the South Rupununi 2012, Dooley & Griffiths 2014), hence many extensions are being requested. The new government

(since 2015) is to establish a Commission where communities can argue dissatisfaction with current demarcation (Granger 2015).

Second, some communities fear that opting-in with current titled areas may forfeit their claims to larger ancestral areas (lead author communications with indigenous leaders).

Third, due to a lack of coordination between ministries there have been several cases where indigenous communities' titles partially overlap with extractive permits, which remain valid if they pre-date the 2006 Amerindian Act (Dooley and Griffiths 2014).

Fourth, although the draft Opt-In Mechanism document (Office of the President 2014) states that opting-in is independent of other national development programs, it also states that the community's REDD+ earnings will be directed to finance the Village Plan, i.e. the village's development needs and priorities drafted by the village. There is therefore a risk in the current draft that community REDD+ earnings are to replace national funds for basic rural development stemming from historical government neglect. A related concern is whether community earnings would need to be allocated to climate adaptation projects, as changed weather patterns are already significantly affecting communities' primary food source (farming) and drinking water supply (pers. comm. and obs. by lead author) in the southern part of Guyana with historically less rainfall than the north (Bovolo *et al*. 2012).

Lastly, the FPIC process (Free Prior Informed Consent) will need a much larger dissemination and engagement effort, as recently even the majority of village leaders in the Rupununi, let alone village members, only had a vague understanding of REDD+ and Opting-In (pers. comms. of lead author with village leaders, and dr. Tom Griffiths of Forest Peoples Programme).

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