

Title: *Are Brazil deforesters avoiding detection?* Reply to Richards et al. 2016

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Abstract

The paper “Are Brazil deforesters avoiding detection?” recently published in Conservation Letters by Richards et al. 2016 has critical shortcomings and conclusions based on biased and not very robust analyses. Here we provide clarifications to some of the most critical points regarding the monitoring of land use changes in the Brazilian Amazon and related greenhouse emissions. Such clarifications are relevant to the readers of Conservation Letters and to a broader audience that rely on sound and robust science for a better management of environmental issues.

Richards et al. 2016 evaluated the use of Brazil’s official system for monitoring Amazon forest loss (PRODES) as a policing tool. The authors suggest that PRODES deficiencies encouraged landowners to deforest in ways and places that evade monitoring and enforcement systems, leading to lower protection of Brazilian Amazon than previously assumed. According to the authors, a downward distortion in deforestation levels carries implications for Brazil’s greenhouse gas (GHG) emissions inventories, as PRODES is the official tool for deforestation estimates. However, the article has many misunderstandings and misconceptions.

We wish to clarify the most critical points. PRODES uses a minimum mapping unit of 6.25 ha to maintain integrity of time series deforestation since 1988. PRODES does map internally deforestation events as small as 1 ha since 2005, which are informed to agencies controlling illegal deforestation. The disclosure of these areas by PRODES happens when these small deforestation patches coalesce over time and reach cumulative size larger than 6.25 ha. The resulting polygon is mapped and counted by the system as a new deforestation in the previous

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year. The trajectory of deforested areas, including secondary forests, was tracked by the TerraClass project that mapped land use of deforested area in the Brazilian Amazon between 2004 and 2014. Richards et al. completely ignored two other monitoring systems: Detection of Deforestation in Real Time (DETER) and Mapping Forest Degradation in the Brazilian Amazon (DEGRAD), which are public available. The DETER was developed in order to generate alerts of deforestation at short intervals reducing the response time of the deforestation control operations. In operation since May 2004, it maps both clear-cut areas and forest degradation – areas where the forest cover is partially removed indicating the spatial trends of deforestation in progress in the region (<http://www.obt.inpe.br/deter/>). Considering the relevance of forest degradation processes for the monitoring of forest cover, the DEGRAD system was developed. Using images from the Landsat and CBERS satellites, the system maps areas of degraded forests above 6.25 hectares, with a tendency to be converted into a clear-cut (<http://www.obt.inpe.br/degrad/>).

Richards et al. hypothesis is that Brazil's decision to use PRODES as a policing tool encouraged landowners to deforest in ways and places that evade monitoring and enforcement systems is an oversimplification of Brazil's monitoring systems and deforestation dynamics. In disagreement with the article statements, Brazil's experience with PRODES and DETER proves that these systems provide valuable information to improve environmental policies and law enforcement.

The authors are equally wrong about GHG emissions estimates from forests and other land uses used for Brazilian mitigation goals. Brazilian estimates are based on IPCC guidelines for national inventories for GHG emissions, which undergo regular scientific reviews and adopted for international negotiations under the UNFCCC. Brazilian Inventories derive from satellite

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images analysis, for determined periods with the same methodology and resolution. Thus, the national mitigation strategy are not based on PRODES-derived data but on new information generated through the National Inventories, considering explicit observations of land use transitions (i.e. more than just clear-cut) in both managed and unmanaged areas country-wide. For the 3rd National Inventory, areas under the different categories of land use and land cover were identified applying spatially explicit observations of land use transitions. The country was divided into spatial units in the form of polygons, which resulted from the integration of the following data (information plans / layers): 1. Brazilian biomes; 2. Municipality limits; 3. Preterit vegetation (vegetation types); 4. Types of soil; 5. Managed areas (Conservation Units and Indigenous Lands). Land use and cover for the Cerrado, Atlantic Forest, Caatinga, Pampa and Pantanal biomes were compared for 1994, 2002 and 2010 while the Amazon data from 1994, 2002, 2005 and 2010 were considered (<http://sirene.mcti.gov.br/>). The information plans generated for each year studied were crossed, generating polygons that cover the entire national territory, each belonging to a biome, county, soil type, vegetation type and use / land cover in the years of interest. Analyses of the geo-referenced images identified where changes occurred in the land cover and use in the periods of interest. From the combination of this information with data on carbon stocks in living biomass (above and below ground), in dead organic matter (litter and dead wood) and soil organic carbon, CO₂ emissions and removals for the periods considered are estimated. This also means that all vegetation types (independent of the carbon density) are considered in all biomes and all land use transitions (not only clear-cut).

Aboveground biomass estimates, for the Amazon forest region, of the 3rd National Inventory (95.89 ± 3.10 Pg) were similar to those reported by Saatchi *et al.* (2011) (86.55 ± 25.96 Pg). They differed from those of Baccini *et al.* (2012), which can be explained by regional and local

variations (Mitchard *et al.* 2013, 2014). Brazil revised upwards the GHG emissions from 2002 to 2005 - as estimated in the 2nd National Inventory (published in 2010) - after completing the 3rd Inventory and made these changes public in the 3rd National Communication to the UNFCCC.

We recognize that much is still to be done for protection in Brazil and sound science is a crucial component. Richards *et al.* paper, however, is far from being a good contribution to this.

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