

Gap Fraction for Detection and Mapping of Canopy Openings in Undisturbed and Selectively Logged Forests

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1. Introduction

Tree mortality in tropical forests often leads to canopy openings gaps that are critical to regeneration and the dynamics of tropical forests. If measures of canopy gaps could be collected using remote sensing, then tropical forest dynamics could be investigated at the regional scale. We ask whether it is possible to detect canopy gaps using ground gathered remotely sensed data and whether there is a relation between forest disturbance age and canopy opening?

2. Methods

We collected an intensive set of gap fraction canopy measurements in the Tapaj s National Forest, Par  (Figure 1a). Gap fractions were measured using a Licor LAI-2000 instrument in 10 plots with dimensions of 50 m x 200 m in areas with different forest disturbance ages (forests logged in 1997, 1999, 2000, 2001, 2002 and 2003) and undisturbed forest (control plots) (Figure 1 b and c). For each one of these treatments, one or two plots were installed. All plots were subdivided in 10 m x 10 m grids with pipes marking corner points. Gap fraction data was collected for each of these grid points (126 measurements per plot).

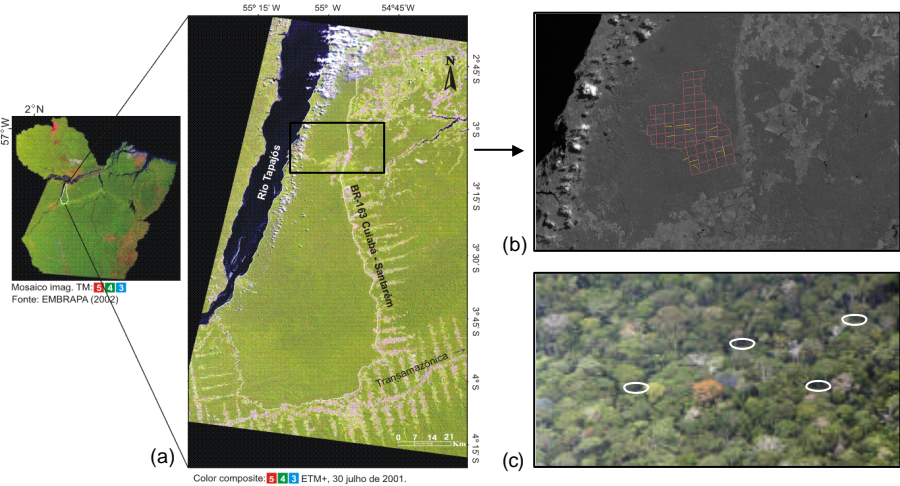


Figure 1. Tapaj s Nat. Forest (a), studied plots (b) and some gaps observed in the field (c).

3. Results

A geostatistical analysis showed that gaps < 200 m² could be detected and differentiated from medium (200 – 400 m²) and large (400 m²) gaps (Figure 2 and 3).

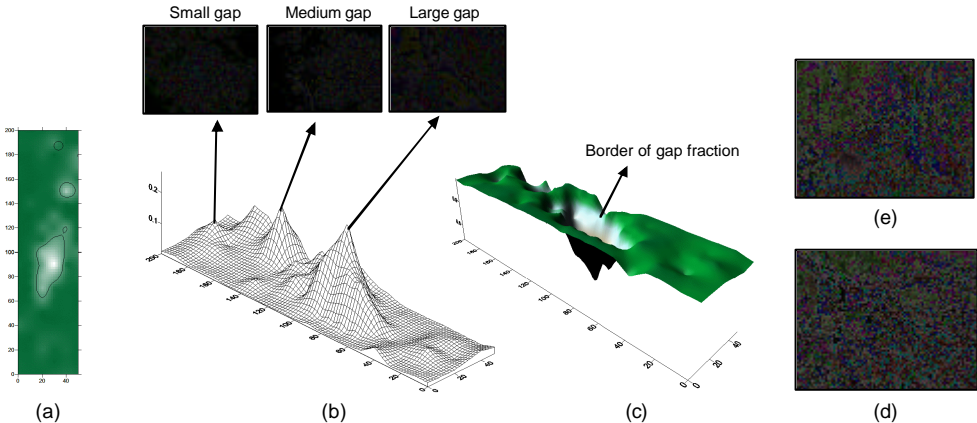


Figure 2. Surface of gap fraction canopy used for detection of gaps (a), 3-D graphic of gap fraction canopy showing gaps in different sizes (b), 3-D graphic of gap fraction canopy inverted (c), picture of a fallen tree branch that created a medium gap (d) and picture of fallen dominant tree that caused a large gap (e).

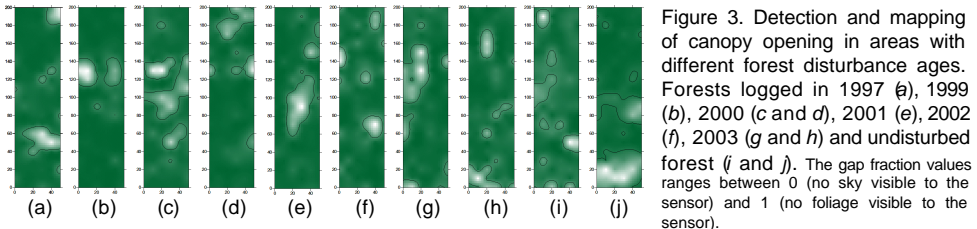


Figure 3. Detection and mapping of canopy opening in areas with different forest disturbance ages. Forests logged in 1997 (a), 1999 (b), 2000 (c and d), 2001 (e), 2002 (f), 2003 (g and h) and undisturbed forest (i and j). The gap fraction values ranges between 0 (no sky visible to the sensor) and 1 (no foliage visible to the sensor).

4. Conclusion

A preliminary analysis indicated that after at least three years of forest regeneration pos-logging, there was no detectable difference in gap fraction canopy between the logged areas and the undisturbed forest.