Biomass burning in Brazil: from the continental to the plot scale.

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The emission of acid precursors and thus of the humid deposition acidification occurs in some regions of the Brazilian territory (Forti et al., 2001); however the extent of its effect is limited, not being an environmental concern at national level. A serious environmental problem that the country has been facing derives from the practices of slash-and-burn of the forests, especially in the south of the Amazon region. Fire is also used to prepare sugar-cane plantations for manual harvest or for easy mobilization of major nutrients to renew pastures.

The fire monitoring system of Brazil, which uses satellite images on real-time, may detect on a single image over 6,000 distinct fires in the Amazon region. Totaled over the year, the figure for the country in 2004 was about 235,000 fires on NOAA-12 images, of which 165,000 in the Brazilian Amazon states that accounted for 70% of the cases. Using all images from the many satellites available, these figures are increased by a factor of five to ten, presenting a very concerning picture of the uncontrolled use of fire in the vegetation of the country. No estimates of the surface burned exist so far, but as in many other tropical countries one may guess that some 20 to 30% of the areas of the country with human presence burn every year, in an extent that will vary depending on climatic, economic and government enforcement policies. Besides the damage to natural ecosystem areas other consequences of wide-spread burning practices include significant emissions of CO and CO_2, fluxes of nutrient in the surface of burned regions, atmosphere visibility problems due to airborne particles, and serious health problems for the regional population.

Detailed studies regarding the slash-and-burn of forests in the scale of hectares showed that due to the characteristics of biomass burning techniques utilized in the process of forest clearing the biomass consumption is quite variable. For instance, a clearing area of 4 ha with a curing period of 15 months presented a burned fraction of 61.5% in mass (Carvalho et al., 2001). Based on these studies the authors estimated that for a biomass consumption of 50%, the expected carbon release to the atmosphere for the Brazilian Amazon region was ~69Mg.ha^{-1}. Considering the input of solutes to the top soil horizons, a concentration peak develops soon after the slash-and-burn of the forest, with values up to 60 times larger than those observed in natural control forest areas. Two years after the disturbance these peaks of nutrient decays to values lower than the ones found in a natural forest controled area soil. This happens because the burned area, which is surrounded by forest, is quickly re-colonized with re-growth of secondary vegetation. An intense leaching of nutrients through the soil profile occurs within the first months after the slash-and-burn of the forest. However, this process is attenuated with time. In two years the chemical content of the soil water reaches values equivalent to the ones observed in the soil water of control natural forest soil.

Deforestation in the Brazilian Amazon region has increased since 1997, and for the period of 2001-03 the figures reached about 23,000 km^2.yr^{-1}. Such values don't include conversion of savannas in the region, which have been eliminated even at a faster pace. For this area, the expected input of nutrient for an equivalent area of natural forest is 7.36 10^3Tg.ha^{-1} and 1.13 10^6Tg.ha^{-1}, for $NH4^+$-N and NO_3^- -N, respectively. However during the following period of conversion of this area to pasture and crop fields the estimated inputs are 1.87 10^6Tg.ha^{-1} and 2.44 10^7Tg.ha^{-1}, for $NH4^+$-N and NO_3^- - N, respectively.

References

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