BIOMASS IN THE BRAZILIAN AMAZON

Its Role in Climate Change

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Biomass in the Brazilian Amazon is a significant source of greenhouse gas emissions today, and potentially a much large source in the future. Land use change in Brazil's 5 X 106 km2 Legal Amazon Region is replacing high-biomass forests with a landscape of much lower average biomass. The replacement landscape includes areas of cattle pasture, agriculture, secondary forest and hydroelectric reservoirs. Most deforested land in Brazilian Amazonia becomes cattle pasture, after which it degrades and may be abandoned for periods to secondary forest. Virtually all the difference in carbon stock between the forest and the replacement landscape represents carbon that is released to the atmosphere, mostly as carbon dioxide (CO_2). The timing and the form of the biomass carbon releases, and timing of uptakes from secondary forest regrowth, affect the global warming impact of these land use changes.

In addition to CO_2, trace gases such as carbon monoxide (CO), methane (CH_4), nitrous oxide (N_2O) are released both from original forest biomass on conversion to other uses and from biomass transformations other than the initial deforestation. The burning of secondary forests and pastures is a net source of greenhouse gases other than CO_2, (the CO_2 portion of the emission from this activity is reabsorbed in the biomass as the secondary forest stands and pastures regrow). A small amount of carbon is removed from the cycle through conversion to soil charcoal. Termites, which consume some of the unburned biomass that decays after the initial clearing, make only a very small contribution to atmospheric methane. Other sources of greenhouse gas emissions include decay of slash from logging and the decay and combustion of wood products derived from the forest harvest. Regrowth of selectively-harvested forests offsets some of the logging emissions. Emissions also result from release of soil carbon in areas from which the forest biomass has been removed, as well as changes in soil fluxes of CH_4 after conversion of forest to pasture. Recent evidence also indicate that carbon may be released from biomass degradation over wide areas of "undisturbed" forest, possibly as a result of climatic changes causing increased tree mortality due to more severe droughts.

All the above sources, with the exception of possible degradation in "undisturbed" forest, are included in the present calculations (*). These indicate that in 1990, Brazil's Legal Amazon was a net source of 1067 X 10^6 t of CO_2 gas, 1.7 X 10^6 t of CH_4, 27.3 X 10^6 t of CO, and 0.14 X 10^6 t of N_2O. The direct effects of only this annual balance of emissions

are equivalent to 296 X 10^6 t of carbon in the form of CO_2 (using IPCC 1992 global warming potentials, undiscounted over a 100-year time horizon). Alternative indices proposed by this author indicate even greater impact.

The net committed emissions from the 13.8 X 10^3 km^2 of deforestation that occurred in 1990 (i.e., the prompt and committed emissions from converting this area to the equilibrium landscape implied by projection of current land use change patterns) are 898 X 10^6 t of CO_2 gas, 2.8 X 10^6 t of CH_4, 24.7 X 10^6t t of CO, and 0.46 X 10^6 t of N_2O. These emissions are equivalent to 253 X 10^6 t of carbon in the form of CO_2 (using the same IPCC 1992 equivalent for direct effects). The annual balance is higher than the net committed emissions because deforestation was occurring at a faster rate in the years preceding 1990, therefore resulting in inherited emissions from biomass felled prior to 1990 that exceed the committed emissions from the smaller area felled in 1990.

Brazil's official estimates of Amazonian emissions have omitted the effect of biomass that is not burned in the initial deforestation event. The emission estimates given above are therefore almost triple the official ones.

Accumulation of carbon in biomass, principally in wood from silvicultural plantations, is one of the response options available for combatting the greenhouse effect. Brazil has been a major proponent of this option, carbon absorption being the rationale for 20 million ha FLORAM proposal (mostly outside Amazonia), a 1 million ha plantation now under development along the Carajas Railway in eastern Amazonia, and Brazil's proposed global warming responses funded by the Global Environment Facility (GEF). While plantations have a role to play in combatting global warming, the tremendous emissions from deforestation in Amazonia combined with the meager benefits that this activity brings to Brazilian society indicate that slowing the loss of biomass carbon stocks in native forests should be given much higher priority.

(*) Subject to Revision

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