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Response to Nasi. 2005. “Potential Methodological Flaw in the Examination of the Effects of Logging”

Accelerating Deforestation in the Congo Basin Can Pose Climate Risks

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In Baidya Roy et al. (2005), we found that extensive logging in the recently opened timber concessions of Gabon and the Republic of Congo may affect the meteorology of adjacent protected areas. Nasi (2005) raised concerns about two aspects of our analysis: first, that post-logging forests convert not to grassland, but to secondary forest, and second, that our assumption of total forest loss in concessions does not reflect the selective nature of logging as currently practiced in the region.

We assumed a future scenario in which timber concessions in Gabon and the Republic of Congo are completely deforested and compared it with the present situation. This method, used widely in climate studies, is like comparing two “snapshots” of a dynamic process. The choice of snapshots is important: The landscape immediately after logging will look quite different a decade later. We considered different post-logging scenarios such as bare ground, grasses, shrubs, woodlands, and even a mosaic of all these. Despite an extensive search, we could not find adequate biophysical data for secondary growth with which to parameterize our model. Because of the absence of such data, we chose to illustrate the potential effects of deforestation using the extreme case of conversion to grassland. This choice may not be as extreme as it sounds because of the well-documented phenomenon of “arrested succession,” in which large, deep-rooted trees tend to regenerate poorly in logging gaps (Chapman et al. 1999, Hall et al. 2003). From a biophysical perspective, the shallow-rooted plants that do fill logging gaps often behave more like grassland than forest. It is also climatologically consistent because grasslands are abundant in this region and form the second most dominant land-cover type in the Republic of Congo.

On the second point, although it is true that logging does not currently cause total forest loss, deforestation rates are not constant, but change over time. The rapid destruction of the Amazonian rain forest during the 1980s and 1990s is a case in point. Deforestation rates fluctuate in response to many factors, including the supply of and demand for timber as well as human population growth. The timber supply is already tightening, because, with the depletion of stocks in West Africa and Southeast Asia, Central Africa and Amazonia are the only remaining major sources of tropical timber. Demand is also on the rise, particularly in the rapidly emerging economies of Asia. Consequently, exports of certain categories of industrial timber from Gabon and the Republic of Congo (FAO 2004) as well as the number of timber concessions (Collomb et al. 2002) are exploding. As logging infrastructure in these countries improves, transportation costs should decrease, thereby further expanding the range of timber species that are profitable to exploit and increasing the intensity of logging.

Of equal concern is conversion of the forest to agricultural land. By 2050, the populations of Gabon and the Republic of Congo are projected to increase by 87% and 186%, respectively (FAO 2004). Even more ominous are projected 56% and 187% increases for the much larger populations of neighboring Cameroon and the Democratic

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Republic of Congo, respectively. Deforestation rates at local hotspots in these neighbors are already catastrophic, at times higher than 1%, compared to 0.36% for central Africa as a whole, 0.71% for southeastern Asia, and 0.33% for Latin America (Achard et al. 2002a, b). This is actually a conservative estimate because Achard et al. (2002a) do not include the effect of selective logging in their study. This population explosion is already spilling over into Gabon and Congo, where it promises to further accelerate deforestation rates. What's more, declining oil stocks in Gabon and Congo are likely to produce both an intensified focus on timber exploitation as a source of foreign exchange and increased land clearance by logging employees, unemployed petroleum workers, and their dependents.

Finally, even if deforestation does not soon approach the rate and scale assumed in our models, it is well known that deforestation does not have to be complete for it to affect climate. For example, the regional convection, cloud, and precipitation regimes in Rondônia have changed significantly in response to only about a 17% loss of forest cover (Baidya Roy and Avissar 2002, Chagnon et al. 2004). Additionally, climatic effects are determined not just by the total amount of deforestation, but also by its spatial structure. Mesoscale circulations triggered by and anchored to the highly organized "fishbone" pattern of deforestation in Rondônia are responsible for such strong impacts (Baidya Roy and Avissar 2002). In particular, forest fragmentation creates edges that both influence current hydrometeorology and magnify susceptibility to desiccation, fire, and windthrow. Even though logging in Gabon is selective, logging gap sizes are large enough to allow substantial wind and light influx because the species that dominates the market (Aucoumea klaineana) occurs in clumps. Furthermore, selective logging requires increased forest penetration via logging roads that are very efficient in creating edges. Consequently, logging in Gabon and Congo probably has an impact far beyond that implied by the modest average removal rate of only one marketable stem per hectare cited by Nasi (2005).

Is logging now affecting the climate of protected areas in Gabon and the Republic of Congo? We do not have adequate data to answer that question. Will it affect the climate in the future? With some advances in modeling techniques, we could do experiments that might provide a more conclusive answer. Because predicting human activity is difficult, a thorough study of possible climatic impacts of logging should include a wide range of future scenarios. However, making accurate climatological forecasts was not the aim of our paper. Rather, our objective was to direct the attention of conservationists and regional managers to the fact that the impacts of deforestation are not localized and protected areas are vulnerable to adverse effects from outside their boundaries.

Responses to this article can be read online at:
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