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Response

Silveira is certainly correct in emphasizing that Brazilian society is more open and democratic than in the past, and that the Avança Brasil program includes many provisions (such as construction of new schools, hospitals, and low-income housing) that would improve the lives of Amazonian residents. According to our estimates, however, about half of the total investments of Avança Brasil (over \$20 billion) would be used for construction of major highways and infrastructure projects that are likely to have serious, negative impacts on Amazonian forests (1). Many of these megaprojects are mainly designed to support corporate soybean, logging, and cattle-ranching industries that tend to benefit major landowners and the wealthy, but have limited benefits for the poor (2). It was these projects on which our article focused.

Silveira suggests that there have been fundamental changes in Brazil that would substantially reduce the impacts of new highways, roads, and infrastructure projects on Amazon deforestation. In our view, little evidence supports this claim. Although there have been laudable improvements in Brazilian environmental legislation and public awareness, deforestation rates are still alarmingly high (3), and illegal logging and forest burning are rampant (4). In the past, highways and roads have dramatically increased deforestation, logging, hunting, and other degrading activities (5, 6), and this situation has not changed fundamentally. It strikes us as naïve to suggest that the Amazon basin could be crisscrossed by dozens of new highways and infrastructure projects and yet there would be little effect on forest destruction.

Silveira says that Avança Brasil will not create new highways, but this is misleading. About 7500 kilometers of existing roads will be paved (1). Paved highways greatly increase year-round accessibility to forests and urban markets and often cause sharp increases in forest exploitation. They also tend to generate extensive networks of secondary roads (5). Hence, the "footprint" of forest destruction and degradation near highways is typically far greater than that of unpaved roads.

Finally, Silveira is correct in suggesting that Brazil has good environmental licensing procedures--on paper--but the implementation of these procedures has frequently been poor (7). Public hearings, for example, have rarely had much effect on the proposed projects, and many of the Amazonian experts to whom Silveira refers were employed by construction or consulting firms that tend to benefit directly from development (8). Until just recently, key agencies such as the Ministry of Environment have been virtually excluded from the planning process.

Our concern is that--given already enormous investments in resources and effort--the Avança Brasil program is becoming an almost unstoppable

juggernaut. Environmental impact studies are slated to occur only during the final stages of planning--at which point individual projects have often gained enormous momentum. These studies rarely consider the indirect impacts of large-scale projects on forests (such as increased immigration and forest colonization), and their recommended mitigation measures are seldom adequate. Indeed, except for efforts such as those of the National Institute for Amazonian Research (5) and of the Instituto de Pesquisa Ambiental da Amazônia (6), there has so far been no systematic attempt to predict the impacts of the massive projects on Amazon forest loss and degradation. Moreover, land-use planning in the Amazon is fraught with problems; it is a hodgepodge of individual zonings by the nine Amazonian states, many strongly influenced by local resource-users and pressure groups (9).

In our view, the megaprojects of *Avança Brasil* present precisely the wrong vision for the Amazon. At present, only a small fraction of the Brazilian Amazon is fully protected (<4%, with a future target of 10%), and many existing reserves would become increasingly vulnerable to predatory logging, wildfires, and overhunting as new roads and highways draw near (10). Opening up vast new frontiers for colonization would encourage further immigration into a region that already is experiencing exponential population growth. It would also help maintain cheap land prices, reducing incentives for landowners to develop more efficient agricultural methods based on perennial crops rather than fire-based ranching and slash-and-burn farming. The megaprojects are also predicted to cause unprecedented forest fragmentation, and the resulting forest remnants will be much more vulnerable than intact forests to degrading activities in the future.

William F. Laurance,*
 Smithsonian Tropical Research Institute,
 Apartado 2072,
 Balboa, Panamá
 Biological Dynamics of Forest Fragments Project

Philip M. Fearnside,
 Ecology Department,
 National Institute for Amazonian Research (INPA),
 C.P. 478,
 Manaus, AM 69011-970, Brazil;

Mark A. Cochrane,
 Basic Science and Remote Sensing Initiative,
 Michigan State University,
 East Lansing, MI 48823, USA;

Sammya D'Angelo,
 Biological Dynamics of Forest Fragments Project

Scott Bergen,

Department of Forest Science,
Oregon State University,
Corvallis, OR 97331, USA

Patricia Delamônica
Biological Dynamics of Forest Fragments Project

*To whom correspondence should be addressed.
E-mail: wfl@inpa.gov.br

References and Notes

1. W. F. Laurance, S. D'Angelo, A. Andrade, Science dEbate response to the Brazilian Embassy, "Re: The future of the Brazilian Amazon," available at <http://www.sciencemag.org/cgi/eletters/291/5503/438>
2. P. M. Fearnside, Environ. Conserv., in press; P. M. Fearnside, *Ambio* 22, 537 (1993).
3. Deforestation in Brazilian Amazonia (Instituto Nacional de Pesquisas Espaciais, San Jose dos Campos, Brazil, 2000).
4. W. F. Laurance, *Trends Ecol. Evol.* 13, 411 (1998).
5. ----- et al., *Science* 291, 438 (2001).
6. D. C. Nepstad et al., *Avança Brasil: Cenários Futuros para a Amazônia* (Instituto de Pesquisa Ambiental da Amazônia, Belém, Brazil, 2000).
7. P. M. Fearnside, R. I. Barbosa, *Environ. Manage.* 20, 631 (1996a); E. Eve, F. A. Arguelles, P. M. Fearnside, *Environ. Manage.* 26, 251 (2000).
8. P. M. Fearnside, R. I. Barbosa, *Environ. Manage.* 20, 615 (1996b).
9. *Um Rumo para a Amazônia* (O Estado de S. Paulo, São Paulo, Brazil, 3 February 2001).
10. L. V. Ferreira et al., *Áreas Protegidas ou Espaços Ameaçados* (World Wide Fund for Nature, Brasília, Brazil, 1999).