



THE WOODS HOLE RESEARCH CENTER

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The Amazon in 2050: Implementing the Law Could Save a Million Square Kilometers of Rainforest

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Economic and political forces are rapidly transforming the forests of the Amazon basin, precipitating one of the world's greatest environmental crises. Through an inter-disciplinary modeling project known as *Amazon Scenarios*, scientists at the Woods Hole Research Center, the Universidade Federal de Minas Gerais (Brazil), and the Instituto de Pesquisa Ambiental da Amazônia (Brazil), with colleagues at several other institutions, are simulating future trends in deforestation, forest fire, rivers, fauna, and climate, providing glimpses of plausible futures for this region. A study of deforestation responses to different policies will be published in the March 23, 2006, issue of *Nature*. It shows that simply implementing existing laws and proposed protected areas would spare the Amazon one million square kilometers of deforestation (one fifth of the entire forest area), avoiding 17 billion tons of carbon emissions to the atmosphere, the elimination of several forest formations, and the degradation of several major watersheds.

According to Britaldo Soares-Filho, the paper's lead author, "For the first time, we can examine how individual policies ranging from the paving of highways to the requirement for forest reserves on private properties will influence the future of the world's largest tropical forest. Our model shows that several unique forest ecosystems and entire watersheds will be badly degraded over the next 45 years if we don't rapidly increase our capacity to govern this dynamic region.

By developing the first empirically-based, policy sensitive model of Amazon deforestation to assess forest losses within major watersheds, eco-regions, vegetation types, and the geographic ranges of 382 mammal species, two extreme scenarios were developed, encompassing the likely range of future trajectories of deforestation through 2050. The first of the two futures discussed is a business-as-usual scenario in which the forces of destruction continue unopposed. Specifically, this scenario (abbreviated as *BAU*) assumes that the network of parks and other protected areas remains at 31 percent of the region's forests, that up to 40 percent of these protected areas are subject to deforestation, and that nearly 85 percent outside of protected areas are subject to deforestation. This translates to a loss of nearly 2 million km², leaving only 56 percent of the original forest area. The second is a frontier governance scenario in which society and government, together with the scientific and environmental communities, work to control frontier expansion and insure the ecological integrity of the basin. Within the governance scenario, protected areas (parks and reserves) are expanded to 41 percent of the region's forests (as currently planned by the Brazilian government), protected areas are fully enforced, and only 50 percent of the forests outside of protected areas are subject to deforestation. Furthermore, the deforestation rate, although rising initially due to road paving, declines over time, simulating the effects of emerging markets for carbon retain in native forests. Under this scenario, 73 percent of the original forest would remain in 2050.

The future expansion of deforestation will not affect all forests and watersheds equally. The dry forest formation of Mato Grosso will virtually disappear by the year 2050, and many watersheds (including the Xingú and Tocantins Rivers) will lose most of the forest cover in their catchments, increasing flooding and sedimentation. The region of greatest loss of mammals will be in the eastern Amazon, where expanding agriculture will overrun many species with small ranges. Of the major highways planned for paving, the Manaus-Porto Velho highway will be the most damaging in terms of new deforestation.



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The challenge of Amazon conservation is to find ways to redirect political and economic forces towards this second, more sustainable future scenario, conserving most of the forest for centuries to come. According to co-author Daniel Nepstad, "By building a policy-sensitive 'crystal ball' for the Amazon, we are able to identify the most important policy levers for reconciling economic development with conservation. We know that parks are important but, alone, insufficient components of a strategy for 'comprehensive conservation' of the Amazon. Private landholder conservationists are essential to the future of the Amazon region."

In subsequent phases of the Amazon Scenarios project, new economic models that determine the trajectory of logging, cattle ranching, and soybean farming are linked with ecological models of forests and climate models to develop integrated simulations of the region's future.

Britaldo Soares-Filho is a geographer and modeler. He has studied Amazon land-use patterns for the last 12 years, developing computer programs that simulate land-use change. He is a professor at the Universidade Federal de Minas Gerais, where his teaching interests include ecosystem dynamics and modeling and digital cartography, and director of the Universidade's Center for Remote Sensing. He is also a Visiting Scientist at the Woods Hole Research Center. He earned his doctorate in Spatial Analysis from the Universidade de São Paulo in 1998. He also holds a master's in remote sensing from the Instituto Nacional de Pesquisas Espaciais.

A tropical forest ecologist, Nepstad has studied Amazon forests and strategies for their conservation for the last 21 years. His research includes forest fires and "savannization", the analysis of public policies to conserve the Amazon's natural resources, the prediction of future trends of Amazon forests and people, and the environmental certification of the region's cattle ranchers and soy farmers. Based in Belém, Brazil, he leads the Center's Amazon program. In 1995, he co-founded the Amazon Institute of Environmental Studies (**Instituto de Pesquisa Ambiental da Amazônia**), which is now the largest independent research institution in the Amazon region. He has published more than 75 scientific articles and books on the Amazon. In 1994, he was awarded a Pew Scholars Fellowship in Conservation.

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