



## **The Fate of the Amazon Forest in the 21st Century (Alexander von Humboldt Medal Lecture)**

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The stability of the Amazon forest-climate equilibrium is being perturbed by a number of human drivers of change (e.g., deforestation, global warming, forest fires, higher CO<sub>2</sub> concentrations and increased frequency of droughts and floods). Quantitative assessments for the maintenance of the tropical forest indicate that “tipping points” may exist for total deforested area (>30% to 40%) and for global warming-induced temperature increase in the Amazon ( $\Delta T > 3^{\circ}\text{C}$  to  $4^{\circ}\text{C}$ ). The likelihood of exceeding a tipping point can be greatly exacerbated by increases in forest fires and droughts, but proper quantification of those effects is still lacking. Forest resilience can be significantly increased if CO<sub>2</sub> ‘fertilization’ effect is proven to be taking place for tropical forests, but it can be offset by continued increases in temperature, rainfall seasonality and forest fires. Currently, about 18% of the Amazon forest has been deforested and surface temperatures have risen close to  $0.8^{\circ}\text{C}$  during the last 100 years, consistent with the global warming signal for land areas. Deforestation rates in the Brazilian Amazon have declined considerably over the last 5 years from a high value of 27,000 km<sup>2</sup> in 2004 to 7,000 km<sup>2</sup> in 2009. However, even if Amazonian countries succeed in reducing deforestation rates to nearly zero, the forest is under the continued threat from global warming. On the other hand, if the goals of the UNFCCC’s COP15 resolution of limiting global warming to less than  $2^{\circ}\text{C}$  are met, projections put that figure between  $2.5^{\circ}\text{C}$  and  $3^{\circ}\text{C}$  for the Amazon, which is not too far from where the risk of ‘savannization’ or forest die-back could become significant. This presentation will describe recent calculations on establishing quantitative thresholds for the Amazon forest, including discussion on uncertainties about ‘tipping points’, and will draw conclusions on the prospects for long-term maintenance of the tropical forest in the Amazon.