Geophysical Research Abstracts
Vol. 13, EGU2011-2498, 2011
EGU General Assembly 2011

Is the planet desavannanising? Evidence for rainforest encroachment and tropical vegetation thickening from three continents

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The low-latitude tropics are dominated by large areas of both forests and the more open savanna vegetation type characterised by a mixture of trees and grasses. The highly dynamic nature of the physical interface between these two biomes, and thus the variability of their spatial extent, has been known for over a century. Nevertheless, our understanding of the magnitude and direction of change in the extent of these spatially extensive tropical ecosystems at a range of time scales remains limited (1, 2). This is particularly evident in so-called Zones of Transition (ZOT), where tropical forest and savanna co-exist in close proximity and where their presence/absence cannot be predicted from climate alone.

Here, we detail accumulating evidence for forest encroachment as opposed to savanna expansion currently occurring on all tropical continents. In some cases this is taking place despite increasing human population pressures and irrespective of land-use changes - a process contrary to what most global vegetation models currently predict (3).

According to the studies reviewed here, forest invades savanna in South America, Australia and Sub-Saharan Africa at an average rate of 50 m yr-1 to 100 m yr-1. Rates of encroachment are locally highly variable ranging from 0.2 m yr-1 to 362 m yr-1 with canopy cover increases from 0.09% yr-1 to 2.34% yr-1. This global trend of forest expanding into savannas experiencing widely different land-use practices, fire regimes, grazing histories and edaphic conditions points towards some global driver(s) of encroachment. Paleoecological and contemporary data suggest that a fertilisation effect due to the prime suspect - elevated atmospheric CO_2 - might indeed be important in driving this response. But as yet, the triggers of this shift in vegetation remain insufficiently understood and certainly at variance with predictions from global vegetation models. This is especially the case when the rates of transitions at some individual sites are considered.

References

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