Geophysical Research Abstracts
Vol. 13, EGU2011-5566, 2011
EGU General Assembly 2011

Temperature variation and biomass

Markku Larjavaara (1) and Helene C. Muller-Landau (2)

(1) Smithsonian Tropical Research Institute, Panama (markku.larjavaara@helsinki.fi), (2) Smithsonian Tropical Research Institute, Panama (hmullerlandau@gmail.com)

Globally, forest ecosystems vary greatly in biomass. This is in part explained by anthropogenic and natural disturbance regimes, but even in relatively disturbance free ecosystems, biomass variability is large. Shrublands represent one extreme of low biomass, while the highest biomass is measured in western North America, south-eastern Australia and southern Chile. Perhaps surprisingly, the mechanisms causing these global patterns are not well understood. It has been reported that the highest biomass is a result of cool temperatures and abundance of precipitation. However, large areas of the highest biomass forests experience a summer drought. Further large areas in eastern parts of North America and Eurasia have similar annual precipitation and temperature but have most of the annual rainfall in the summer months, when water is most needed. Therefore it could be expected that a more favourable rainfall distribution would increase productivity and old-growth forest biomass. We hypothesize that intra-annual temperature variation is a significant driver of old-growth forest biomass in temperate climates. If this variation is large in an area whose annual average temperature favours high biomass observed biomass patterns will be considerably lower because the heat waves of summer cause autotrophic respiration to increase dramatically and cold spells in winter make photosynthesis impossible. We plotted biomass data from 141 plots around the world based on two datasets. AGB varied strongly with average annual temperature and annual temperature range. Tropical plots with high temperatures and low temperature variation have intermediate AGB) while boreal plots with low average temperatures and high temperature variation have low AGB. The 10 plots with the highest AGB all occur in average annual temperature of 8°C – 15°C and with annual temperature range of less than 15°C. Patterns are thus overall consistent with our hypothesis. In other work, we are further exploring the mechanistic basis for this pattern (Larjavaara & Muller-Landau, in preparation). Forest biomass and carbon stocks have recently been the focus of wide interest as deforestation releases forest carbon stocks into atmosphere influencing the greenhouse effect. Further, it is hypothesized that global change is altering carbon stocks even in undisturbed natural forests, potentially causing positive or negative feedbacks on the greenhouse effect. This is hotly debated in the recent scientific literature. We believe that understanding the current global biomass variation is key to understanding potential changes due to changing climate.