Geophysical Research Abstracts
Vol. 18, EGU2016-3553, 2016
EGU General Assembly 2016

Methane Emissions from Upland Forests

Patrick Megonigal (1), Scott Pitz (1,2), and Zhi-Ping Wang (3)

(1) Smithsonian Environmental Research Center, Edgewater, MD, USA, (2) Department of Earth and Planetary Sciences, Johns Hopkins University, Baltimore, MD, USA, (3) State Key Laboratory of Vegetiation and Environmental Change, Institute of Botany, Chinese Academy of Sciences, Beijing, China

Global budgets ascribe 4-10% of atmospheric methane sinks to upland soils and assume that soils are the sole surface for methane exchange between upland forests and the atmosphere. The dogma that upland forests are uniformly atmospheric methane sinks was challenged a decade ago by the discovery of abiotic methane production from plant tissue. Subsequently a variety of relatively cryptic microbial and non-microbial methane sources have been proposed that have the potential to emit methane in upland forests. Despite the accumulating evidence of potential methane sources, there are few data demonstrating actual emissions of methane from a plant surface in an upland forest. We report direct observations of methane emissions from upland tree stems in two temperate forests. Stem methane emissions were observed from several tree species that dominate a forest located on the mid-Atlantic coast of North America (Maryland, USA). Stem emissions occurred throughout the growing season while soils adjacent to the trees simultaneously consumed methane. Scaling fluxes by stem surface area suggested the forest was a net methane source during a wet period in June, and that stem emissions offset 5% of the soil methane sink on an annual basis. High frequency measurements revealed diurnal cycles in stem methane emission rates, pointing to soils as the methane source and transpiration as the most likely pathway for gas transport. Similar observations were made in an upland forest in Beijing, China. However, in this case the evidence suggested the methane was not produced in soils, but in the heartwood by microbial or non-microbial processes. These data challenge the concept that forests are uniform sinks of methane, and suggest that upland forests are smaller methane sinks than previously estimated due to stem emissions. Tree emissions may be particularly important in upland tropical forests characterized by high rainfall and transpiration.