

Terra Preta – opportunities for meeting global challenges of soil degradation and climate change

Johannes Lehmann¹, Marco Rondon², Julie Major¹, Joseph Kimetu¹, Chih-Hsin Cheng¹, Lucerina Trujillo³, Danny Day⁴, Biqing Liang¹, John Gaunt⁵, Saran Sohi⁶, Dawit Solomon¹, Flavio Luizão³

¹Cornell University, USA; ²CIAT-TSBF, Colombia; ³INPA, Brazil; ⁴Eprida, USA; ⁵GY Associates, UK; ⁶Rothamsted Research, UK.

Increasing global demands for food and fiber cannot be met by expanding agricultural lands without causing severe degradation of natural resources, significant loss of biodiversity, and critical changes in world climate. The intensification of agricultural activities and sustainable utilization of existing agricultural landscapes are the only solution to this challenge. One important lesson learned from recent research on Amazonian Dark Earths is the importance of biomass-derived black carbon for the surprisingly sustainable high fertility and high organic matter contents of these soils locally known as Terra Preta de Índio. Applications of biomass-derived black carbon (called bio-char) to soil has shown to considerably improve crop yields and maintain more stable soil organic matter over longer periods of time than commonly feasible by organic matter additions such as mulches and manures. Degraded soils can be restored and losses of nutrients can be reduced as seen from experimentation at various sites in South America and Eastern Africa. Key to the positive effects of bio-char applications on soil biogeochemistry are their chemical structure and surface properties as well as changes to rates and mechanisms of soil organic matter turnover. Long residence times of bio-char carbon in soils and observed net decreases of emissions of methane and nitrous oxide from soils make bio-char a powerful tool for long-term mitigation of climate change. Important opportunities are the combination of bio-char soil management with energy production through emergent technologies such as low-temperature pyrolysis, with fuel economies in developing countries and with existing landuse practices such as shifting cultivation.