

# Application of Oil Palm Empty Fruit Bunch: Effects on Soil Biota and Functions A case study in Sumatra, Indonesia

Hsiao-Hang Tao<sup>1\*</sup>, Jake L. Snaddon<sup>2</sup>, Eleanor M. Slade<sup>1,3</sup>, Ludovic Henneron<sup>4</sup>, Jean-Pierre Caliman<sup>5</sup>, Kathy J. Willis<sup>1,6,7</sup>

<sup>1</sup>Department of Zoology, University of Oxford, Tinbergen Building, South Parks Road, Oxford OX1 3PS, United Kingdom

<sup>2</sup>Centre for Biological Sciences, University of Southampton, Life Sciences Building, Highfield Campus, Southampton SO17 1BJ, United Kingdom

<sup>3</sup>Lancaster Environment Centre, Lancaster University, LEC Building, Bailrigg, Lancaster LA1 4YQ, United Kingdom

<sup>4</sup>National Institute of Agricultural Research (INRA), Paris, France

<sup>5</sup>SMART Research Institute (SMARTRI), Pt SMART, Jalan Teuku Umar 19, 28112 Pekanbaru, Riau, Indonesia

<sup>6</sup>Royal Botanical Gardens, Kew, Richmond, Surrey, TW9 3AB, United Kingdom

<sup>7</sup>Department of Biology, University of Bergen, PO Box 7803, Bergen 5020, Norway

\* Corresponding author: Hsiao-Hang Tao, [hsiaohang.tao@gmail.com](mailto:hsiaohang.tao@gmail.com)

## ABSTRACT

Oil palm (*Elaeis guineensis*) is an important tropical crop which provides one-fifth of the world's vegetable oil, yet its rapid expansion can negatively influence the soil ecosystem. Identifying suitable agronomic management such as crop residue application is important for the sustainable development of oil palm. We examined the effects of adding empty fruit bunches (EFB), a major oil palm residue, on multiple soil abiotic properties, soil biota, and indicators of soil functions. We compared treatments of EFB applications with three application rates, and a chemical fertilizer treatment in a 15-year trial in Central Sumatra, Indonesia. EFB application increased pH and aggregate stability in 0–10 cm soils and decreased the soil bulk density. EFB application increased the abundance of soil detritivore mites, soil fauna feeding activity, and soil microbial activity. EFB application decreased the biomass of a dominant invasive earthworm species, *Pontoscolex corethrurus* (Müller, 1857). Results from structural equation modelling suggested that EFB directly affected soil biota and functions, rather than through altering soil abiotic properties. The effects of EFB application on most soil abiotic properties, soil biota and function indicators were independent of the application rate. Our results revealed that EFB application has a high potential to enhance soil biota and functions in oil palm plantations.

Note: this paper is accepted for publication in *Agriculture, Ecosystems and Environment* (2018).