**Session Proposal**

# Session Title

Rubber-based agroforestry ecosystems enhance soil enzyme activity but exacerbate microbial nutrient limitations

# Session Organizers

**Name:** Wenxian Xu, primary contact person;

Affiliation: Rubber Research Institute, Chinese Academy of Tropical Agricultural Sciences, Haikou 571101, China;

Email address: xuwenxian1023@126.com

**Name:** Yingying Zhang, Tahir Ashar, and Zhixiang Wu;

Affiliation: Rubber Research Institute, Chinese Academy of Tropical Agricultural Sciences, Haikou 571101, China;

**Name:** Wenjie Liu, Qiu Yang.

Affiliation: College of Ecology and Environment, Hainan University, Haikou 570228, China;

**Name:** Yumiao Cao, Changgeng Kuang.

Affiliation: School of Geography and Environmental Sciences, Hainan Normal University, Haikou 571158, China;

# Session Description

Agroforestry ecosystems are an efficient strategy for enhancing soil nutrient conditions and sustainable agricultural development. Soil extracellular enzymes (EEAs) are important drivers of biogeochemical processes. However, changes in EEAs and chemometrics in rubber-based agroforestry systems and their mechanisms of action are still not fully understood. Distribution of EEAs, enzymatic stoichiometry, and microbial nutrient limitation of rubber plantations under seven planting patterns (RM, rubber monoculture; AOM, *Hevea brasiliensis-Alpinia oxyphylla Miq*; PAR, *Hevea brasiliensis-Pandanus amaryllifolius Roxb*; AKH, *Hevea brasiliensis-Alpinia katsumadai Hayata*; CAA, *Hevea brasiliensis-Coffea Arabica*; CCA, *Hevea brasiliensis-Cinnamomum cassia (L.) D. Don*, and TCA, *Hevea brasiliensis-Theobroma Cacao*) were analyzed to investigate microbial metabolic limitations and identify primary determinants. Compared with rubber monocultures, agroforestry ecosystems show increased carbon (C), nitrogen (N), and phosphorus (P)-acquiring enzyme activities. The ecoenzymatic stoichiometry model showed that all plantation patterns experienced C and N limitation. Compared to monocultures, agroforestry systems have intensified C and N limitations by reducing the vector angle and increasing the vector length. No P limitation was detected for any pattern. In agroforestry, progression from herbs to shrubs to trees through intercropping reduces soil microbial nutrient constraints due to litter and root biomass accumulation, thereby enhancing soil nutrient content and accessibility. As the soil depth increased, the microbial nutrient limitations became more pronounced. PLS-PM indicated nutrient ratios and soil total nutrient content were key factors influencing microbial C limitation (−0.46 and 0.40) and N limitation (−0.30 and −0.42). This study presented novel evidence regarding the constraints and drivers of soil microbial metabolism in rubber agroforestry systems. Considering the constraints of soil nutrients and microbial metabolism, intercropping of rubber trees with arboreal species is recommended over that of herbaceous species to better suit the soil environment of rubber plantation areas on Hainan Island.

# Format

Format: Oral presentations

# Proposed Speakers

Speaker: Wenxian Xu;

Affiliation: Rubber Research Institute, Chinese Academy of Tropical Agricultural Sciences, Haikou 571101, China;

Email address: [xuwenxian1023@126.com](mailto:xuwenxian1023@126.com);

Contribution: Dr. Xu is the principal author of this study and participated comprehensively in the experimental design, field trials, data analysis, and composition and revision of the manuscript.