ABS – SCHOLARSHIPS FOR EARLY CAREER RESEARCHERS OF COUNTERPARTS & STAKEHOLDERS

With begin of Phase 3, in 2020 and 2021, *EFForTS* extended 8 scholarships and awarded one new one. Two doctoral researchers completed their dissertations in December 2020 and October 2021:

- Rawati Panjaitan – December 2020 at IPB University: Diversity and Abundance of Butterflies (Lepidoptera:Papilionoidea) in Four Land Use in the Bukit Duabelas and Hutan Harapan Landscape, Jambi, Sumatera. Supervised by Purnama Hidayat and Damayanti Buchori, both counterparts of Z02.
- Winda Ika Susanti – March 2022 at the University of Göttingen: Soil Fauna in the Lowland Rainforest and Agricultural Systems of Sumatra: Changes in Community Composition and Trophic Structure with Focus on Collembola. Supervised by Stefan Scheu / UGoe & Rahayu Widyastuti / IPB University (Picture 1 c). [*Link*]

Research summary – Winda Ika Susanti

In 2019 I started to investigate the community composition and trophic position of Collembola in the *EFForTS* core sites. Collembola are among the most abundant arthropods inhabiting the belowground system sensitively responding to changes in vegetation and soil conditions. However, parameters which are more closely linked to ecosystem functioning, such as trophic niches, received little attention. I used stable isotope analysis (^{13}C and ^{15}N) to investigate changes in the trophic structure and use of food resources by Collembola in four land-use systems (rainforest, rubber agroforest, rubber (*Hevea brasiliansis*) and oil palm (*Elaeis guineensis*) monoculture plantations. Overall, the results suggest that rainforest conversion into plantation systems is associated with marked shifts in the structure of trophic niches in soil and litter Collembola with potential consequences for ecosystem functioning and food web stability. Across Collembola species $\Delta^{13}C$ values were highest in rainforest suggesting more pronounced processing of litter resources by microorganisms and consumption of these microorganisms by Collembola in this system. Lower $\Delta^{13}C$ values, but high $\Delta^{13}C$ variation in Collembola in oil palm plantations indicated that Collembola shifted towards herbivory and used more variable resources in this system. Small range in $\Delta^{15}N$ values in Collembola species in monoculture plantations in comparison to rainforest indicated that conversion of rainforest into plantations is associated with simplification in the trophic structure of Collembola communities (Fig. 1).

Further, I investigated the response of Collembola communities to the conversion of rainforest into rubber agroforestry ("jungle rubber"), rubber, and oil palm plantations. Samples from litter and soil layer taken in 2013 and 2016 were used and Collembola data were combined with data on environmental factors (litter C/N ratio, pH, water content, composition of microbial community and predator abundance). Overall, land-use change negatively affected Collembola communities in the litter layer, but less in the soil layer. Pantropical genera of Collembola (i. e., *Isotomiella*, *Pseudosinella*, and *Folsomides*) dominat-

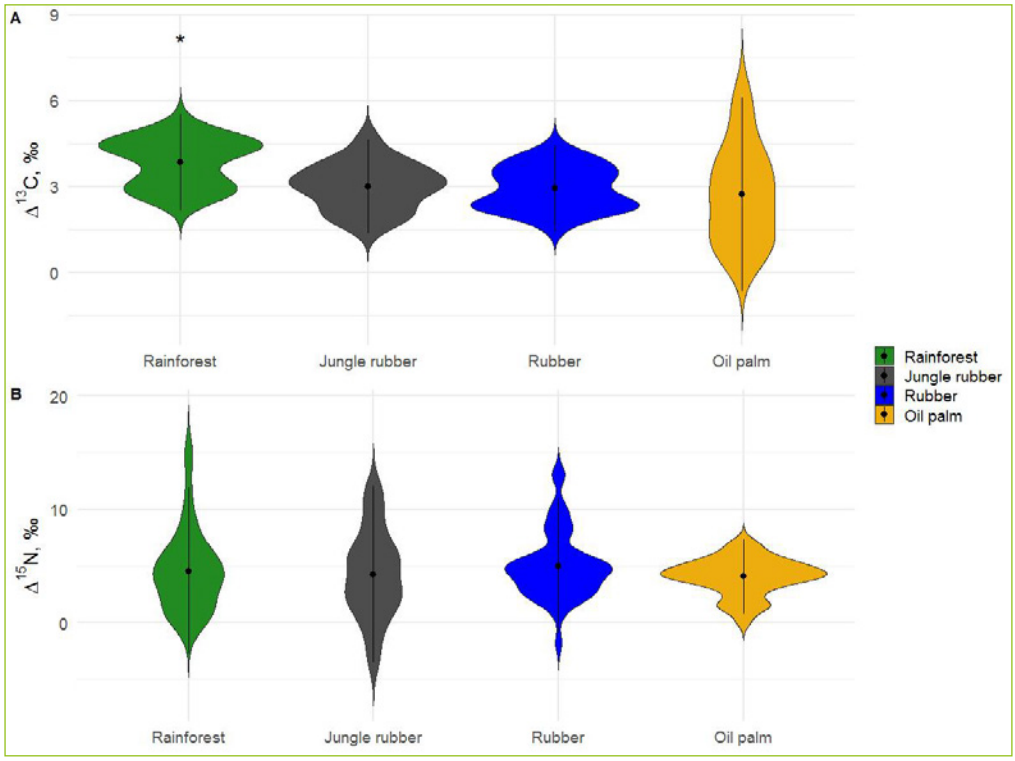

Figure 1. Variations in $\Delta^{13}C$ and $\Delta^{15}N$ values of Collembola among the studied land-use systems (rainforest, jungle rubber, rubber and oil palm plantations). Violin plots show frequency distribution of values (mirrored Kernel density estimation), all individual measurements are displayed together, independently of the taxonomic identity. *Average $\Delta^{13}C$ values in rainforest were significantly higher than in the other three land-use systems ($P < 0.05$).

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ed across land-use systems, reflecting their high environmental adaptability and/or efficient dispersal, calling for studies on their ecology and genetic diversity. The decline in species richness and density of litter-dwelling Collembola with the conversion of rainforest into plantation systems calls for management practices mitigating negative effects of the deterioration of the litter layer in rubber plantations, but even more in oil palm plantations (Fig. 2).

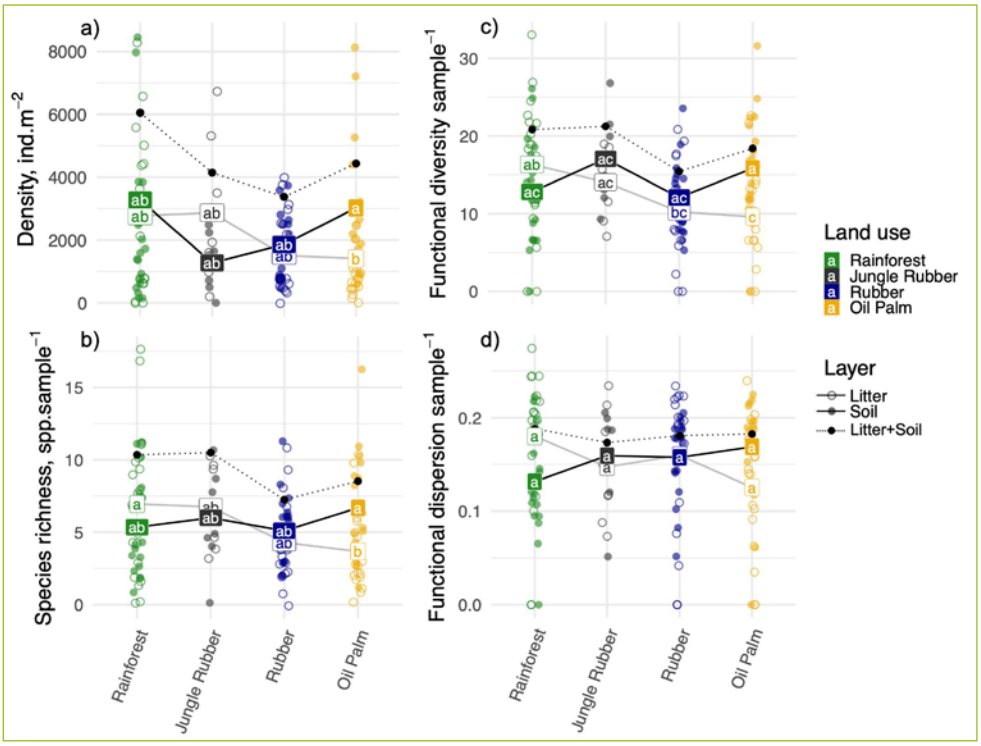

Figure 2. Density and species richness of Collembola in different land-use systems across sampling years. (a) Density of Collembola per square meter, (b) number of Collembola species per sample (256 cm^2), (c) functional diversity (FD) of Collembola communities per sample, and (d) functional dispersion (FDis) of Collembola communities per sample. Each soil core was divided into litter and soil layers (0-5 cm), and these layers were treated as replicates and presented as separate points in the figure (open points – litter, filled points – soil). Labels connected by solid lines show mean values for litter and soil separately (white labels – litter, black labels – soil). Mean values across layers and systems sharing the same letter are not significantly different for the given variable (Tukey contrasts). Black points connected with dotted lines show mean values for litter and soil combined (sum of density, newly calculated after combining layers for species richness, FD and FDis).

Publications:

Susanti, W. I., Widyastuti, R., Scheu, S., & Potapov, A. (2021). Trophic niche differentiation and utilisation of food resources in Collembola is altered by rainforest conversion to plantation systems. *PeerJ*, *9*, e10971.

Susanti, W. I., Bartels, T., Krashevska, V., Widyastuti, R., Deharveng, L., Scheu, S., & Potapov, A. (2021). Conversion of rainforest into oil palm and rubber plantations affects the functional composition of litter and soil Collembola. *Ecology and evolution*, *11*(15), 10686-10708.

Seminar and training:

1. Indonesian Collembola identification with collembologist Louis Deharveng and Anne Bedos in Muséum National d'Histoire Naturelle, France (January–February 2019)
2. Oral presentation at 10th International Seminar on Apterygota, Paris-France, 17th–21st June 2019
3. Seminar on Stable Isotope Analysis (KOSI- Goettingen University), February 2020

Pictures 1a–c. Winda at the Gänseliesel. In Göttingen, it is an old custom for graduates to go to the "Gänseliesel" in the city's market square after the graduation ceremony.