Name	Counterpart	Title
Purnama Hidayat	Z02	Monitoring arboreal arthropods communities across four different land-use systems

Background and Objectives

Tropical rainforest harbor much of the world's biodiversity, including arthropods. However, it is threatened by massive forest conversion to monoculture, particularly rubber and oil palm, over the last decade. In the present study, we compare the diversity of arboreal arthropods along different rainforest transformation system gradients, i.e., forest, jungle rubber, rubber, and oil palm plantation. The different land use systems represent the transition from natural habitat (forest) to extensively managed agriculture (jungle rubber) and intensively managed monoculture (rubber and oil palm plantation). This study is a follow-up research conducted since 2013 (Drescher *et al.* 2016). It is essential to conduct a long-term monitoring of arboreal arthropods diversity, which could be useful to monitor population dynamic of arboreal arthropod along land-use transformation gradients over times.

Methods

Sampling was conducted in four different land use types, i. e., forest, jungle rubber, rubber, and oil palm plantations in Harapan and Bukit Duabelas landscape. For each land use type, four plots were selected as replicates, giving a total of 32 plots. In addition, a total of 12 plots were established for riparian site of forest, rubber, and oil palm plantation. The arboreal arthropods were collected by canopy fogging (Drescher *et al.* 2016). Data analysis was performed using R v 4.0.3 (R Core Team 2020) and visualized using ggplot2 (Wickham 2016). The arboreal arthropod abundance between land use types was analyzed using glm by Gaussian family with the log link function. The same analyses were also conducted to compare canopy arthropod abundance between upland and riparian sites.

Results and Conclusion

In total, we collected 78,744 of arboreal arthropods specimens. Hymenoptera was the most abundant arthropod order found in this study with 16,628 individuals, followed by Collembola (14,311 individual), Coleoptera (9,628), and Diptera (8,010 individual) (Fig. 1). This study was in accordance with our expectation, since Hymenoptera was known to be one of the major insect order with its trait as social insect, the other beings Coleoptera, Diptera, and Lepidoptera (Goulet and Huber 1993).

Abundance of arboreal arthropod differed among land use types ($F_{40,43}$= 7.43; $P<0.01$). Surprisingly, the abundance was slightly higher in rubber jungle than forest and was highest compared to rubber and oil palm monocultures (Fig. 2). This result differs from 2013 results for many taxa, such as ants, butterflies, and parasitoid wasp, which were found highest in forest than other land use type (Grass *et al.* 2020). However, further in-depth analyses using the 2017 data in some specific taxa may produce the same result with the 2013 data, as some taxa respond differently to the occurrence of

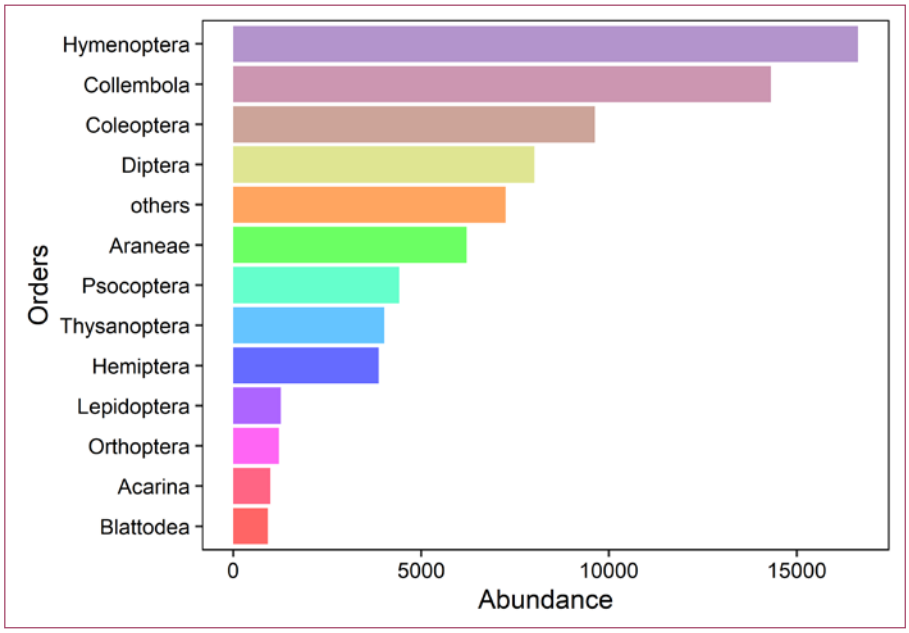

Figure 1. Canopy arthropod abundance which collected in four land use types

rainforest transformation. The lowest abundance in monoculture, both rubber and oil palm plantation, indicates that rainforest conversion to monoculture leads to a decline of arboreal arthropod.

The analysis of arboreal arthropod in upland and riparian sites showed that abundance was significantly different in different land use types ($F_{1,21}$= 4.67; P=0.02). The highest abundance of arboreal arthropod was found in forest and the lowest in rubber plantation. The abundance in riparian sites was marginally different compared to upland habitat ($F_{1,20}$= 4.27; P=0.05). The abundance of arboreal arthropod at each site showed different patterns. There is no difference in arthropod abundance between land-use system in riparian site. Nevertheless, there was a difference in upland sites where forest was most abundant, followed by oil palm and rubber plantation (Fig. 3).

This study found that forest and jungle rubber, representing agroforestry, had the highest abundance of arboreal arthropod than monocultures of rubber and oil palm plantations. This pattern was also evident in the upland site of land use system. Upland and riparian site did not give significant differences of arboreal arthropods abundance. Future in-depth analyses of some dominant and specific taxa, such as ants, hymenopteran parasitoid, and Coleoptera need to be conducted to investigate their response to conversion of natural habitats to rubber and oil palm plantations.

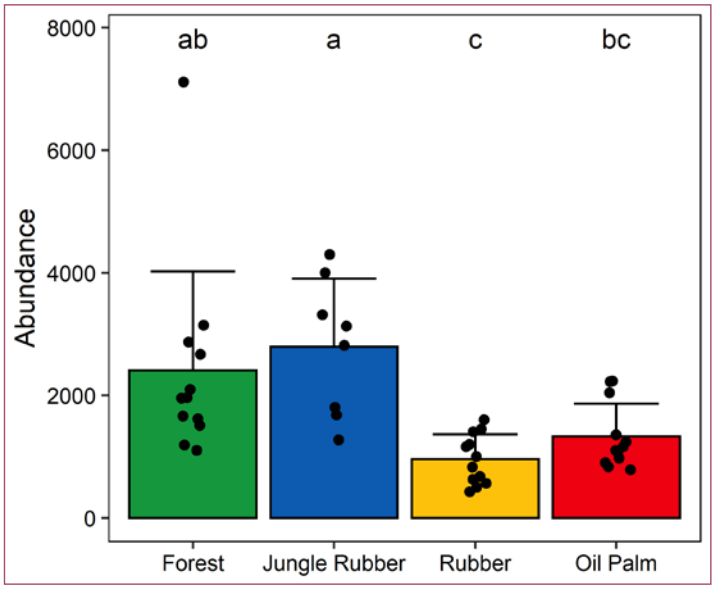

Figure 2. Arboreal arthropod abundance in four different land-use system. Different letters above the bar indicate significant differences of arboreal arthropods abundance between the land use systems.

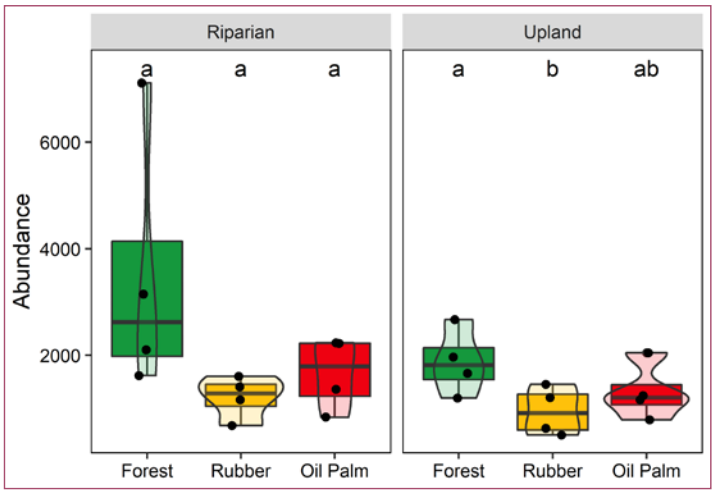

Figure 3. Arboreal arthropod abundance in different land-use system between riparian and upland site. Different letters above the bar indicate significant differences abundance between the land use systems.

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