

**THE CTFS-FORESTGEO ARTHROPOD INITIATIVE
ANNUAL REPORT 2016 – EXECUTIVE SUMMARY**

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Background. The ‘Arthropod Initiative’ of the Center for Tropical Forest Science (CTFS) aims at monitoring key arthropod assemblages over long-term and studying insect-plant interactions over the network of the Forest Global Earth Observatories (ForestGEO, <http://www.ctfs.si.edu/group/arthropod%20monitoring/>). The Initiative integrates with ongoing monitoring of plant dynamics within the ForestGEO network, causes minimum possible impact to the plots and focus on a priority set of assemblages chosen for their ecological relevance, taxonomic tractability and ease of sampling. At each participating ForestGEO site, the first years of the program are usually devoted to a ‘baseline’ survey. The baseline survey is followed by longer-term programs of field work and analysis, organized into two main sub-programs: monitoring, and key interaction studies. The monitoring sub-program is directed to detecting long-term changes, as reflected in priority assemblages, driven by climatic cycles, climatic change and landscape scale habitat alteration. Monitoring protocols are derived from those used during the baseline survey. The food web approach of interaction studies targets interactions between plants and specific insect assemblages, with different protocols than those used for monitoring. So far, the Arthropod Initiative involves nine ForestGEO sites: Yasuni in Ecuador, Barro Colorado Island (BCI) in Panama, Rabi in Gabon, Khao Chong (KHC) in Thailand, Tai Po Kau (Hong Kong), Dinghushan and Xishuangbanna in China, Bukit Timah in Singapore and Wanang (WAN) in Papua New Guinea.

Monitoring – BCI, KHC and WAN. Year 2016 represented the eighth year of insect monitoring at BCI. So far, the BCI database contains data on 435,849 arthropods, including 2,157 species (1,720 of which with pictures, 80%) and 51,898 pinned specimens in our collections. Instead of detailing statistics for each protocol performed on BCI during 2016, as we did for previous years, we present in the long version of this report the full text of an article on comparing assemblages of butterflies and termites in forests and plantations in Panama. The abstract is detailed below. A new project, funded by SENACYT, was initiated to analyze long-term records of alate ants and termites on BCI. Year 2016 represented the sixth and fourth years of insect monitoring at KHC and WAN, respectively. At KHC our database includes 149,702 specimens (31,283 pinned specimens in collections) and 2,266 species. At WAN the ForestGEO insect database contains data on 28,338 specimens, but apart from butterflies and fruitflies, few of these specimens are yet identified.

Interaction studies. We are examining and comparing the interaction networks based on assemblages of insect seed predators at BCI, KHC and WAN and we hope to publish these results in 2017. We started a new project, funded by the Grant Agency of the Czech Republic, which extends the previous study and compares specifically the effects of insect herbivores on seeds and seedlings at the same ForestGEO plots. The field component consists of setting up experimental blocks including seeds and seedlings treated or not with insecticide. Panama was also host to a new international project funded by the European Research Council. The project seeks to compare the interaction networks of caterpillars feeding on vegetation between three pairs of sites: Front Royal (USA) vs. San Lorenzo (Panama), and sites in Czech Republic vs. Africa and Japan vs. Papua New Guinea.

Scientific output. In 2016, the ForestGEO Arthropod Initiative trained 22 assistants, 4 interns, one volunteer, one MSc and one PhD students at BCI, KHC and WAN. The work of other PhD students and researchers was also facilitated at BCI, KHC and WAN. The new ForestGEO Arthropod database is 70% complete and has been routinely used since April 2016 in Panama. It should be finished in 2017. It will allow, for sites interested to join the database project, to (a) conveniently and securely store their data; (b) facilitate overall analyses including data from several sites (for data owners interested in this opportunity); and (c) foster scientific collaboration via a better visibility of the ForestGEO Arthropod Initiative and release of case studies based on BCI data. Year 2016 saw the start of three different and exciting research projects related to the ForestGEO Arthropod Initiative. We expect a high output of scientific publications in 2017, as many interesting data sets are now ready to be analyzed and compared, within and between participating ForestGEO sites.

Contrasting the distribution of butterflies and termites in plantations and tropical forests –Abstract.

In the tropics vast areas of natural forests are being converted into plantations. The magnitude of the resulting loss in arthropod biodiversity and associated ecosystem services represents a significant topic of research. In this study we contrasted the abundance, species richness and faunal turnover of butterflies, resident butterflies (i.e., whose host plants were ascertained to occur in the habitats studied) and termites between small (average 4.3ha) 20+ year old exotic plantations (teak and Terminalia), native plantations (Cedro espinosa), and an old growth forest in Panama. We used Pollard walks and manual search to quantify the abundance or occurrence of butterflies and termites, respectively. In 2014 we observed 4,610 butterflies representing 266 species and 108 termite encounters (out of 160 quadrats) representing 15 species. Butterflies were more abundant and diverse in plantations than in the forest, whereas this pattern was opposite for resident butterflies and termites. There was marked faunal turnover between plantations and forest. We conclude that (a) the magnitude of faunal changes between forest and plantations is less drastic for termites than for butterflies; (b) resident butterfly species are more impacted by the conversion of forest to plantations than all butterflies, including transient species; and (c) species richness does not necessarily decrease in the series forest > native > exotic plantations. Whereas there are advantages of studying more tractable taxa such as butterflies, the responses of such taxa can be highly unrepresentative of other invertebrate groups responsible for different ecological services.

Plate I. Representative activities/items for the ForestGEO Arthropod Initiative in 2016. (1) Field team at the San Lorenzo crane, Panama. (2) *Lasioderma* sp. (Anobiidae), damaging seeds of *G. ulmifolia* in Panama. (3) Male of *Stigmatomma* sp. (Formicidae), new record for BCI and Panama (S. Arizala). (4) Overview of monitoring protocols at Tai Po Kau and Dinghushan (C.-L. Luk). (5) A capsule of *Guazuma ulmifolia*, with seeds damaged, in Panama. (6) Display of insect pictures with the new ForestGEO Arthropod Database. (7) *Macrotermes* sp. from XTBG (J. Sobotnik). (8) The most common species of butterflies in teak plantations in Panama, see Appendix I for more details. (9) Seed damaged by Diplopoda at KHC (R. Ctvrticka). (10) Sowing seeds with a frame at Wanang for the new seed/seedling insect predator project. (11) View of the insect collections at KHC. (12) Functional groups and relation with climatic anomalies for Saturniidae at BCI.

