THE FORESTGEO-CTFS ARTHROPOD INITIATIVE
ANNUAL REPORT 2014 – 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 year of the program is devoted to a 'baseline' survey to serve several purposes, notably to refine the methodology and the definitive choice of assemblages. 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 seven ForestGEO sites: Barro Colorado Island (BCI) in Panama, Khao Chong (KHC) in Thailand, Wanang (WAN) in Papua New Guinea, Yasuni in Ecuador, Hong Kong and Xishuangbanna in China, and Rabi in Gabon. Full insect protocols are currently only implemented at the three first sites.

Monitoring – BCI, KHC and WAN. During 2014, we replicated butterfly and termite transects near BCI in the Canal Zone as part of an environmental study for Argos (CementoPanama). This boosted our butterfly collections and we will prepare a report for Argos summarizing the results in 2015. In November, we moved from two cubicles in the Maestria de Entomologia (University of Panama) to a large room (81m^2; Plate 1) of the Center for Tropical Palaetolongy and Archaelogy (CTPA). Year 2014 represented the sixth year of insect monitoring at BCI. So far, the BCI database contains data on 340,914 arthropods, including 1,792 species (1,628 of which with pictures, 91%) and 34,921 pinned specimens in our collections. Instead of detailing statistics for each protocol performed on BCI during 2014, as we did for previous years, we present in the long version of this report a draft of a manuscript on the Saturniidae of BCI. The abstract is detailed below. Year 2014 represented the fourth and second years of insect monitoring at KHC and WAN, respectively. At KHC most of the material collected in 2014 has been processed (the remaining backlog will be absorbed next year), and our database includes 132,046 specimens (26,303 pinned specimens in collections) and 2,209 focal species. Two volunteer students from Bristol University helped the project for two months. At WAN we implemented termite transects, Winkler protocols for litter ants and monitoring of Tephritidae by McPhail traps this year. This complement the butterfly protocols initiated last year. The CTFS insect database contains data on 11,567 specimens, but apart from butterflies, few of these specimens are yet identified.

Interaction studies. A current project is replicating the seed predation protocol established at BCI in the plots of KHC and WAN. The project aims at comparing quantitative food webs based on seeds and their insect predators and parasitoids at BCI, KHC and WAN. Field work is now finished on BCI, while we are still actively rearing insects from seeds at KHC and WAN. At BCI, we reared 23,500 insects from 486 plant species. At KHC, we reared 5,922 insects from 272 plant species, while at WAN we reared 24,965 insects from 296 plant species.

Scientific output. The BCI and KHC teams continue to prove that our model is viable and that with a minimum of organization and personnel, insect population can be monitored with high accuracy that will allow statistical analysis of annual data and, therefore, of long-term changes in insect populations. In 2014, the CTFS Arthropod Initiative trained 16 assistants and interns at BCI, KHC and WAN. We hope that our mini-network consisting of 7 ForestGEO sites may be consolidated in 2015 by securing current monitoring programs at the sites which joined recently the network, and by the addition of further monitoring programs targeting different taxa at most sites.

The Saturniidae of Barro Colorado Island: DNA barcodes and recent population trends –Abstract. The Saturniidae are among the largest moths and are best represented in the Neotropics, but there are few recent lists available for Panama and particularly for Barro Colorado Island (BCI), one of the best-studied rainforest sites in the tropics. By collating published lists, and recent rearing and monitoring records, we provide an actualized list of the 60 species of Saturniidae collected on BCI during the period 1958-2014. This list will serve as baseline data for assessing long-term changes of saturniids on BCI in the future, as 87% of species can be identified by their unique DNA Barcode Index Number, including 8 cryptic species not yet formally described. A local species pool of 60+ species breeding on BCI looks plausible, but more cryptic species are bound to be discovered in the future. We use monitoring data with light traps to analyze recent population trends on BCI for saturniid species that were relatively common during 2009-2014, this period representing probably > 20 saturniid generations. The abundance of 7 species, out of 11 tested, could be fitted to significant time-series models. One species showed a strong linear increase in time, whereas six species had significant effects for each time point. Of the latter, one species showed a strong decline in time, two a moderate decline and for the three others the direction of the change was uncertain. Seven out of the 11 species showed a peak in abundance during 2011 but this observation remains unexplained. We conclude that Saturniidae may be recommended as model taxa for studying the long-term effects of climate change on tropical insects, but that their relative sensitivity to these effects must be compared to that of insect taxa popular in the conservation literature.

Plate I. Representative activities/items for the CTFS Arthropod Initiative in 2014. (1) Drone flight over KHC plot, see youtube link (S. Milne). (2) Composite view of the new insect laboratory at CTPA in Panama. (3) Extracting litter ants at Wanang. (4) McPhail trap to attract Tephritidae at Wanang. (5) The first butterflies collected at the Xishuangbanna plot in China (A. Nakamura). (6) Extract of the Tephritidae guide prepared by M. Schutze for Wanang. (7) Seeds reared at Wanang showing attacks of Scolytinae. (8) Litterfall traps in construction that will be later set up at Wanang for the seed predation project. (9) Butterflies waiting to have a leg extracted for DNA barcoding at KHC. (10)-(12) Representative pictures of Saturniidae, as featured in the long version of this report: *Rhescyntis hippodamia*, *Periphoba* sp. 1YB and *Dysdaemoria boreas*.

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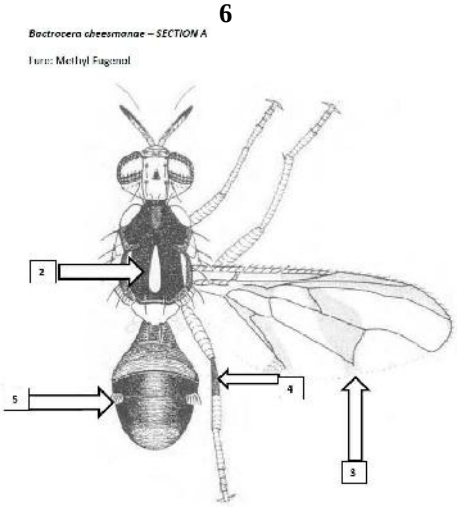

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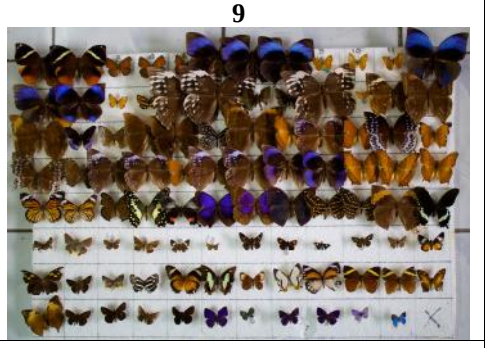

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