



## **BIODIVERSITY OF INSECTS IN THE HEART OF BORNEO**

### **An international research project in aid of conservation management**

initiated by

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### **Introduction**

The interior mountain ranges of Central Borneo represent the only remaining large, contiguous and undisturbed tropical rainforest of Southeast Asia outside of western New Guinea. The destruction of rainforest by logging and conversion to agricultural landscapes is well advanced everywhere else in the region (e.g. Sumatra, Peninsula Malaysia, Thailand, Sulawesi and the Philippines), where forest fragments persist in the form of national parks or other reserves. Destruction is also proceeding in Borneo, especially in its Indonesian part, by the recent expansion of large scale oilpalm plantations.

The World Wildlife Fund (WWF) led a conservation initiative for this remaining large block of Southeast Asian rainforest— a total of 220,000 km<sup>2</sup> of equatorial rainforest - under the title “*Heart of Borneo*” to protect this unique ecosystem before it is lost for ever. In 2007 a declaration was signed by the governments of Malaysia, Indonesia and Brunei which recognizes the *Heart of Borneo* initiative as a trans-boundary conservation project including national parks, production forest and other sustainable land-use. All three governments announced their cooperation towards this aim. The initiative is still awaiting the implementation of the declared visions.

Any conservation project of this scale needs to prioritize available funds and efforts. It will be fundamental for this initiative to define core conservation areas and areas that can be used economically in a sustainable way. Along with socio-economic studies that already started (see [WWF](#)), mapping of biodiversity, analyses of actual forest conversion threats and the status of keystone species need to provide essential information for scientifically founded decisions for conservation management. It is recognized by all parties involved that the protection of the *Heart of Borneo* is a “now or never”-situation requiring quick action on decision making and implementation.

Conservation Biology traditionally is oriented towards vertebrates such as birds and large mammals because they are attractive to the public and good distribution data often exist. However, the biodiversity of tropical rainforests is defined by invertebrates - especially insects - and many functional processes in this ecosystem are driven by them.

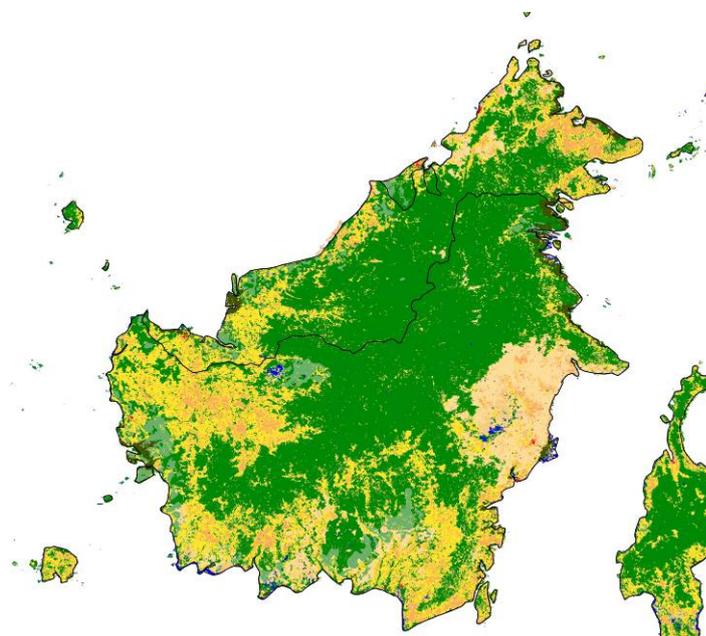
We therefore suggest a research project on insect biodiversity patterns in Borneo as a contribution of Biology towards the implementation of an effective management of the proposed conservation area.

## Research strategy

With our proposed project we aim at reaching scientifically well-founded conclusions on the biodiversity status (such as species richness, proportion of endemic species, rare species communities) of various regions in the prospective conservation zone within a few years. Together with socio-economic data this will contribute to classify areas according to their “conservation worthiness”, hereby aiding decisions on how to utilize available resources most effectively.

The majority of tropical insects is not yet taxonomically described, and even for known species there is often very sparse, if any, ecological background information (e.g. life history, behavior, distribution). It is therefore impossible to meet our aims for the whole insect fauna. Instead, we will focus on a selection of taxonomic groups chosen to be distinct in life history and habitat use in order to capture much variation of possible distribution patterns, but which are well known taxonomically and in their distribution within Borneo. Preliminary distribution analyses based on available data will be completed by sample programs in previously unexplored regions. These data, aided by remote sensing data and statistical modeling, will provide spatial coverage of diversity patterns across the region.

In the first phase of the project, for which we seek funding possibilities, we will focus on insect taxa that fulfill the above stated criteria and for which we are internationally recognised experts. Once under way, we expect further researchers to join our ‘core group’, leading to a broader taxonomic perspective of the project.



**Landscape types of Borneo** (simplified from data in [TREES](#), 2002). Green colors denote natural forest types; Yellows and Reds indicate secondary vegetation (after logging) and agricultural lands. The last 5 years have seen further, rapid decline of forests.

## **Investigated taxa and regions**

Our taxonomic focus will be on butterflies and moths, ants, cicadas and dragonflies. The taxonomy of these groups is well resolved and good distribution data are available for Borneo (see e.g. [MoB](#), [antbase](#)). The chosen groups are found at different trophic levels in the food web (herbivorous moths, cicadas, predatory dragonflies and ants) and differ in dispersal ability and habitat specialization. All selected taxa can be sampled quantitatively in large numbers using established and tested techniques.

For historical and geographic reasons the natural history of northern Borneo (Malaysia, Brunei) is much better known than that of the central and southern part of the island (Indonesian provinces of Kalimantan), a fact that also reflects on available data for our focal organisms. Therefore we expect that most new sampling will have to be carried out in the Indonesian part of Borneo, particularly in the area south of the Malay-Indonesian border.

## **Competence of the initiators, associated scientists**

All three initiators of the project spent considerable part of their careers in Borneo (graduate projects, masters- and PhD theses, JB also as a post-doc researcher) and worked on related topics and on the selected organisms. Their experiences in scientific as well as local administrative and logistic matters will greatly improve the feasibility of the project. All three speak Malay/Indonesian and have good contacts and established co-operations with scientists from the three countries on the island of Borneo.

Some colleagues already indicated their interest to contribute to the proposed project, among them J.D. Holloway (Natural History Museum London: Lepidoptera taxonomy, biogeography of Southeast-Asia), K.E. Linsenmair (Univ. of Würzburg: tropical biology, biodiversity), K. Fiedler (Univ. of Vienna: biodiversity and biology of Lepidoptera), W. Schwanghart (Univ. of Basel: GIS, physical geography), U. Grafe (Univ. of Brunei: amphibians), Chey V.K. (Forest Research Centre, Sabah: insect diversity, conservation biology in Borneo), P. Nagel (Univ. of Basel: ant nest beetles). A project summary was accepted by the coordinating office for research of the Heart of Borneo project in Brunei.

## The initiators



**Carsten Brühl**, received his PhD in 2001 from the University of Würzburg. He worked as a study director and team leader in ecotoxicology in the agrochemical industry in Switzerland and England. Since 2006 he is leading the section on community ecology and ecotoxicology at the Institute for Environmental Sciences of the University of Koblenz-Landau. His research is concerned with multiple stressors in agricultural landscapes, with a focus on the biodiversity of tropical agro-ecosystems and ants as indicator organisms.



**Jan Beck**, received his PhD in 2005 from the University of Würzburg. He was a Research Fellow of Kuala Belalong Field Studies Centre in Brunei in 2005 and 2006. Since 2007 he is a scientific assistant at the Institute of Biogeography at Basel University. His recent research concerns the macroecology, biodiversity and biogeography of insects, with a focus on tropical Lepidoptera. He is particularly interested in the spatial patterns of biodiversity, which he investigates with a combination of field biology and ecological modeling.



**Christian Schulze**, received his PhD in 2000 from the University of Bayreuth. He is a scientific assistant at, and vice head of, the Institute of Population Ecology at Vienna University. His recent research treats biodiversity and conservation in Europe and in the tropics, with a focus on Indonesian rainforest regions. He has manifold contacts to Indonesian research institutes.

## Relevant publications:

- BECK J, CHEY VK (2008) Explaining the elevational diversity pattern of geometrid moths from Borneo: a test of five hypotheses. *Journal of Biogeography*, online early (doi:10.1111/j.1365-2699.2008.01886.x).
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- BRÜHL C. & ELTZ T. (2010) Fuelling the crisis: Species loss of ground-dwelling forest ants in oil palm plantations in Sabah, Malaysia (Borneo). *Biodiversity & Conservation*. 19:519–529.
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- BRÜHL CA, ELTZ T & LINSENMAIR KE (2003) Size does matter - Fragmentation of tropical rain forests in Sabah Malaysia and the effects on the leaf litter ant community. *Biodiversity and Conservation*, 12: 1371-1389.
- BRÜHL CA, GUNSALAM G & LINSENMAIR KE (1998) Stratification of ants (Hymenoptera, Formicidae) in a primary rain forest in Sabah, Borneo. *Journal of Tropical Ecology*, 14, 285-297.
- SCHULZE CH & FIEDLER K (in press): Artenreichtum tropischer Nachtfalter entlang von Umweltgradienten. *DFG-Journal Forschung*.
- SCHULZE CH, WALTERT M, KESSLER PJA, PITOPANG R, SHAHABUDDIN, VEDDELER D, STEFFAN-DEWENTER I, MÜHLENBERG M, GRADSTEIN SR, TSCHARNTKE T (2004): Biodiversity indicator taxa of tropical land-use systems: comparing plants, birds and insects. *Ecological Applications* 14(5): 1321-1333.
- VEDDELER D, SCHULZE CH, STEFFAN-DEWENTER I, BUCHORI D & TSCHARNTKE T (2005): The contribution of tropical secondary forest fragments to the conservation of fruit-feeding butterflies: effects of isolation and age. *Biodiversity and Conservation* 14: 3577- 3592.

