

PROJECT TITLE: Uptake and effects of heavy metals and pesticides in the wildlife of the Oil palm plantation affected landscape of the Lower Kinabatangan flood plain.

DTP Research Theme(s): Living World

Lead Institution: UK Centre for Ecology & Hydrology (UK CEH)

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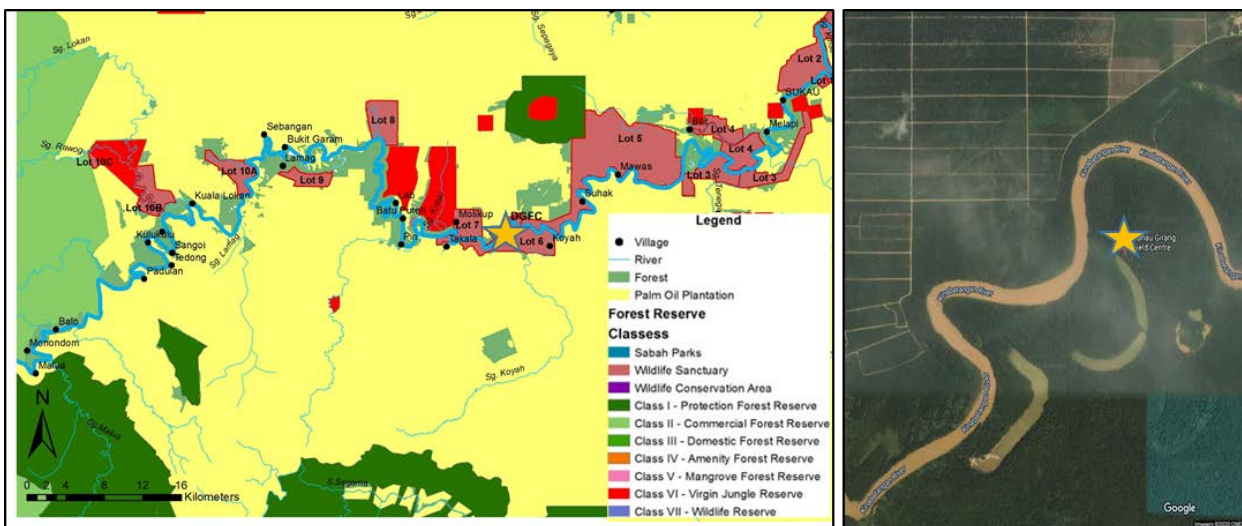
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Project keywords: Pollution, Oil Palm, Chemical Fate and Uptake, Rainforest conservation



Lower Kinabatangan Floodplain and Oil Palm landscape around Danau Girang Field Centre (Sabah, Borneo) [Orange Star]

Project Background

There is a growing realisation that effects of increased habitat fragmentation and degradation by human activities, particularly agricultural development, threatens global biodiversity. The pressures upon wildlife in such increasingly intensified agricultural zones are many and complex, and the Lower Kinabatangan Floodplain (Sabah, Borneo) provides an iconic example of how such a patchwork forest landscape heavily fragmented by oil palm plantations is impacting local wildlife. While habitat fragmentation is one side of the pressures on wildlife here, then the chemicals used and released during the terracing of the soils and the pesticides and fertilisers used in the cultivation of the oil palm trees lead to different pesticide and heavy metal exposures and body loadings in wildlife with different proximity to the plantations. These levels and the risks they present to wildlife are dependent on both the environmental fate of the pollutants and the ecology and life-stage of the organisms.

Project Aims and Methods

This project aims to develop further understanding of how big a part the chemical pollution resulting from oil palm farming may have on local wildlife and how far into the surrounding rainforest and rivers this footprint may reach. The student will collate and measure chemical signatures of the soils, waters, diets, droppings, hair and body fluids (blood and urine) from capture/release animals and where possible carcass tissues (of individual found dead) of key wildlife species. These values will be combined with environmental fate and bio-uptake modelling to build an understanding of how widespread the footprint of the chemical pollution is in the landscape outside the oil palm plantations and assess what risks it may present to the various wildlife. Such risks are heavily dependent on organism ecology, life stage and habitat proximity to the oil palm plantations. For example, insect and fish-eating birds will likely receive very

different dietary inputs, and longer-lived wildlife such as elephants and orang-utans may build up tissue levels as they grow to maturity and then pass certain portions of those chemicals to offspring in high doses during lactation.

A primary task will be for the student to build a conceptual fate and exposure model identifying the key zones and wildlife species on which to focus sampling. This will be based on combining the knowledge of existing wildlife toxicology and monitoring (e.g. the UK CEH Predatory Bird monitoring Scheme) and previous studies of the Lower Kinabatangan floodplain (e.g. as run by Cardiff University at the Danau Girang Field Centre in Borneo).

Based on this initial model, key hypothesis will be established and tested to determine the likely “risk maps” for certain chosen chemical and species combinations. Maps which can be integrated using mixture toxicity knowledge to provide integrated “chemical risk maps” either charting a set larger region or focusing on and comparing smaller areas around oil palm plantations of different farming intensity (e.g. certified “sustainable” vs non-certified plantations).

Candidate requirements

Applicants must hold (or expect to hold) an environmental science degree at the 2:1 level or higher. A high level of competence in either ecology or chemistry is essential, and experience in either ecotoxicology, environmental chemistry or modelling would be a significant advantage, but not requisite since full training will be provided.

Training

The student will receive training from the supervisors in building understanding of the environmental fate, uptake and risk of chemicals. This will include the design of models and monitoring schemes and associated sampling techniques and analytical chemistry. Depending on the track chosen by the student the balance between modelling (fate and/or mixture toxicity), wildlife toxicology and monitoring can be adjusted, but it is expected that the student will be a full member of the UK CEH Pollution Science Area (65 staff and 10 PhD students) and have opportunity to spend time both in the Ecotox & Chemical Risks, Environmental Contaminants and Central Chemistry groups. There are close and longstanding collaborations between Cardiff University and the UKCEH supervisors, so full use can and will be made of facilities and training opportunities at CU as well as UKCEH. Field work opportunities at or in collaboration with the Danau Girang Field Centre in Borneo is foreseen for sample collection, but personal travel is not a requirement and up to the student’s preferences at the time. This combination of Research Centre, University and Field Centre based project provides the student unique opportunity to work alongside and learn from researchers in different sectors and across key disciplines and to take part in regular interdisciplinary events and workshops on key pollution and conservation ecology related topics.

Background reading and references

Heinz-R. Köhler & Rita Triebkorn (2013) Wildlife Ecotoxicology of Pesticides: Can We Track Effects to the Population Level and Beyond? *Science*. Vol. 341, Issue 6147, pp. 759-765. DOI: 10.1126/science.1237591

UK CEH Predatory Bird Monitoring Scheme - <https://pbms.ceh.ac.uk/>

Danau Girang Field Centre (Sabah, Borneo) - <http://www.dgfc.life/>

Claus Svendsen, Lee A. Walker, et al (2020) Key principles and operational practices for improved nanotechnology environmental exposure assessment. *Nature Nanotechnology*; Vol 15, 731–742

Barnett, C. L., Beresford, N. A., Wood, M. D., Izquierdo, M., Walker, L. A., and Fawkes, R. (in press). Element and radionuclide concentrations in soils and wildlife from forests in north-east England with a focus on species representative of the ICRP’s Reference Animals and Plants, *Earth Syst. Sci. Data Discuss.*, <https://doi.org/10.5194/essd-2020-119>

Useful links

To apply please send your CV and a covering letter stating your suitability for the project to the project supervisor, Dr Claus Svendsen (csv@ceh.ac.uk). Further information about the UK Centre for Ecology & Hydrology and Pollution Science Area can be found on the [UKCEH website](#).

The application deadline is Friday 8 January 2021 at 2359 GMT. Interviews will take place from 8th to 19th February 2021. For more information about the NERC GW4+ Doctoral Training Partnership please visit <https://www.nercgw4plus.ac.uk>.