Exploration of Fluorescence LIDAR for Remote Entomological Applications in Ghana

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Tropical climates provide a healthy ecosystem that favors rich biodiversity in atmospheric fauna, particularly insects. The insects play roles such as pollination, predation or as preys, pests, disease vectors, etc. In Ghana, conventional techniques such as sweep nets, pit falls, sticky traps continue to be used to study these insects. These conventional techniques are somewhat destructive, time consuming and laborious. Nowadays, complementary and alternatives to the conventional techniques are been offered by LIDAR techniques which can provide rapid, non-invasive, in-situ and remote measurement. Fortunately, relatively less costly systems for LIDAR operation are been developed and demonstrated by Brydegaard et al., [1, 2]. They (Brydegaard et al) have since 2009 organized regular workshops and training among some countries in Africa (Burkina Faso, Cameron, Cote D' Ivoire, Ghana, Mali, Senegal, Togo and Kenya). Through this program the Laser and Fibre Optics Centre (LAFOC) in Ghana at the University of Cape Coast has been has been provided with a Fluorescence Lidar for remote studies. The LIDAR is equipped with a Diode laser of 100 mW power and a wavelength of 401 nm. It also has a home-built telescope system which has most of the optical components held by 3D printed parts. The Lidar is arranged in the Scheimpflug configuration providing elastic and fluorescence echo of insects traversing the path of the light within a range of six (6) to hundred (100) meters. The Scheimpflug configuration is very conducive to obtain high resolution, temporal and spatial data from flying insects [2].
Currently, the LIDAR system is being deployed for field studies of some insects, particularly Bees, House flies and Mosquitoes, which have economic interest to the country. Bees contribute mostly to pollination, they produce honey and other products which are used in food, medicine and cosmetics as well as providing foreign exchange through exportation of bee products and tourism. Mosquitoes on the other hand are vectors of some of the most devastating diseases to humans particularly malaria which drains the country economically in the control and treatment. Similarly, houseflies a type of domestic pests that carry pathogens from place to place. Causing several diseases such as cholera, typhoid, food spoilage etc. Studies therefore to locally understand the general characteristics and behavior of these insects remotely to advance strategies for their control (vectors) and development (Bees) will be of great relevance. Meanwhile obtaining this important information about the insects remotely using this relatively low-cost Lidar system will be of great benefit in terms of cost, labor and time saving opportunities for insect studies, vector control, as well as a progressive research and development in the field of entomology and associated fields.

[1] M. Brydegaard, A. Gebru, & S. Svanberg, Pro. In Elec. Res. **147**, (2014).
[2] M. Brydegaard, E. Malmqvist, S. Jansson, J. Larsson, S. Török, & G. Zhao, SPIE. **10406** (2017).