

An ecological observatory to study malaria vectors

What is the ecological observatory focusing on?

The “ecological observatory” project contributes to predicting the impact of locally suppressing *Anopheles gambiae* mosquitoes, which are one of the principal vectors of malaria in Africa. The project, which started in 2018, is jointly led by the University of Ghana and the University of Oxford as part of the Target Malaria project.

The research takes place in an environment where both mosquito larvae and adult mosquitoes of the *An. gambiae* specie are present, and which is ecologically representative of the key relationships that *An. gambiae* can be expected to have in many settings.

The research studies the ecological relationships of *An.gambiae* with other species in the community including its larval competitors, adult predators and the plant species it may help pollinate. The goal is to determine the effect, if any, that the local suppression of *An. gambiae* would have on the ecological community within which it is embedded. For example, would its predators suffer from reduced food resources and might another vector of human disease occupy its ecological niche.

How do you conduct this research?

A large part of the research is about increasing our knowledge of the role and interactions that *An. gambiae* has with others in its ecological community. This requires gathering and mapping information from *An. gambiae* itself, as well as from the other species and plants it interacts with.

To do so, we collect water, insects and samples from other animals in selected sites, and we use



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DNA analysis to build a careful picture of the environment in which the mosquito larvae grow, and of the species with which the adult mosquito interacts. These techniques allow us, among other things, to say for the first time exactly what predators feed on *An. gambiae*.

Using this information enables the research team to estimate what impact changing the number of *An. gambiae* would have on its ecosystem.

Why is this research important to Target Malaria?

Target Malaria is working to develop genetic technologies that is contributing to eliminate malaria in Africa, by significantly reducing the population of malaria mosquitoes that are responsible for transmitting the disease.

The project needs to understand what impact, if any, reducing the population of malaria mosquitoes would have on the environment. This is key to any decision about whether to use these genetic technologies. This is a common concern that was shared by stakeholders, from communities to regulators, and the project wants to help them make an informed decision by doing this research.

This can only be done by understanding the position of *An. gambiae* in ecological communities. This research provides information not only about possible impacts in Ghana, but also likely consequences elsewhere. It is also developing methodologies that can be replicated in other locations and applied to different control interventions.

How do you 'map' larval niches and food chains?

Typical larval breeding sites for *An. gambiae* are already known from previous work over many decades so we are able to use this information as a basis. We are complementing existing knowledge by creating a detailed profile of the species present in different sites, both microorganisms and larger organisms.

For the food web, we analyse the position of *An. gambiae* larvae in the breeding sites, but also the position of adult *An. gambiae*. For adults, current knowledge is very limited so our research will establish many new feeding relationships.

We are able to do this work thanks to new techniques for molecular identification, called 'DNA barcodes' that are specific to each species. We can identify with great precision the species present in a given community. By analysing the content of their stomach or faeces, we can also determine who eats whom.

Why is the research taking place in Ghana?

- *An. gambiae* is one of the main vector species responsible for transmitting malaria in Africa. Our research needs to be done where *An. gambiae* is present and in a setting that is as 'typical' as possible of its habitat.
- The University of Ghana has excellent expertise and track record in its faculty in vector ecology and entomology, and the ability to provide the necessary facilities for the research. In addition, there are good field sites near the University, which makes access to larvae and adults *An. gambiae* sites relatively easy.

- The outcome of the research, in particular the extensive DNA barcoding of species, provides information that can be used in other locations, allowing similar studies elsewhere in West Africa and beyond.
- The project also involves knowledge transfer and capacity building with the other teams that are part of Target Malaria. They are trained in ecological and technical skills that they can apply for research in other institutions.

Who provides oversight?

The project is subject to the oversight of the University of Ghana, including its Ethics Committee which reviews all research protocols.

In addition, we have put in place an advisory committee that provides independent guidance and advice to the project to ensure the research questions are answered to the highest standards.

Does the project affect local communities?

Target Malaria is committed to engaging with stakeholder in all project activities. A Community Liaison Officer reaches out to the populations at or near the sites to ensure that the work that takes place and that they are supportive of the research.

We do not anticipate the work of our team to directly or indirectly affect the communities working near the sites, since the activities of collection of species do not require their participation and do not modify their environment.

If the local communities oppose the work, we will not carry on our work in these communities.

This part of Target Malaria's work does not involve any genetically altered mosquitoes or other organism.