

Project Update: April 2026

This report contains the main activities developed during the period from January 2024 to March 2026 related to the project “Is flying enough for butterflies? Assessing diversity patterns and interactions in tropical forest landscapes”

Following the fieldwork, we began extracting pollen from the butterflies to produce microscope slides. All collected butterflies that visit flowers were observed under a stereomicroscope for pollen removal (Figure 1-2). In total, there were 2,587 butterflies and approximately 1,100 pollen slides (Figure 3). We also collected pollen samples from flowers in the field to create a pollen reference collection to assist with identification (Figure 4).

However, we did not have enough time to identify all the pollen of all species and build the butterfly-flower interaction networks in terms of project deadlines. Therefore, we focused on one species, *Heliconius sara*, which was well-represented in our samples in terms of both the number of individuals and the amount of pollen. *Heliconius sara* is a butterfly species from the Nymphalidae family that visits flowers in search of nectar and pollen, thus carrying large amounts of pollen on its proboscis.

Between October 2024 and March 2025, I had the opportunity to complete an internship at the Mediterranean Institute for Advanced Studies (IMEDEA) in Spain, with a scholarship from the Coordination for the Improvement of Higher Education Personnel (Capes - Brazil). Under the guidance of Professor Anna Traveset, we analysed the interaction network between the *Heliconius sara* butterfly and flowers in Atlantic Forest fragments in southern Bahia. I presented the results of this work at an event, Ecoflor (Figure 5-7), which gathered several experts in the field in León, also in Spain.

In August 2025, I defended my doctoral thesis entitled “Butterfly diversity in tropical forest landscapes: responses to anthropogenic disturbances.” In this work, we evaluated the effects of landscape changes, along with local habitat structure, on the richness, diversity, abundance, and species composition of butterflies in Atlantic Forest remnants in Southern Bahia. This study showed that, in general, anthropogenic disturbances negatively affect butterfly communities in tropical forests. Although fragmented landscapes can support a high richness and abundance of species adapted to disturbances, this occurs at the expense of losing forest-dependent species, diversity, and evenness.

During this process, I co-advised two undergraduate research students, who presented their work at the COP Mata Atlântica – *Hileia Baiana* (Figure 8). The event

took place at the Santa Cruz State University (UESC) in October 2025, bringing together scientists, indigenous peoples, social movements, and public authorities to debate the strategic role of the Atlantic Forest in combating the climate crisis.

Even after the defence, I continue to work with the data obtained from the fields funded by Rufford. Currently, we have two undergraduate research students evaluating the effects of forest loss in the landscape on the colours of butterfly communities and on wing asymmetry, which is an indicator of stress. This information will help us further understand the effects of anthropogenic actions on the group and, consequently, their effects on the human population. We are also still working on identifying pollen and building interaction networks for other nectar-feeding butterfly species.

At the moment, we are working on the creation of a butterfly guide to use with a school in the study area's community (see some photos of the guide in Figure 9). The workshop is scheduled to take place next June.

All of this work was only possible due to the immense contribution of the Rufford Foundation, to which I am immensely grateful.

Pictures

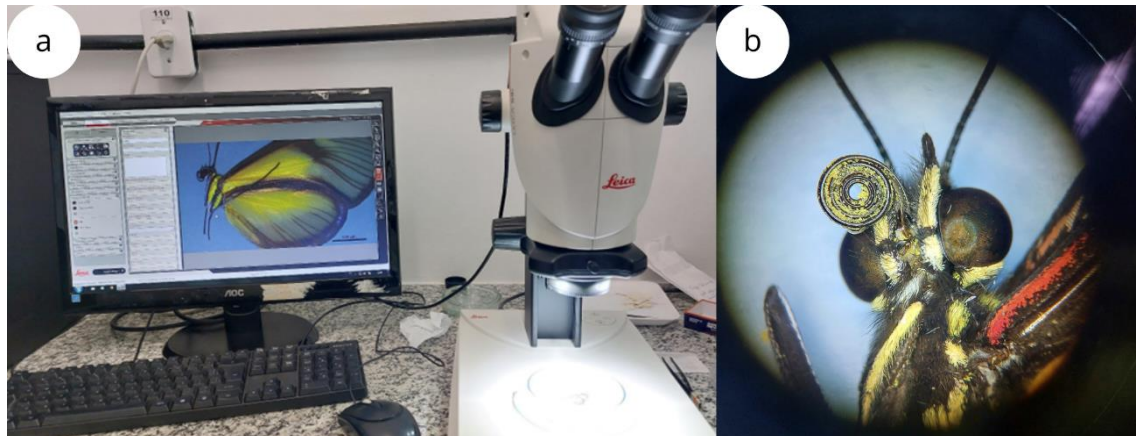


Figure 1: A butterfly under a stereomicroscope, with pollen being examined on its body. a: View of a butterfly of the species *Pteronymia euritea* under a stereomicroscope. b: View of the proboscis, filled with pollen, of a butterfly of the genus *Heliconius* under a stereomicroscope.

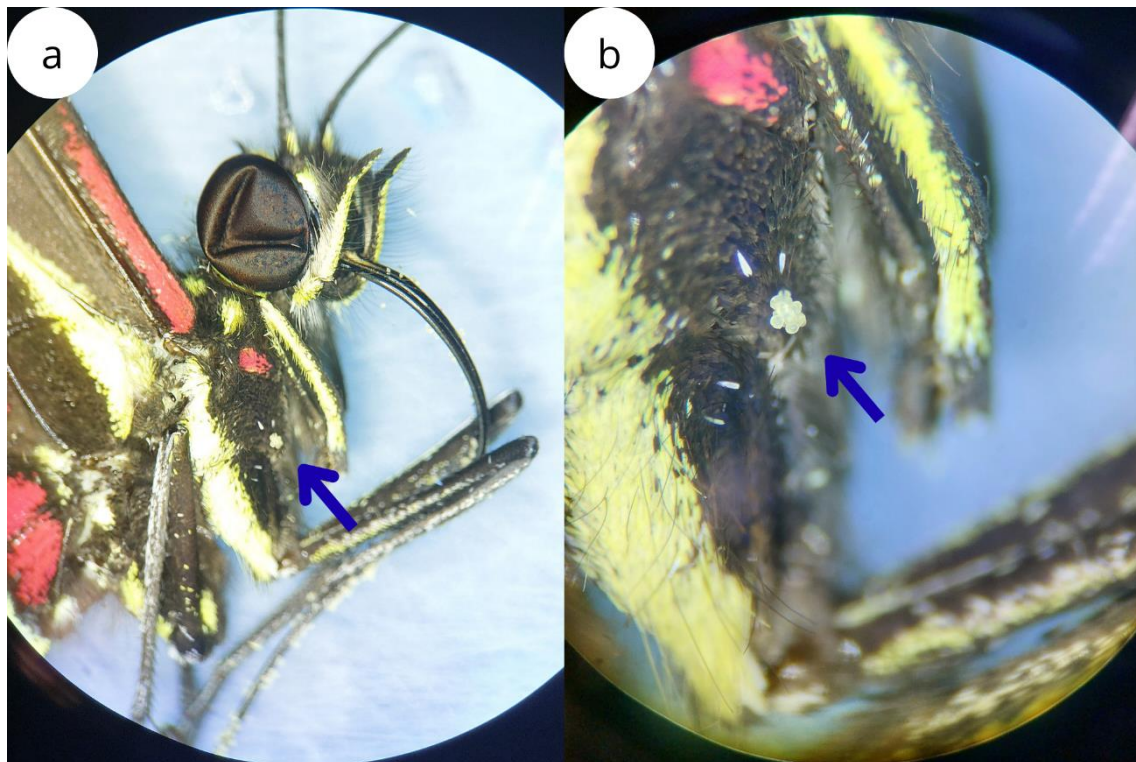


Figure 2: A butterfly under a stereomicroscope, being examined for pollen on its body. The arrow points to a cluster of pollen. See b for an enlarged view of a.

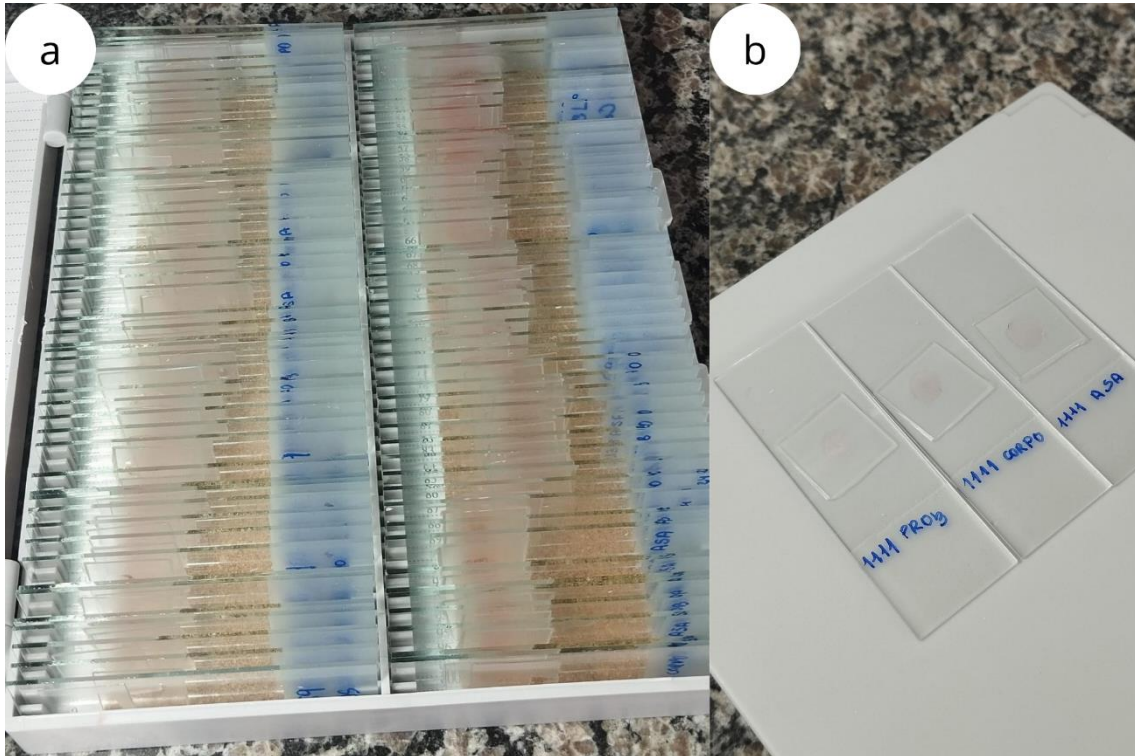


Figure 3: Pollen microscope slides from butterflies.

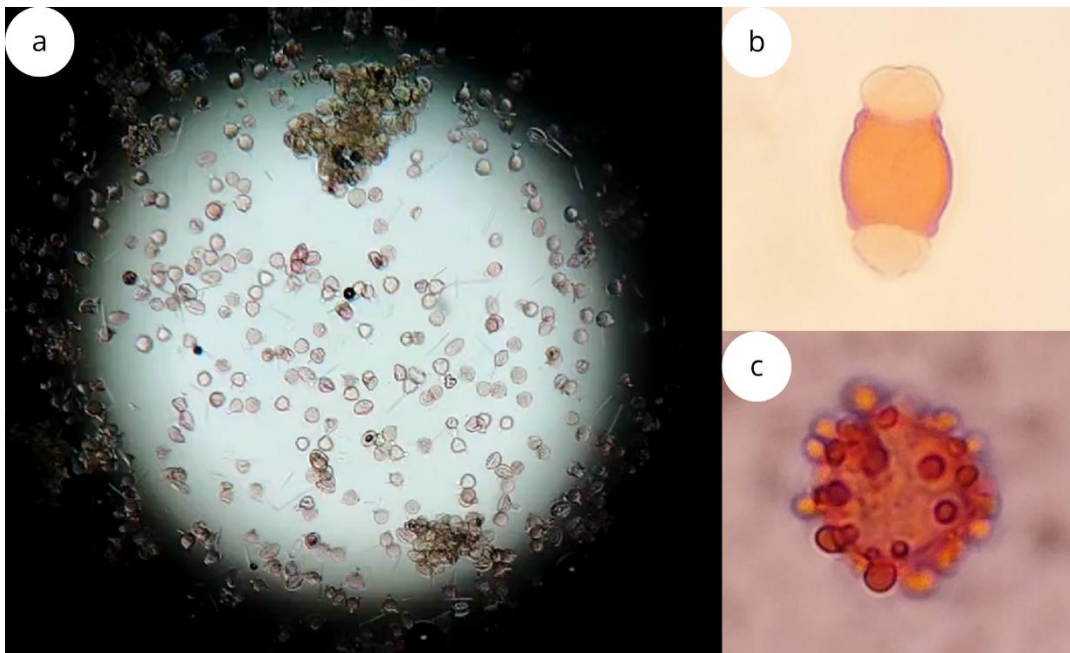


Figure 4: a: Pollen grain viewed under a microscope. b-c: Examples of pollen grains recorded.

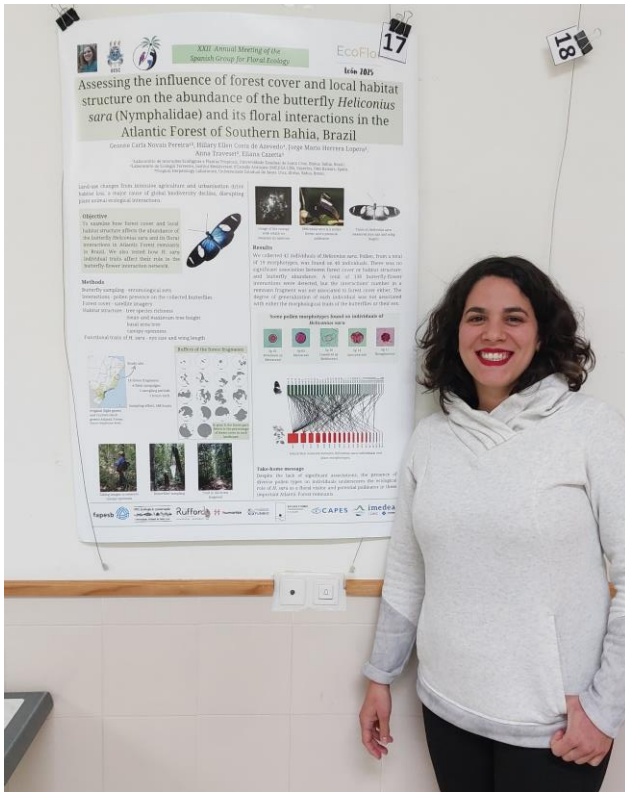


Figure 5: Presentation of the research as a poster at the Ecoflor event in León, Spain.



Figure 6: Presentation of the research in poster form at the Ecoflor event in León, Spain, alongside the team from the Mediterranean Institute for Advanced Studies (IMEDEA).



XXII Annual Meeting of the
Spanish Group for Floral Ecology

EcoFlor

León 2025

Assessing the influence of forest cover and local habitat structure on the abundance of the butterfly *Heliconius sara* (Nymphalidae) and its floral interactions in the Atlantic Forest of Southern Bahia, Brazil

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Land-use changes from intensive agriculture and urbanisation drive habitat loss, a major cause of global biodiversity decline, disrupting plant-animal ecological interactions.

Objective

To examine how forest cover and local habitat structure affects the abundance of the butterfly *Heliconius sara* and its floral interactions in Atlantic Forest remnants in Brazil. We also tested how *H. sara* individual traits affect their role in the butterfly-flower interaction network.

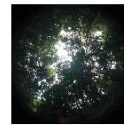


Image of the canopy with which we measure its openness



Heliconius sara is a pollen feeder and a potential pollinator



Traits of *Heliconius sara* measured (eye size and wing length)

Results

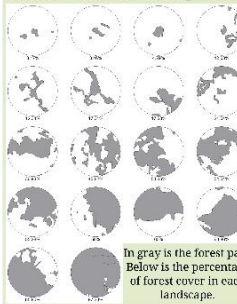
We collected 42 individuals of *Heliconius sara*. Pollen, from a total of 19 morphotypes, was found on 40 individuals. There was no significant association between forest cover or habitat structure, and butterfly abundance. A total of 138 butterfly-flower interactions were detected, but the interactions' number in a remnant fragment was not associated to forest cover either. The degree of generalization of each individual was not associated with either the morphological traits of the butterflies or their sex.

Methods

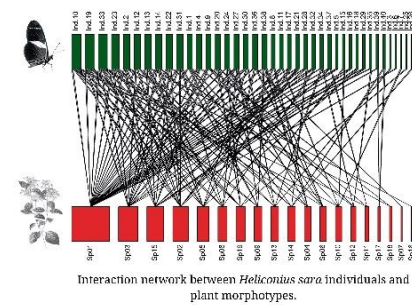
- Butterfly sampling - entomological nets
- Interactions - pollen presence on the collected butterflies
- Forest cover - satellite imagery
- Habitat structure - tree species richness, mean and maximum tree height, basal area tree, canopy openness
- Functional traits of *H. sara* - eye size and wing length



Buffers of the forest fragments



Some pollen morphotypes found on individuals of *Heliconius sara*



Take-home message

Despite the lack of significant associations, the presence of diverse pollen types on individuals underscores the ecological role of *H. sara* as a floral visitor and potential pollinator in these important Atlantic Forest remnants.



Taking images to measure canopy openness



Butterflies' sampling



Trail in the forest fragment



PPG Ecologia & Conservação
Universidade Estadual de Santa Cruz



Figure 7: Poster presented at the Ecoflor event in León, Spain.

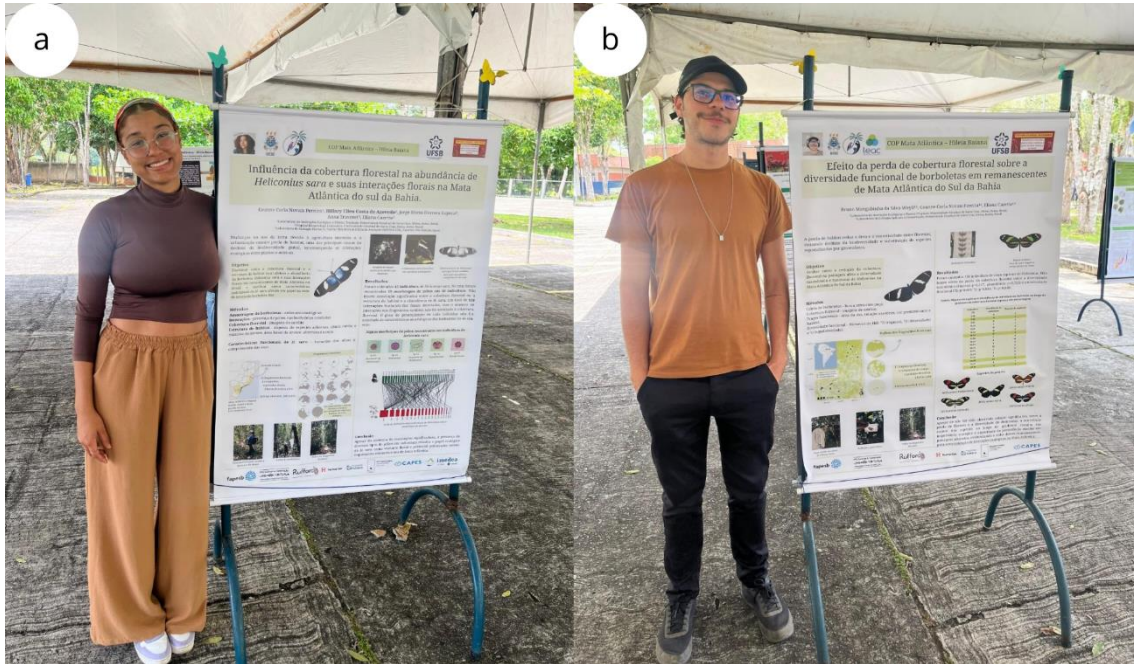


Figure 8: Presentation of the undergraduate research students work at the COP Mata Atlântica – *Hileia Baiana*, at the Santa Cruz State University (UESC), Ilhéus Bahia. a: Hillary Ellen Costa de Azevedo and b: Bruno Mangabinha.



Figure 9: Some butterflies recorded during fieldwork carried out in fragments of the Atlantic Forest in southern Bahia, Brazil. (**a - g**) Nymphalidae, (**h - j**) Hesperidae, (**k - l**) Riodinidae. (**a**) *Amiga arnaca* (Fabricius, 1776), (**b**) *Pareuptychia ocirrhoe interjecta* (R.F. d'Almeida, 1952), (**c**) *Pierella lena brasiliensis* (C. Felder & R. Felder, 1862), (**d**) *Hermeuptychia* sp. Forster, 1964, (**e**) *Myscelia orsis* (Drury, 1782), (**f**) *Hypothyris euclea* (Godart, 1819), (**g**) *Siproeta stelenes* (Linnaeus, 1758), (**h**) *Burnsius orcus* (Stoll, 1780), (**i**) *Calpodex* sp. Hübner, [1819], (**j**) *Telegonus alardus* (Stoll, 1790); (**k**) *Stalachtis susanna* (Fabricius, 1787); (**l**) *Semomesia geminus* (Fabricius, 1793) macho.