

**Preliminary Report**

**Costa Rica 2025**

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## Executive summary

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This project was a three-week ecological field expedition to the Work With Nature (WWN) Reserve in Costa Rica, where we investigated how historical land use affects biodiversity, and structural complexity in tropical secondary forests. Tropical forests are vital for biodiversity, carbon sequestration, and climate regulation, yet widespread deforestation has led to the loss of primary forests and the emergence of highly variable secondary forests. While secondary forests offer great potential for ecological recovery, their regeneration pathways and carbon dynamics are strongly shaped by prior land-use history (LUH) - a critical yet understudied factor in tropical conservation.

Our research was conducted in partnership with WWN, a local conservation organisation implementing a long-term study of secondary forest regeneration across multiple LUH types (the “EHLUBB” project). WWN consists of a small team of three permanent scientists who manage multiple research and restoration initiatives, and therefore rely heavily on volunteers and visiting researchers to maintain continuous data collection. Their current methodology classifies each forest plot into an LUH category based on field observations/evidence and focuses on measuring key forest attributes including stem density, diameter at breast height (DBH), and species composition. However, a key issue brought up by the WWN team was a lack of any exploratory statistical test that tied particular forest traits to LUHs. Some plots shared forest characteristics with other LUHs and were under consideration of being changed or removed from the data set. There was a need for exploratory statistical analyses to evaluate whether these forest attributes reliably distinguish LUH types, and to inform decisions on reclassifying or excluding plots with ambiguous characteristics.

Our independent analyses addressed this methodological gap by comparing species diversity and structural indicators across three LUH categories: old-growth forest, naturally regenerated secondary forest, and actively reforested sites. By assessing how well measured forest traits differentiate these LUH types, we provided data-driven recommendations to support plot classification and strengthen the overall EHLUBB framework. These insights offered WWN a new and clearer understanding of patterns in their dataset not yet explored, as well as bringing awareness to certain plots that may have a unique LUH compared to the others.

This expedition also offered a unique opportunity for international scientific and cultural exchange. Working closely with the WWN team and local researchers, we gained insight into community-led conservation practices while contributing field support, analytical expertise, and a final research report to advance their long-term goals. This student-led project operated under the guidance of Durham University was intentionally embedded within an existing local conservation framework and project to avoid parachute science. The results will be compiled into a comprehensive report shared with both WWN and Durham University, with the potential to inform broader reforestation and forest-restoration initiatives across the tropics.

## Projects aims

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The primary aim of our project was to contribute to WWN's long-term ecological study by analysing their forest monitoring data and evaluating the effectiveness of the indicators currently used to classify forest plots into historical land-use types (EHLUBB categories). Although these indicators were originally selected by WWN for practical monitoring purposes, we applied them because they are also supported in the literature as robust measures of succession, disturbance history, and forest recovery (Brown & Lugo, 1990; Jakovac et al., 2021).

More specifically, our goals were to:

1. Assess the strength, consistency, and ecological utility of these indicators - such as species richness, abundance, stem density, and DBH distributions - in distinguishing among plots with differing land-use histories, including old-growth forest, naturally regenerated areas, and actively reforested sites. These structural and compositional characteristics are well-established descriptors of forest condition and successional stage (Letcher & Chazdon, 2009; Guariguata et al., 1997).
2. Support WWN's ongoing fieldwork by assisting with species inventories and structural measurements. This enabled us to ensure data quality, better understand the consistency of measurement methods, and identify potential refinements to the field manual to improve future monitoring efficiency and reliability.
3. To build analytical capacity, share more advanced statistical approaches, and strengthen long-term monitoring strategies.

Our findings ultimately seek to contribute to WWN's overarching objective of improving reforestation and conservation outcomes by identifying which land-use histories and reforestation strategies are associated with higher biodiversity and carbon recovery.

## Fieldwork Overview

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To avoid parachute science, our field work was conducted within the research framework laid out by the WWN team as we helped with their long term study. Our own analysis of data not originally part of the WWN methodology was shared with them and is complementary to their efforts.

For this project, we utilised the existing network of 15 permanent plots (PPs) established across multiple LUH parcels within the WWN reserve. Each plot covers an area of 0.25 hectares, typically laid out as a 50 m x 50 m square, and is subdivided into a grid of twenty subsegments (5x25 grid), see figure 4. There are five plots located in the five different LUH types (25 total plots) (for details see figure 2 and previous location details). Due to limited time of study we focused efforts in three LUHs: old growth, naturally regenerated, and actively reforested.

We assisted with locating and establishing suitable plots to contribute to the ELUBB dataset:



Once at an established plot, we followed an established crossing methodology within each plot, moving systematically through the grid along parallel transects spaced at 5-meter intervals, thereby ensuring full coverage of the plot area.



Diameter at breast height (DBH) and species identification was done for every tree within each subsegment with a DBH >10cm. DBH was measured at a standard height of 1.30 meters above ground level using a measuring tape or, in cases where tree morphology (e.g., buttresses or deformities) prevented accurate measurement at this height, we shifted the measurement point upwards to the next straight section of the trunk.





GPS and photographs were also taken at each tree in order to document the data accurately and any new trees found to be of the minimum diameter for documentation (10cm) were then tagged and added onto the database.



ELUBB data was analysed back in the lab at the WWN research centre.



## Interim Final financial breakdown for two people:

Event	Cost (£)
Total Awarded	+ 3000
International Travel (flights)	- 669 - 817.2 (410.4 to San Jose + 406.8 Return)
Subsistence (accommodation and food) at the research center	- 1218 (29 per day per member)
accommodation not at the research center (aka between airport and destination in San Jose)	- 46 (Maya 11.5 a night for 4 nights) - 46 (Guillem 4 nights)
food out of the research centre between flights for both members	- 60
2 SIM cards for in country communication	- 15
In-country travel	- 60 (15 per person per trip, most economic bus from capital San Jose to field work area and back to the capital) - 15 (Maya airport transfer Uber, safer for solo women traveller) - 3 (Guillem public bus to airport and from)
Insurance	- 94.69 (Guillem insurance cost during research month) - 69.88 (Maya insurance cost during research month)
ESTA US customs	- 15.53
Medical/health and safety	- 30 (first aid kits) - 296 (Vaccinations maya) - 26.34 (vaccinations Guillem yellow fever and dengue ) - 20 (malaria medication just in case)
Research Permits	N/A
<b>Total expenditure</b>	<b>awarded: 3000</b>
<b>That is subtracting expenses from amount awarded</b>	<b>Spent: 3531.64</b>
	<b>- 531.64</b>

Receipts of payments available upon request for certain costs done via bank transfer

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## Bibliography:

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