# BUTTERFLIES IN THE CITY: MODELING URBAN POPULATION DYNAMICS

Summary

How do butterfly populations persist and organize across fragmented green spaces in urban environments? This project investigates the **spatio-temporal dynamics** of butterfly species in the city of Barcelona, using high-resolution data from the Urban Butterfly Monitoring Scheme (uBMS). The student will develop and analyze **mathematical and computational models**— including differential equations, stochastic simulations, and agent-based models— implemented in **Python (or Julia)**.

$$\frac{dx_i}{dt}dt = \begin{matrix} f_i(x_1,..,x_n) \\ f_n(x_1,..,x_n) \end{matrix}$$

GIS
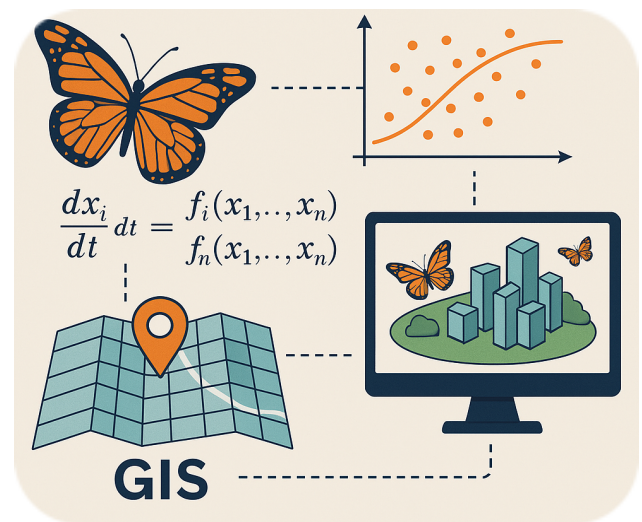
This TFM is ideal for students with a strong background in **mathematical modeling, programming**, and an interest in applying engineering methods to ecological systems. The work will be carried out in collaboration with Dr. Yolanda Melero's group (Universitat de Barcelona), and will connect with a parallel project using **neural networks** to model butterfly population trends. The student will gain experience applying advanced modeling and simulation techniques to real-world data in a context that combines engineering, ecology, and computation.

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