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Optimising Insect-Production Facility Location: A Bi-objective Cost–Sustainability Model

The insect-production industry has been growing rapidly, creating a demand for new decision-support tools. Locating insect-production facilities, however, is difficult because site choice directly affects the cost savings and sustainability benefits that can be achieved. A poor location can undermine a project: if a plant is not close to sources of insect feed, transporting the necessary by-products becomes much more expensive and reduces the overall sustainability of the supply chain.

Facility-location and supply-chain studies already address multi-objective trade-offs between cost and sustainability, but little research does so for the insect industry while taking its unique production traits into account. We set our work apart by allowing the rearing substrate to consist of a mix of by-products to represent flexibility in substrate production.

In this study we formulate a bi-objective mixed-integer linear model that minimizes total cost and the environmental impact associated with each by-product. The model employs the AUGMECON ε-constraint strategy, enabling decision-makers to generate Pareto-efficient solutions and explore cost–sustainability trade-offs. To test the model, we will use the Gurobi solver in Python to compare scenarios for small, medium and large production facilities.

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