5 August 2025

Re. Manuscript submission to Methods in Ecology and Evolution

Dear Editors,

We are pleased to submit our manuscript entitled "Data-Driven Discovery of Mechanistic Ecosystem Models with LLMs" for consideration in *Methods in Ecology and Evolution*. This work presents a novel framework, AI for Models of Ecosystems (AIME), that integrates large language models (LLMs) with evolutionary optimization to automate the generation of interpretable, mechanistic ecosystem models from time-series data.

Ecosystem models are foundational tools for sustainable environmental management, yet their development remains time- and expertise-intensive. AIME addresses this bottleneck by enabling rapid, automated model generation while preserving ecological interpretability. Unlike black-box AI approaches, AIME produces models with biologically meaningful parameters, offering both predictive power and scientific insight.

We demonstrate AIME's capabilities through two complementary marine case studies. In the first, a synthetic nutrient–phytoplankton–zooplankton (NPZ) model, AIME nearly perfectly recovers known ecological dynamics with high quantitative fidelity. In the second, a Crown-of-Thorns Starfish (COTS) model, AIME-generated models approach expert-generated models in capturing outbreak dynamics and forecasting coral cover. These results suggest that approaches like AIME could accelerate model development for ecosystem-based management, particularly in contexts requiring timely responses to environmental threats. We believe this work aligns strongly with *MEE*'s mission to publish research that advances methodological developments in ecology and evolutionary biology.

We confirm that this manuscript is original, has not been published elsewhere, and is not under consideration by another journal. All authors have approved the manuscript and agree with its submission to *Methods in Ecology and Evolution*.

Thank you for considering our work. We look forward to your feedback and hope it will contribute meaningfully to the journal's readership and the broader sustainability community.

Sincerely,

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