Unifying ecological networks and dynamical systems.

Vasileios Vachtsevanos, *Aristotle University of Thessaloniki & University of Thessaly*
Email : vvachtse@physics.auth.gr

Introduction

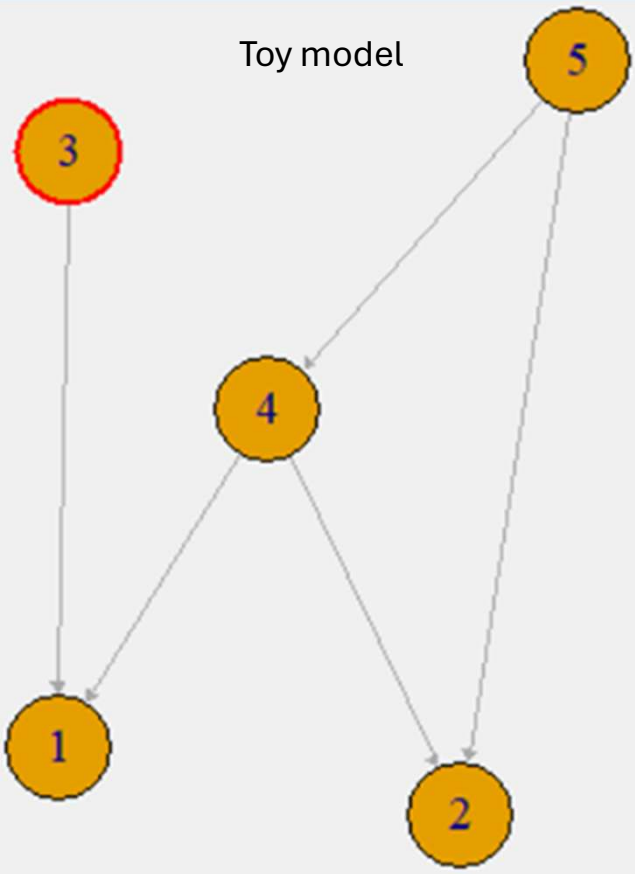
Ecology is a science that has long been related to both dynamical systems through predator prey models or competition models. However, one aspect of ecology that is well within the range of complexity is the stability of ecosystems when represented as an ecological network. So far techniques directly inspired by network analysis (like loop analysis or centralities) have been used to study those complex systems.

Proposed Model

One idea that sprang to mind was the unification of both principles. Using a network we should be able to create a dynamical system to describe its behaviour. However this task has some limitations:

- Model Accuracy
- Coverage of all complex phenomena (ie larval stages)
- Computational feasibility

Toy model



$$u_1' = a_1(1 - b_4(u_4 + u_3))u_1$$
$$u_2' = a_2(1 - b_2(u_4 + u_5))u_2$$
$$u_3' = a_3(1 + c_3u_1 - e_3u_4)u_3$$
$$u_4' = a_4(1 + c_4(u_1 + u_2) - e_4(u_3 + u_5) - b_4u_5)u_4$$
$$u_5' = a_5(1 + c_5(u_4 + u_2) - e_5u_4)u_5$$

Solution

For this reason the following system was developed based on the Lotka-Volterra model .

$$u_i' = a_i(1 + c_i\sum u_m - e_i\sum u_k - b_i\sum u_j)u_i$$

Where for each species i , the species competes with all the species k and is preyed upon species j and m is it's prey/ source of food. The group k is determined using ego nets around i's source of food

Aknowledgements

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