

A (not so) gentle introduction to ecological networks

Timothée Poisot

Université du Québec à Rimouski

August 14, 2013

Why should I care about networks?

- ▶ A good way to harness complexity
- ▶ A solid mathematical foundation
- ▶ Elegant algorithms
- ▶ That guy is going to talk about them for, like, two hours...

What is a network?

A mathematical approach

A *graph* is a **representation** of a **set of objects** where some pairs of objects are **connected** by **links**.

Or more formally, $G = (V, E)$, a *graph* G is an ordered pair of *vertices* V linked together by *edges* E .

Each element of E is a two-element subset of V .

The *order* of a graph is $|V|$, and its *size* is $|E|$.

What is a network?

An example

In an omnivory scenario, one top predator P consumes both an intermediate consumer C and a primary producer R . The intermediate consumer also consumes the producer.

This network is specified by

$$G = (\{P, C, R\}, \{\{P, C\}, \{P, R\}, \{C, R\}\})$$

Or for brevity

$$G = (\{P, C, R\}, \{PC, PR, CR\})$$

What is a network?

Edge direction

Edges can be *directed* (arcs, directed edges) or not. An edge between a vertex and itself (cannibalism) is a *self-loop*.

In an **undirected graph**, there are at most $|V|(|V| - 1)/2$ edges if there are no *self-loops*.

In a **directed graph**, there are at most $|V|(|V| - 1)$ edges if there are no *self-loops*.

Exercise: What is the maximal size of a graph of order n if there are self-loops?

Where is the ecology in all that?

- graph** The whole community, *i.e.* the populations and their interactions
- vertices** The composition of the community (species present)
- edges** The interactions between the populations

Where is the ecology in all that?

Exemple of “networkable” systems

- ▶ Trophic systems
- ▶ Plant–pollinators
- ▶ Hosts–parasites
- ▶ Mutualism
- ▶ Social interactions

Any system in which the **same ecological interaction** happens several time in a community can (should) be studied using network theory

The niche model of food webs