

Knowledge Graphs in Ecology: Linking Data, Concepts, and Systems

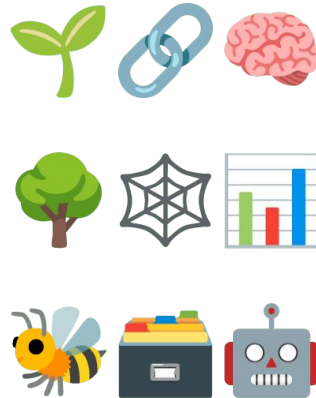


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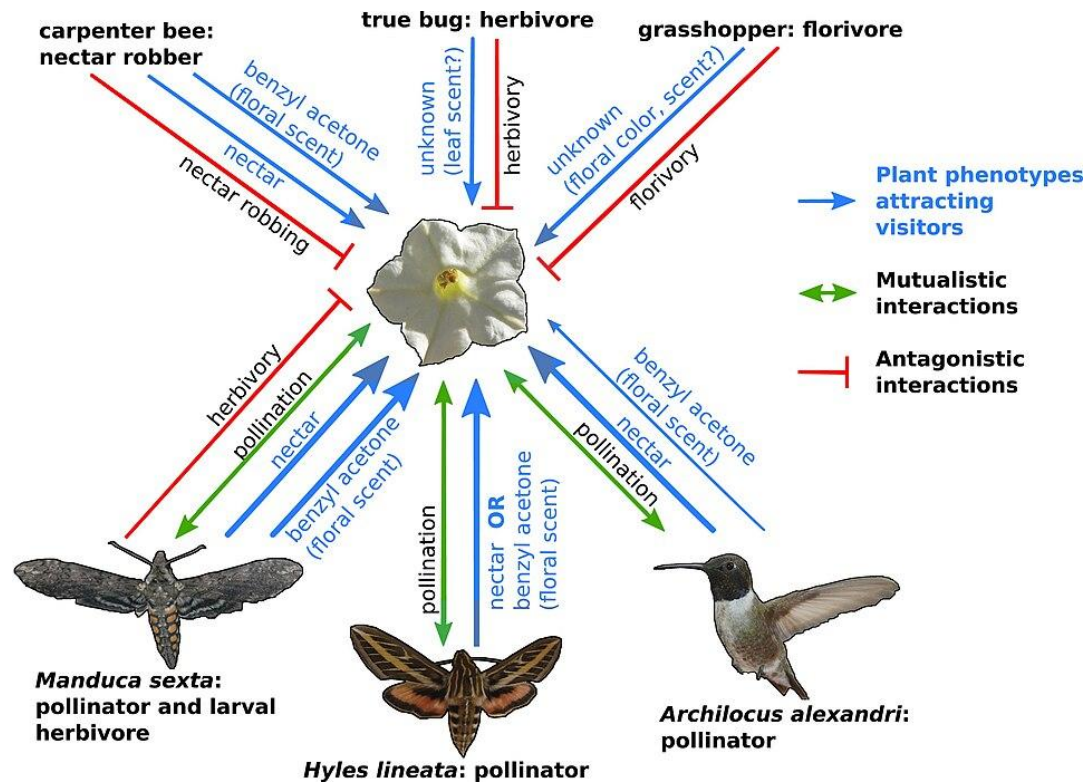
Networks in ecology (I)

- What kinds of networks do you know that are relevant for ecology?

Networks in ecology (II)

Pollinator networks

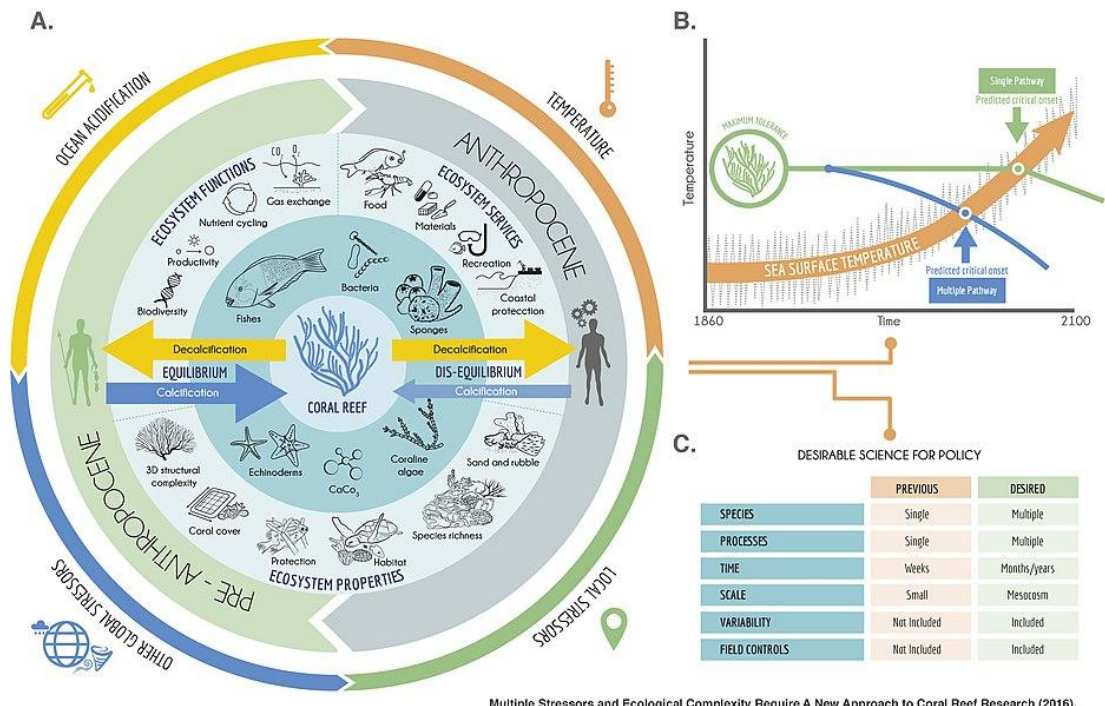
- Species
- Phenotypes
- Interactions
- Mechanisms
- Costs
- Benefits
- ...



Networks in ecology (III)

Reef networks

- Species
- Phenotypes
- Interactions
- Mechanisms
- Costs
- Benefits
- Humans
 - data
 - tools
 - policies



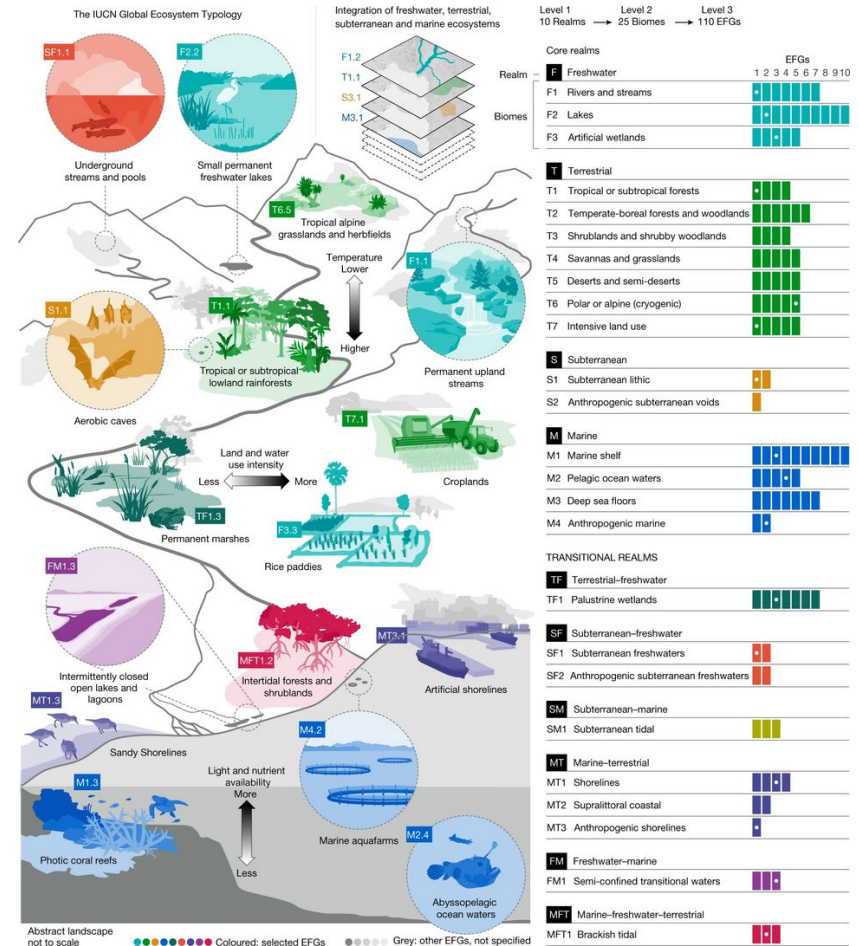
Multiple Stressors and Ecological Complexity Require a New Approach to Coral Reef Research (2016)

... Pendleton et al. (2016) Multiple Stressors and Ecological Complexity Require a New Approach to Coral Reef Research. Front. Mar. Sci. 3:36. doi: [10.3389/fmars.2016.00036](https://doi.org/10.3389/fmars.2016.00036) . CC BY 4.0.

Networks in ecology (IV)

Ecosystems

- Species
- Phenotypes
- Interactions
- Mechanisms
- Costs
- Benefits
- Habitats
- Abiotic factors
- ...

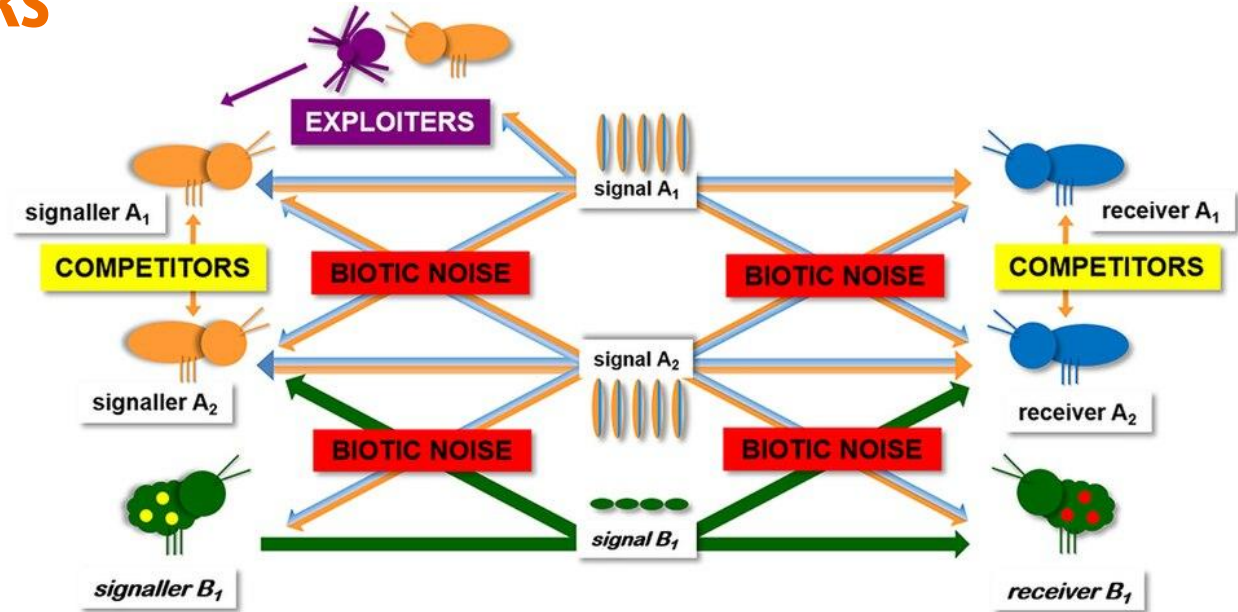


Keith, D.A., Ferrer-Paris, J.R., Nicholson, E. et al. A function-based typology for Earth's ecosystems. Nature (2022). doi: [10.1038/s41586-022-05318-4](https://doi.org/10.1038/s41586-022-05318-4). CC BY 4.0.

Networks in ecology (V)

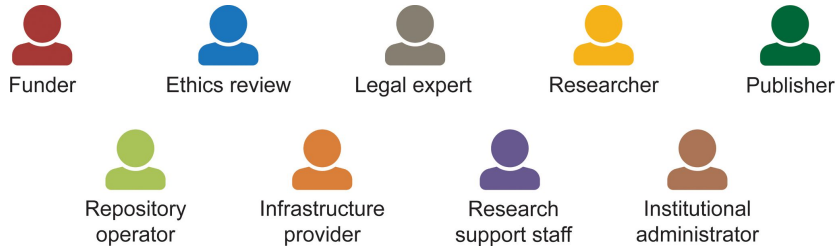
Signalling networks

- Species
- Individuals
- Phenotypes
- Interactions
- Signals
- Costs
- Benefits
- ...



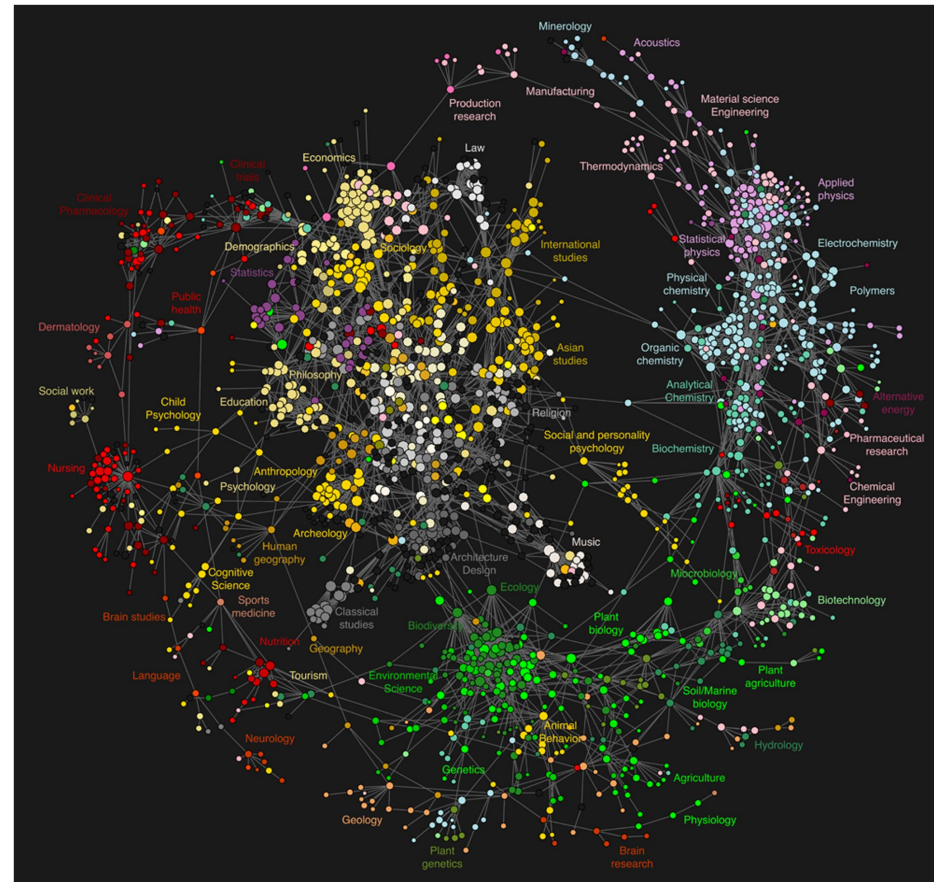
Virant-Doberlet M, Kuhelj A, Polajnar J and Šturm R (2019) Predator-Prey Interactions and Eavesdropping in Vibrational Communication Networks. Front. Ecol. Evol. 7:203. doi: [10.3389/fevo.2019.00203](https://doi.org/10.3389/fevo.2019.00203). CC BY 4.0.

Networks in ecology and beyond



Miksa et al. (2019) Ten principles for machine-actionable data management plans. PLoS Comput Biol 15(3): e1006750. <https://doi.org/10.1371/journal.pcbi.1006750>

Ecology is part of a broader research landscape with multiple stakeholder groups



Bollen et al. (2009) Clickstream Data Yields High-Resolution Maps of Science. PLoS ONE 4(3): e4803. doi: [10.1371/journal.pone.0004803](https://doi.org/10.1371/journal.pone.0004803) . Public domain.

Knowledge graphs (II)

Most of the networks we have seen so far can be thought of as graphs built around entities and their relationships.

A pollinates B

C attracts D

E senses F

E eats F

...

General concept of a semantic triple (A,B,C):

Entity A has relationship B with Entity C
(node A $\Rightarrow$ edge B $\Rightarrow$ node C)

Graphs consist of collections of such semantic triples:

Entity A has relationship B with Entity C

Entity A has relationship G with Entity H

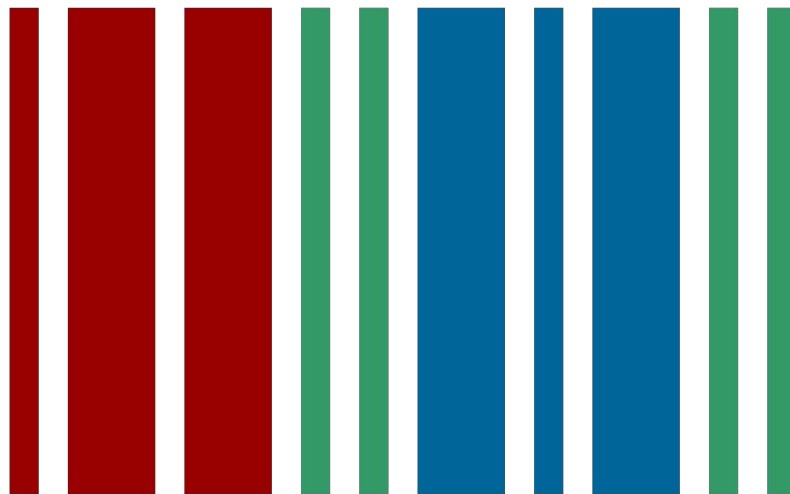
Entity A has relationship I with Entity J

Entity K has relationship L with Entity C

...

Practical examples of knowledge graphs (I): Wikidata

- <https://wikidata.org/>
- Sister project to Wikipedia
- Over 100 million entities
- Over 10,000 relationships
- The database that anyone can edit / the edit button of the semantic web.
- Knows about taxa, habitats, chemicals, researchers, research methods, papers, TV shows, figure skating, mathematics and more
- ...



- Can be browsed via <https://scholia.toolforge.org/>

Practical examples of knowledge graphs (II): GloBI

- <https://globalbioticinteractions.org/>
- Knows about taxa and relationships between them
- Comes with a [dedicated browser](#)
- ...



Thank you!

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