

## Coincidence?!

Strong correlations can result from direct causality between two factors, a common confounding factor, or coincidences (see e.g. <http://www.tylervigen.com/spurious-correlations>). For example, a strong correlation between temperature and the population size of loggerhead turtles, is unlikely to imply that the number of loggerhead turtles affects global temperatures. Although difficult, being able to distinguish causes, effects and coincidences is crucial for effective ecosystem management. Fortunately various methods have been developed that aim at making this distinction. These methods range from simple statistics such as Granger causality to more elaborate techniques such as convergent cross mapping (CCM) and structural equation modelling (SEM). However, like any statistical method, these methods too can return false positives: i.e. identify spurious causal relationships.

The goal of this project is to assess the power of these methods for ecological systems. Depending on the interests and skills of the prospective student, the project would focus on applying the methods either to a variety of simulated data, or to existing time series that are to be extracted from online databases, such as BioTime and satellite based temperature data. From these applications, the student is expected to construct an understanding of the strengths and weaknesses of these methods compared to ordinary correlation analyses.

I'm looking forward to your message if you want to discuss this project in more detail!

### Suggested reading

Sugihara, G., R. May, H. Ye, C. H. Hsieh, E. Deyle, M. Fogarty, and S. Munch (2012). *Detecting causality in complex ecosystems*. Science

Barraquand, F., Picoche, C., Detto, M., & Hartig, F. (2021). *Inferring species interactions using Granger causality and convergent cross mapping*. Theoretical Ecology

**Methods** Analysis of existing datasets, and possibly data simulations in R (or Python).

**State of the project** This is a new project. New projects tend to come with greater freedom as well as greater challenges.



**Staff member:** Koen van Benthem

**Daily supervisor:**

**Expertise group:** TRÊS

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**Contact:**

**Type of project:**  Bioinformatics  Fieldwork  Laboratory  Theoretical  Data analysis

**MSc program:**  Biology  Ecology and Evolution  Behavioural and Cognitive Neurosciences

Biomedical Sciences  Biomolecular Sciences  Marine Biology

**ECTS:**  30  40 **Language:**  Dutch  English

**Start date:** flexible

**Location:** at a desk