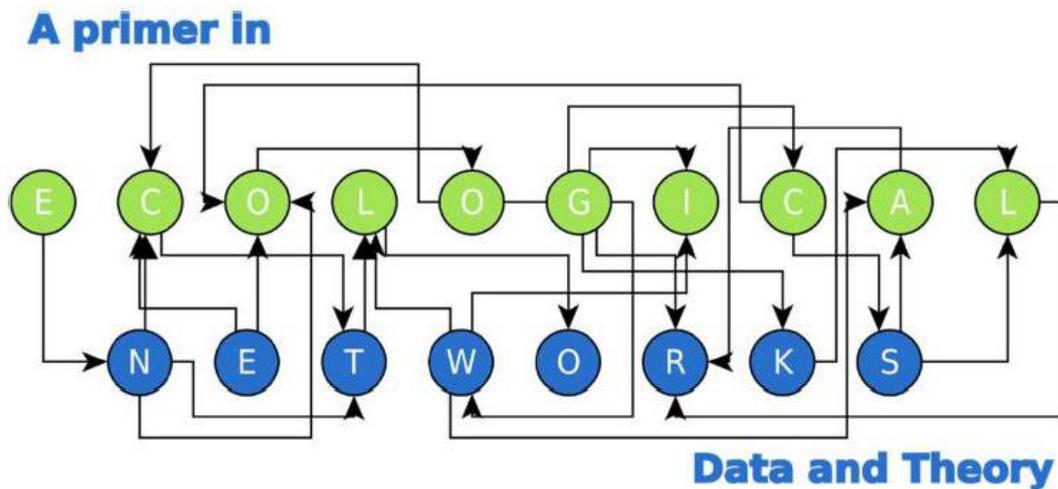


PHD PROGRAM:
EVOLUTIONARY BIOLOGY AND ECOLOGY
UNIVERSITY OF PARMA, FERRARA AND FLORENCE (ITALY)

UNIVERSITY OF PARMA, CAMPUS, PARCO AREA DELLE SCIENZE

INTERNATIONAL SUMMER SCHOOL



“...there are always connections: you have only to find them”

Umberto Eco – Foucault’s Pendulum

“Nothing is more practical than theory”

Richard Levins – Harvard University

TITLE 2019: “NETWORKS AS TOOLS TO DISENTANGLE THE COMPLEXITY OF SOCIO-ECOLOGICAL SYSTEMS”

June 18-20, 2019

Networks have become a paradigmatic representation of the complexity of natural and human-dominated environments, whose dynamics is the result of the multiplicity of interactions between their many components. The last frontiers of ecological and social research identify networks as the ideal means to understand the nature of these systems and their dynamics, which is full of counterintuitive behaviors and feedbacks. Moreover, the two domains interact: social relationships, paradigms and attitudes shape policies through which humans manage and affect nature. It is thus important that social and ecological networks are seen as integrated in a social-ecological realm so that causes and effects of environmental changes can be really understood. The summer school aims to introduce network analysis to graduate students and early postdocs but participation is possible to anyone who has interest in applying networks in the socio-ecological realm: from data collection to theoretical analysis, using a wide array of network types (food webs, ecosystem models, social networks) as well as mathematical and statistical tools to investigate them. The focus of this 2019 summer school is on qualitative networks and its applications to socio-ecological systems.

Instructors:

Antonio Bodini – Department of Chemistry, Life Sciences and Environmental Sustainability, University of Parma, Italy

Ferenc Jordan – Centre for Ecological Research, Hungarian Academy of Sciences, Budapest, Hungary

Marco Scotti – GEOMAR Helmholtz Center for Ocean Research Kiel, Germany

School coordinator:

Antonio Bodini

Syllabus

Tuesday, June 18, 2019

09:00-09:45

Antonio Bodini (School Coordinator)

- Opening lecture: presentation of the school, aims, topics and their relevance in the current pathways of scientific investigation

Lectures by *Ferenc Jordán*

Title – *The versatility of networks for the construction of a systemic view of science*

Morning (9:45-13.00)

- Food webs
- Animal social networks
- Protein interaction networks
- Habitat landscape networks
- Similarities and differences between the systems
- Old and new methods for studying networks

Afternoon (14.00-18.00)

- Network analyses on some example networks (software program: UCINET)
- Comparing the results of different approaches and discussing their use

Wednesday, June 19, 2019

Lectures by *Antonio Bodini*

Title – *The qualitative analysis of complex systems: an introduction to loop analysis*

Morning (9:00-13.00)

- Ecological and socio-ecological systems as signed digraphs
- Structural properties of signed digraphs: paths, loops and feedback
- Stability analysis of signed digraphs
- Loop model: predicting changes

Afternoon (14.00-18.00)

- How to construct a graph: variables, links, and alternative models
- Predictions and observations: how to compare model outcomes with observed changes
- A case study: building a model for the savanna ecosystem, comparing predictions with observations, analysis of management actions

Thursday, June 20, 2019

Lectures by *Marco Scotti & Antonio Bodini*

Title – *The qualitative analysis of complex systems: “LevinsAnalysis”, an R package for qualitative modelling*

Morning (9:00-13.00)

- Application of the qualitative algorithm of loop analysis to predict how food web interactions can mediate responses to perturbations: the case study of the Black Sea ecosystem in the years 1960-1990
- *LevinsAnalysis*: a package for loop analysis in R

Afternoon (14.00-18.00)

- How to create and import digraphs in the format required by the package *LevinsAnalysis*
- Use of loop analysis to generate predictions for all systems variables following the perturbation of target variables
- Properties of the digraphs (e.g. number of paths and their strength)
- Null models to test the significance of the results generated
- Interpretation of the main outcomes from loop analysis
- Visualization and graph layout

Software tools needed (participants are requested to download these programs):

- Microsoft Excel
- UCINET: www.analytictech.com
- R: <http://www.r-project.org/>
- R-studio: <https://www.rstudio.com/products/rstudio/download/R-studio>

R packages to install: *igraph*, *msm*, *MASS*, *DiagrammeR*, *DiagrammeRsvg*, *rsvg*

Registration

The course is mandatory for all the PhD students enrolled in the program “Ecology and Evolutionary Biology” of the Universities of Ferrara, Florence and Parma. Other PhD students and postdoctoral researchers are welcome. Attendance is free of charge although participants are requested to provide on their own for living and travel expenses. Registration will be open until June 1, 2019. To be registered to the school, an e-mail message with CV must be sent to antonio.bodini@unipr.it (school coordinator) before the deadline (June 1, 2019). Participants will be granted with 3 CFU and will receive a certification of attendance. An account to access the web during the days of the school will be provided to any of the attendants.

Date and Location

The course will be held June 18-20, 2019 at the University Campus, Centro Didattico Polifunzionale (see map below) Parco Area delle Scienze, Parma (Italy). From train station or city center the University Campus is served by buses n. 7 and 21. The last stop of the bus is right in front of the Centro Didattico Polifunzionale, the place where the course will be held.

CAMPUS MAP



Main entrance from
Via Langhirano (bus
n. 7, 21)

Where the course
will be held
Centro Didattico
Polifunzionale