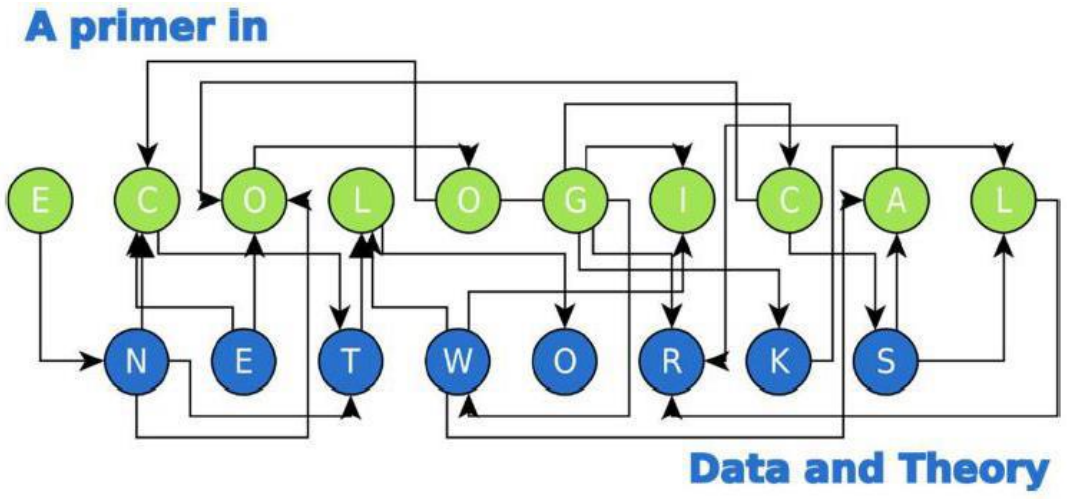
PHD PROGRAM:
EVOLUTIONARY BIOLOGY AND ECOLOGY
UNIVERSITY OF PARMA, FERRARA AND FLORENCE (ITALY)

UNIVERSITY OF PARMA, CAMPUS, PARCO AREA DELLE SCIENZE

INTERNATIONAL SUMMER SCHOOL



"…there are always connections: you have only to find them"
Umberto Eco ï Foucaultôs Pendulum

"Nothing is more practical than theory"
Richard Levins ï Harvard University

TITLE 2021: **"NETWORKS HELP EXPLORE THE CONTRADICTIONS OF SUSTAINABILITY"**

September 6-8, 2021

The passage from the awareness that a more environmentally sound society is a priority, to its effective achievement requires first that we recognize that environmental dynamics are complex and contradiction pervades this complexity. Neglecting contradiction as inherent constituent of complex systems has led to the idea, rooted in the general system thinking, that a sustainable society is one that provides permanent prosperity within the biophysical constraints of the real world in a way that is fair and equitable to all of humanity, to other species, and to future generations (e.g., environmental resources, opportunity, economy, privacy, community, the arts, education, and health). This view is clearly goal-seeking and it promises generalized benefits for which win-win solutions are called for. However, it is at best visionary, because human and environmental systems are governed by opposite interests and goals and this brings about contradictions at various levels. Because of this the road map to sustainability is contradictory in itself and far from being a smooth pathway.

In the field of environmental sciences and management we are experiencing a great contradiction: never in the past we had as many tools at disposal to predict and monitor the environment as we have today; similarly, the number and type of enforced regulations that nowadays curb human activity is unprecedented. Nevertheless the environment, human health, and biodiversity are being eroded at a faster rate. Ever grater problems call for more knowledge and stringent regulations in a vicious circular path that allows polluters and regulators to prosper and reinforce reciprocally although they are in opposition one another.

In this school we will guide students to use the network approach to analyze environmental complexity and provide some basic ideas as for exploring contradictions that are inherent in management questions. The summer school aims to introduce network analysis to graduate students and early postdocs but participation is possible to anyone who has interest in using networks: from data collection to model building to theoretical analysis and applications.

Instructors:

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

Ferenc Jordan – Central European University, Budapest, Hungary

Marco Scotti – GEOMAR Helmholtz Center for Ocean Research Kiel, Germany and National Research Council, Italy.

School coordinator:

Antonio Bodini

Syllabus

Monday, September 6, 2021

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

Since ecology is the science of co-existence, interactions and their networks are essential objects of ecological thinking. To better understand the complexity of ecosystems, one strategy is to identify the most important components of ecological networks. Several approaches to network analysis will be presented, from earliest to the latest ones, focusing on the position of individual organisms, the role of interactions and the structure of whole networks. Beyond food webs, also habitat networks and animal social networks will be discussed.

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 (14.30-17.00)

- Network analyses on some example networks (software program: UCINET)

Tuesday, September 7, 2021

Lectures by ***Antonio Bodini***

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

Morning (9:45-13.00)

- Loop analysis as a predicting tool: essential concepts and graphic algorithm
- How to describe environmental systems using signed digraph
- Ecosystem response to perturbations: trade-offs and synergies or why win-win solutions are the exception rather than the rule in environmental management

Afternoon (14.30-17.00)

- Working groups to explore a case study: model construction, analysis and dialectical interpretation.

Wednesday, September 8, 2019

Lectures by ***Marco Scotti***

Title ï **Network models to plan the management of marine ecosystems**

Marine ecosystems are exposed to multiple and simultaneous anthropic pressures, which threaten biodiversity conservation and alter food web functioning. Such pressures are of either local (e.g. nutrient enrichment, fishing) or global (e.g. ocean warming) origin and concur to move ecosystems away from their Good Environmental Status, as described in the EU Marine Strategy Framework Directive. However, defining what a healthy ecosystem consists of and disentangling the cause-effect mechanisms responsible for modifying both structure and dynamics of marine food webs are objectives far from trivial. During the lecture, I will introduce the use of qualitative and quantitative ecosystem models to illustrate the key role that overfishing had to cause the regime shift observed in the Black Sea during the early 1990s. I will also present a comparative analysis between alternative management scenarios applied to the western Baltic Sea case study, showing how ecosystem-based fisheries management responds to the needs of maintaining the yields of the main commercial targets without eroding biodiversity.

Morning (9:00-13.00)

- Loop analysis and the case study of the Black Sea ecosystem
- Ecopath with Ecosim (EwE) and the case study of the western Baltic Sea

Afternoon (14.00-18.00)

- How to create and import digraphs in the format required by the package LevinsAnalysis
- Loop analysis to generate predictions 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 the PhD students enrolled in the program ñEcology and Evolutionary Biologyò 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 August 20, 2021. 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 (August 20, 2021). 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 attendant.

ATTENTION: given the situation generated by the COVID-19 pandemic event, enrollment for the 2021 school is limited to Italian candidates or foreign candidates who are permanently in Italy. Further instructions concerning the measures anti COVID-19 will be provided in due time.

Date and Location

The school will be held September 6-8, 2021 at the University Campus, Cascina Ambolana (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 first stop of the bus inside the Campus is close to the Cascina Ambolana, the place where the course will be held.