**COMO ITALY
VILLA DEL GRUMELLO
August, 23rd-29th 2018**

1st International Summer School on statistical analysis of spatial data in agro-environmental research

SCHOOL DIRECTORS

Marco Acutis
Professor for Agronomy
University of Milan

Michael Maerker
Professor for Geomorphology
and GIS, University of Pavia

SPEAKERS

Aldo Lipani,
PhD, UC London, UK

Alessia Perego,
PhD, Univ. Milan Italy

Sergio Saia,
PhD CREA, Italy

Calogero Schillaci,
PhD, Univ. Milan, Italy

Elena Valkama,
PhD, Luke Insistute, Finland

Fabio Veronesi,
PhD, WRc plc Consulting, UK

SPONSORS

LAKE COMO SCHOOL
OF ADVANCED STUDIES

UNIVERSITÀ DEGLI STUDI
DI MILANO

UNIVERSITA' DI PAVIA

PROGRAM

The summer school on **S**tatistical analysis of spatial **d**ata in **a**gro-**e**nvironmental research (**SDAE**) aims to present statistical and numerical approaches for the integration of spatial information at various scales by combining land management with catchment and regional scale environmental data (e.g. soil organic carbon preservation and sequestration, nitrate leaching).

Topics: experimental and sample size design, advanced literature search tools (e.g., meta-analysis), statistical evaluation of input data, techniques for estimation of data at territorial scale (e.g., spatial mixed models, kriging, random forest, regression boosted trees), model performance evaluation, methods for covariate acquisition (satellite images) and selection, use of reference databases on land cover (CORINE land cover), soil data (LUCAS and ESDAC-JRC products), and weather data (MARS, Worldclim).

At the end of the **SDAE** summer school, participants will be able to set up field experiments, to use spatial information derived from plot to regional scale assessments, and to use advanced literature search tools. Students will acquire skills that will bridge the gap between scientific and requested professional knowledge in the field of spatial analysis.

The course is dedicated to PhD students, young researchers, master students, professionals specialized in territorial analysis with numerical-statistical background

General information: The SDAEST summer school takes place from 24ᵗʰ to 28ᵗʰ of August 2019 (09:00-18:00)

Costs and requirements: The **course fee is 250 €** and includes lunches, coffee breaks, and the social dinner. Transfer and overnight stay are on students expenses. The course is limited to 25 students. The admission to the course is subject to an evaluation of CVs. At the end of the course a certificate will be issued. Interested students and professionals are requested to send their CV to the course secretariat within **May 1ˢᵗ 2019** (**sdaestat@gmail.com**). The selected course participants will be informed on May 15ᵗʰ 2019 and the registration form will be sent with payment details. Accommodation in the nearby guest house (multiple rooms) is available at low fares for a limited number of participants (maximum 15), hotels within walking distances from the venue are also available.

Credits: Attendees will receive a course certificate (4 credits). However, it is up to the participant's institution to recognize the summer school as official course credit.

Location: Villa del Grumello, Fondazione Alessandro Volta COMO (Italy).

The course is organized by **Professor Marco Acutis** (full professor in Agronomy, University of Milan) and **Prof. Michael Märker** (associate professor of geology and geomorphology, University of Pavia), with the support of the Italian Society of Agronomy (SIA), the Italian Association of Physical Geography and Geomorphology. The course is divided into theoretical lessons in the morning and computer sessions in the afternoon with applications to case studies of agronomic interest, spatial data management, and terrain analysis. Participants can use their own laptops; software will be provided as trial version.

Preliminary Program

Monday 24 August 2019 - **Introduction to the Course and training objectives** Prof. Acutis, Dr. Perego, Prof. Märker. Basic of statistical models: ANOVA (one way, factorial), ANCOVA and Regression (linear, non linear and multiple), sampling size, number of replication, and sampling design. **First class**: Prof. Acutis- ANOVA, Sample size, number of replications **Second class:** Prof. Acutis-Dr. Perego, Multiple regression, Mixed model for long-time dataset (repeated measurement, random effects, covariance matrix). **Practical**: Sample size determination and definition of the number of replication, use of general linear models, complex designs (e.g Latin hypercube).

Tuesday 25 August 2019 – **Quantitative methods in literature search and analysis "Meta-analysis for environmental science". First class:** Dr. Valkama, introduction on literature analysis, **Second class:** Dr. Valkama, Meta-analysis. **Practical applications:** Creation of a literature database and applications using "OpenMEE" software.

Wednesday 26 August 2019 - **Spatial data processing and interpretation of topographical features through GIS software, Topography as source for environmental information. How to assess Digital elevation models. DEM quality assessment**. Prof. Märker, Dr. Schillaci. The use of topographic information in physically based and stochastic models to estimate agro-environmental variables. **First class:** SAGA terrain analysis, environmental process modelling such as soil erosion and storm flow. **Second class:** Spatial data inter- and extrapolation. **Practical applications**: examples and applications using SAGA GIS.

Thursday 27 August 2019 - **Machine learning for environmental modelling using reference databases, Dr. Veronesi, Dr. Schillaci, First class:** Spatial databases for soil and climate, Digital soil mapping and local uncertainty for environmental mapping; **Second Class:** Dr. Veronesi, Digital soil mapping, predictive mapping **Practical:** Machine learning as a tool for environmental mapping with R.; Spatial uncertainty modelling with R Dr. Veronesi, Dr. Schillaci, Dr. Saia.

Friday 28 August 2019- **Digital soil mapping and geostatistics for spatial assessment of the agro-environment**. **First class**: Dr. Schillaci, Dr Saia, Dr. Lipani: covariate selection (LASSO etc,) multiple linear regression, neural networks, the caret package(R). **Second Class:** Dr. Schillaci, Dr Saia, Dr. Lipani: Digital soil mapping of soil organic carbon (Boosted regression trees, Random Forest); **Practical:** Predictive mapping examples and applications-spatial uncertainty modelling with R. Dr. Schillaci, Dr. Lipani, Dr. Saia- Dr. Veronesi, Prof. Märker.