



ALMA MATER STUDIORUM  
UNIVERSITA DI BOLOGNA

## Workshop on Statistical methods for analysis of soil data

by

**Prof. Marco Bittelli**

Department of Agricultural and Food Sciences, University of Bologna, Italy

<http://www.dista.unibo.it/~bittelli/>

**13<sup>th</sup> to 16<sup>th</sup> September 2021**

Venue: Online Seminar

This workshop is organised as part of the ongoing SPARC project on “Prediction of soil hydro agricultural properties using Ground Penetrating Radar for improving Agricultural practice” jointly by IISc, Bangalore and University of Bologna, Italy. Is open for Post Graduate and Doctoral Students in Science and Engineering. Few faculty members are also allowed to participate. No registration fee but prior registration is mandatory. The seminar will be held using either Microsoft Teams or Google meet. Further details may be obtained from Dr. P Raghuvver Rao at [prvr Rao@iisc.ac.in](mailto:prvr Rao@iisc.ac.in)

### Schedule

Day 1 - 13<sup>th</sup> September 2021

16.00 – 17.30 Lecture 1

17.30 – 17.45 Break

17.45 – 19.15 Lecture 2

Day 2 - 14<sup>th</sup> September 2021

16.00 – 17.30 Lecture 3

17.30 – 17.45 Break

17.45 – 19.15 Lecture 4

Day 3 - 15<sup>th</sup> September 2021

16.00 – 17.30 Lecture 5

17.30 – 17.45 Break

17.45 – 19.15 Lecture 6

Day 4 - 16<sup>th</sup> September 2021

16.00 – 17.30 Lecture 7

17.30 – 17.45 Break

17.45 – 19.15 Lecture 8

All timings are Indian Standard Time (12.30 to 15.45 Italian Time)

Registration link: [https://docs.google.com/forms/d/e/1FAIpQLSf89ysrjzEJTQEkR-4rbSO57ySd\\_OvIEQRA7UHy-5gVJnupKw/viewform?vc=0&c=0&w=1&flr=0](https://docs.google.com/forms/d/e/1FAIpQLSf89ysrjzEJTQEkR-4rbSO57ySd_OvIEQRA7UHy-5gVJnupKw/viewform?vc=0&c=0&w=1&flr=0)

# Contents

**Introduction**

**RStudio**

**Data types and operators** (Vectors, Matrix, Array, List, Data Frame)

**Conditional Statements and Loops** (If statement, Else If statement, Else statement For loop, While loop)

**Managing Data** (Qualitative and quantitative data, managing Dates, subsetting, merging)

**Data Visualization** (Create graphs using plot, Create graphs using ggplot)

**Descriptive statistics:** Frequencies, Classes, Cumulative curves and frequencies, Measures of Central Tendency, Measures of Variability.

**Inferential statistics:** Population and sample, Confidence Intervals, Hypothesis tests

**Experimental Designs:** Completely randomized design, Randomized block design, Factorial experimental design, Latin square design, Nested design, Fixed or random variables: which model should I use?

**Analysis of Variance:** General description, Example, Analysis with R, Test for normality, One way ANOVA, Two way ANOVA, Tukey test

**Multivariate Analysis:** Principal components analysis, Factorial Analysis

**Linear Models:** Fitting a line to data, Least squares regression, Linear models with multiple parameters

**Non Linear Models:** Least squares regression for non linear models, Applications in R

**Time Series Analysis:** Singular Spectrum Analysis

**Geostatistics:** Application of basic geostatistics concepts.