

**TENTATIVE COURSE AGENDA- SOIL MAPPING COURSE AT MAKERERE UNIVERSITY, COLLEGE OF COMPUTING AND INFORMATION SCIENCES.**

Time	Topic	Responsible person
<b>DAY ONE (13 /JUNE/2022)</b>		
08:00 – 08:30	Arrival and Registration	-Dr. Janet Nabwami (FAO) and Dr. Patrick Musinguzi (MAK)
08:30 – 09:00	Prayer and Self-Introductions	
	<b>SESSION ONE: COURSE OVERVIEW</b>	
09:00 – 09:15	<ul style="list-style-type: none"> <li>Main learning outcomes of the course and course content</li> </ul>	- Ms. Isabel Luotto (FAO)
	<b>SESSION TWO: INTRODUCTION TO DIGITAL SOIL MAPPING AND SPATIAL DATA</b>	
09:15 – 10:00	<ul style="list-style-type: none"> <li>Introduction to soil mapping and spatial data</li> </ul>	-Ms. Isabel Luotto (FAO)
	<b>SESSION THREE: INTRODUCTION R</b>	
10:00 – 10:30	<ul style="list-style-type: none"> <li>What is R and what are its advantages?</li> <li>Introduction to RStudio</li> <li>What are packages and how do you install them?</li> </ul>	-Ms. Isabel Luotto (FAO)
<b>10:30– 11:00</b>	<b>TEA BREAK</b>	<b>-MAK</b>
	<b>SESSION FOUR: INTRODUCTION R</b>	
11:00 – 13:00	<ul style="list-style-type: none"> <li>Basic structure of the R language</li> <li>Basic example data analysis in R using a subsample soil data set</li> <li>Software installation trouble-shooting</li> </ul>	- Ms. Isabel Luotto (FAO)
<b>13:00– 14:00</b>	<b>LUNCH BREAK</b>	<b>-MAK</b>
	<b>SESSION FIVE: OFFICIAL OPENING AND WELCOME</b>	
14:00– 14:45	<b>Welcome remarks</b> <ul style="list-style-type: none"> <li>Principal, college of Agricultural and Environmental sciences (CAES), Makerere University</li> <li>Assistant Commissioner Soils and water conservation, MAAIF</li> <li>FAO Representative</li> <li>Director, South-South and Triangular Cooperation Division (PST), FAO</li> </ul>	Associate Professor, Goretta Nabanoga – CAES, Makerere university  Mr. Kabango Fred, MAAIF  Dr. Querido Antonio, FAO UG  Mr. Ye Anping, FAO Rome
<b>14:45– 15:00</b>	<b>GROUP PHOTO</b>	<b>MAK</b>
15:00– 15:30	<ul style="list-style-type: none"> <li>SSM Project overview</li> </ul>	Dr. Janet Nabwami
	<ul style="list-style-type: none"> <li>Introduction to the GSP, its areas of works and projects</li> </ul>	Ms. Isabel Luotto (FAO)
	<b>SESSION SIX: INTRODUCTION TO R</b>	
15:30 – 16:45	<ul style="list-style-type: none"> <li>Software installation trouble-shooting</li> </ul>	Ms. Isabel Luotto (FAO)
<b>16:45– 17:15</b>	<b>TEA BREAK AND END OF DAY ONE</b>	<b>-MAK</b>

<b>DAY TWO (14/JUNE /2022)</b>		
<b>SESSION ONE- OPENING AND WELCOME</b>		
08:00 – 08:30	<ul style="list-style-type: none"> <li>Arrival and Registration</li> </ul>	-Dr. Janet Nabwami (FAO) and Dr. Patrick Musinguzi (MAK)
08:30– 09:00	<ul style="list-style-type: none"> <li>Welcome and recap of day one</li> </ul>	Participants
<b>SESSION TWO- INTRODUCTION TO R FOR SPATIAL DATA ANALYSIS</b>		
09:00 –10:30	<ul style="list-style-type: none"> <li>Packages for digital soil mapping and data analysis used in this course</li> <li>Reading and plotting shape files into R</li> <li>Modifying the attribute table of a shape file</li> <li>Reading and plotting rasters into R</li> <li>Changing the resolution and projection of Rasters</li> </ul>	- Ms. Isabel Luotto (FAO)
<b>10:30– 11:00</b>	<b>TEA BREAK</b>	<b>-MAK</b>
<b>SESSION THREE- INTRODUCTION TO R FOR SPATIAL DATA ANALYSIS</b>		
11:00 –13:00	<ul style="list-style-type: none"> <li>Cropping and masking rasters</li> <li>The raster stack/brick</li> <li>Basic raster calculations</li> <li>Creating maps in R</li> </ul>	- Ms. Isabel Luotto (FAO)
<b>13:00– 14:00</b>	<b>LUNCH BREAK</b>	<b>-MAK</b>
<b>SESSION FOUR- INPUT DATA PREPARATION</b>		
14:00 – 16:45	<ul style="list-style-type: none"> <li>Importing, exploring and merging the soil data into R</li> <li>Explore and clean the SOC data</li> <li>Explore and clean the Clay data</li> <li>Explore and clean bulk density data</li> <li>Explore and clean coarse fragments data</li> <li>Pedotransfer functions</li> <li>Estimating target depth</li> <li>Calculating organic carbon stock</li> <li>Data Normalization</li> <li>Calculating organic carbon stock</li> <li>Splitting the data into a training and testing data set</li> </ul>	- Ms. Isabel Luotto (FAO)
<b>16:45– 17:00</b>	<b>TEA BREAK AND END OF DAY TWO</b>	<b>-MAK</b>
<b>DAY THREE (15 /JUNE/2022)</b>		
<b>SESSION ONE- OPENING AND WELCOME</b>		
08:00 – 08:30	<ul style="list-style-type: none"> <li>Arrival and Registration</li> </ul>	-Dr. Janet Nabwami (FAO) and Dr. Patrick Musinguzi (MAK)
08:30– 09:00	<ul style="list-style-type: none"> <li>Welcome and Recap of day two</li> </ul>	-Participants
<b>SESSION TWO: PREPARATION OF THE COVARIATES</b>		
9:00 – 10:30	<ul style="list-style-type: none"> <li>Finding and preparing the covariates</li> <li>Creating a RasterStack (matching extent, projection and resolution)</li> </ul>	- Ms. Isabel Luotto (FAO)

	<ul style="list-style-type: none"> <li>Create a Spatial Points Data Frame</li> </ul>	
<b>10:30– 11:00</b>	<b>BREAK TEA</b>	<b>-MAK</b>
	<b>SESSION THREE: PREPARATION OF THE COVARIATES</b>	
11:00 – 13:00	<ul style="list-style-type: none"> <li>Extract data from the Rasterstack and merge it with our data</li> <li>Check which covariates are correlated with the target variable</li> <li>Subset the Rasterstack</li> <li>Reproject a land cover map</li> </ul>	-Ms. Isabel Luotto (FAO)
<b>13:00– 14:00</b>	<b>LUNCH BREAK</b>	<b>-MAK</b>
	<b>SESSION FOUR: PREPARATION OF THE COVARIATES</b>	
14:00 – 16:45	<ul style="list-style-type: none"> <li>Rasterize a soil type map</li> <li>Mask our stacked covariates</li> <li>Editing the script to apply the same procedure for Clay</li> </ul>	- Ms. Isabel Luotto (FAO)
<b>16:45– 17:15</b>	<b>TEA BREAK AND END OF DAY THREE</b>	<b>-MAK</b>
	<b>DAY FOUR (16/JUNE /2022)</b>	
	<b>SESSION ONE- OPENING AND WELCOME</b>	
08:00 – 08:30	<ul style="list-style-type: none"> <li>Arrival and Registration</li> </ul>	-Dr. Janet Nabwami (FAO) and Dr. Patrick Musinguzi (MAK)
08:30– 09:00	<ul style="list-style-type: none"> <li>Welcome and recap of day three</li> </ul>	-Participants
	<b>SESSION TWO- MAPPING SOIL PROPERTIES USING REGRESSION KRIGING</b>	
09:00 –10:30	<ul style="list-style-type: none"> <li>Intro to Regression Kriging</li> <li>Extracting covariate values</li> <li>Categorical variables in modeling</li> <li>Linear regression</li> <li>Assumptions of linear regression</li> </ul>	- Ms. Isabel Luotto (FAO)
<b>10:30– 11:00</b>	<b>TEA BREAK</b>	<b>-MAK</b>
	<b>SESSION THREE- MAPPING SOIL PROPERTIES USING REGRESSION KRIGING</b>	
11:00 –13:00	<ul style="list-style-type: none"> <li>Multiple Linear Regression in R</li> <li>Stepwise variable selection</li> <li>Graphical diagnosis of MLR</li> <li>Collinearity test</li> <li>Kriging the residuals</li> <li>Estimating uncertainty</li> <li>Modifying the script to run it for Clay</li> </ul>	- Ms. Isabel Luotto (FAO)
<b>13:00– 14:00</b>	<b>LUNCH BREAK</b>	<b>-MAK</b>
	<b>SESSION FOUR- RANDOM FOREST</b>	
14:00 – 16:45	<ul style="list-style-type: none"> <li>Intro to data-mining: Random Forest</li> <li>Data Preparation</li> <li>Tuning Random Forest parameters</li> <li>Running the model</li> <li>Estimating uncertainty using quantile regression forest</li> </ul>	- Ms. Isabel Luotto (FAO)

	<ul style="list-style-type: none"> <li>Modifying the script to run it for Clay</li> </ul>	
<b>16:45– 17:00</b>	<b>TEA BREAK AND END OF DAY FOUR</b>	<b>-MAK</b>
<b>DAY FIVE (17 /JUNE/2022)</b>		
<b>SESSION ONE- OPENING AND WELCOME</b>		
08:00 – 08:30	<ul style="list-style-type: none"> <li>Arrival and Registration</li> </ul>	-Dr. Janet Nabwami (FAO) and Dr. Patrick Musinguzi (MAK)
08:30– 09:00	<ul style="list-style-type: none"> <li>Welcome and Recap of day four</li> </ul>	-Participants
	<b>SESSION TWO: UNCERTAINTY ESTIMATION</b>	
09:00 – 10:30	<ul style="list-style-type: none"> <li>What is uncertainty?</li> <li>Sources of uncertainty</li> <li>Uncertainty of Regression Kriging</li> <li>Uncertainty of Random Forest</li> </ul>	- Ms. Isabel Luotto (FAO)
<b>10:30– 11:00</b>	<b>BREAK TEA</b>	<b>-MAK</b>
	<b>SESSION THREE: MAP VALIDATION AND VISUALIZATION</b>	
11:00 – 13:00	<ul style="list-style-type: none"> <li>What is validation?</li> <li>Validation methods</li> </ul>	-Ms. Isabel Luotto (FAO)
<b>13:00– 14:00</b>	<b>LUNCH BREAK</b>	<b>-MAK</b>
	<b>SESSION FOUR: MAP VALIDATION AND VISUALIZATION</b>	
14:00 – 15:30	<ul style="list-style-type: none"> <li>Prediction error and map quality measures</li> </ul>	- Ms. Isabel Luotto (FAO)
15:30-16:00	<ul style="list-style-type: none"> <li>Course evaluation</li> </ul>	- Ms. Isabel Luotto (FAO) and Dr. Janet Nabwami (FAO)
16:00-16:45	<ul style="list-style-type: none"> <li>Closing remarks</li> </ul>	FAO, MAAIF, MAK
<b>16:45– 17:15</b>	<b>TEA BREAK AND END OF DAY FIVE</b>	<b>-MAK</b>