2025 Seminar Series "Case Studies on Food and Agricultural Statistics"

LM Statistical Methods and Applications

Seminar Abstracts

4 March - Methodology for the disaggregation of SDG indicators – Aida Khalil

The seminar will introduce data disaggregation methodologies for SDG Indicators computed using survey microdata. After presenting the main concepts related to direct and indirect estimation, the basic area and unit level Small Area Estimation (SAE) models will be discussed along with the key steps for their implementation. The seminar will also provide practical examples of possible SAE applications in official statistics and in the context of the SDG Monitoring Framework, based on the experience of FAO and other International Organizations.

11 March - Laboratory: Small Area Estimation techniques for the disaggregation of SDG indicators – Aida Khalil, Stefano Di Candia

Building on Small Area Estimation (SAE) models presented during the seminar on the *Methodology for the disaggregation of SDG Indicators*, this laboratory will focus on a practical application of an area-level SAE model for the disaggregation of SDG Indicator 2.1.2 (Prevalence of moderate and severe food insecurity in the population) at granular sub-national level. The case study will be implemented with R, using microdata from the Chilean National Socio-Economic Characterization Survey and auxiliary variables retrieved from several administrative registers and the database of the Chilean Population and Housing Census.

18 March – SDG indicator 15.4.2: Monitoring progress on the conservation of mountain ecosystems – Javier De Lamo

This session will focus on SDG Indicator 15.4.2: a) Mountain Green Cover Index, b) Proportion of Degraded Mountain Land, one of the two indicators that monitor progress on the conservation of mountain ecosystems in the SDG Monitoring Framework. The session will cover the key standards and metrics associated to this indicator as well the process carried out for the recent methodological refinement of this indicator. Participants will explore methods for calculating this indicator, including through using some of the computational tools produced by FAO for this purpose, and how to interpret its results to assess progress the conservation of mountain ecosystems.

25 March - National Forest Monitoring for Climate Action – Javier Garcia Perez

This seminar will focus on the critical role of sample-based area estimation in tracking forest cover changes. Sample-based methods provide a robust statistical approach for estimating deforestation, forest degradation, and associated land-use changes. These techniques are vital for countries to meet international reporting obligations, such as under REDD+ (Reducing Emissions from Deforestation and Forest Degradation), while supporting climate action commitments. The seminar will delve into the importance of stratified sampling, reducing bias and uncertainties, and ensuring reliable national forest monitoring systems.

Students will be provided with hands-on tools and knowledge to address real-world challenges in forest monitoring and climate mitigation. By combining theoretical understanding with practical exercises, participants will gain critical insights into statistical methods that enhance the accuracy and reliability of forest-related emission reduction estimates, contributing to evidence-based climate action.

1 April - Monte Carlo Techniques for Climate Mitigation in Forests – Javier Garcia Perez

This seminar will introduce participants to stochastic simulation methods for uncertainty estimation in emission reductions. Monte Carlo simulations allow for the propagation of uncertainties from multiple sources, such as sampling, measurement errors, and emission factors, by repeatedly sampling from probability distributions. Through an interactive Excel-based exercise, students will learn how to apply Monte Carlo techniques to estimate emissions reductions from avoided deforestation. This practical component will demonstrate how statistical simulations can improve the robustness of emission estimates, addressing uncertainties inherent in forest monitoring systems.

Similarly to the previous seminar, students will be provided with hands-on tools and knowledge to address real-world challenges in climate mitigation. By combining theoretical understanding with practical exercises, participants will gain critical insights into statistical methods that enhance the accuracy and reliability of forest-related emission reduction estimates, contributing to evidence-based climate action.

8 April – Preparing to model wood fuel and to communicate results – Ashley Steel

Wood fuel is an affordable fuel to those who cannot access other energy sources, yet takes time to collect and therefore presents a tremendous opportunity cost, particularly for women. According to estimates in Tracking SDG7 - The Energy Progress Report 2021 (IEA, IRENA, UN, World Bank and WHO, 2021), one third of the global population, or about 2.6 billion people worldwide, relied on traditional fuels, mainly biomass (wood, agricultural residues, etc.) and charcoal for household cooking in 2019. Use of wood fuel can also lead to indoor air pollution and illegal charcoal production is associated with deforestation and forest degradation.

Estimating the global production of wood fuel is therefore of particular importance for designing energy, land management, and human health policies that can lead toward sustainable development. Estimating the global production of wood fuel is also of particular importance for

understanding and tracking the share of wood-based energy in total final energy consumption, the proposed indicator 10 of the Global Core Set of Forest-related Indicators. However, data to understand and quantify the production of wood fuel, particularly, wood fuel that is informally collected, are sparse.

This seminar will begin with data etymology (the original source of data) and the role of international classifications in model building as well as the elements of and importance of a well-designed question. It will provide details of (and inside story of) a systematic country-by-country search for available data to update the model used by FAO in estimating wood fuel production for countries which do not submit official statistics. It will also describe the expert panel that was convened to design a conceptual model of drivers of wood fuel production, at national level, that can be used for creating future estimates. Finally, this seminar will conclude with the importance of and opportunities for communicating uncertainty in modelled estimates with enthusiasm and touch on hidden statistical uncertainty in the multiverse.

15 April – Modelling wood fuel and wood charcoal production – Oliver Stoner

Global wood fuel production reflects sustainable development, forest management, and energy access. Estimates are essential for tracking many global goals; yet reliable measurements of wood fuel removals and charcoal production are rare. Revised estimates were created using Random Forest models built on the strongest FAO data and newly found data as well as the suite of potential covariates identified in the conceptual model. Two of the covariates, the proportion of the population predominantly using biomass for cooking and the proportion of the population predominantly using wood charcoal for cooking were taken from previous published work conducted in cooperation with WHO and are described in detail.

This seminar will share the revised estimates, the covariates that were most influential across different areas of the globe and how revised estimates compare to past estimates. For 2019, FAO estimated that 2,525.7 million m^3 of wood were removed from forests globally, approximately 30% higher than previously understood. New estimates are about 50% higher in Africa and 40% higher in Asia, 10% lower in the Americas and 20% lower in Europe. Global production of wood charcoal is estimated at 70.5 million tonnes, approximately 50% higher than previous values; new estimates are about 20% higher in Africa and three times higher in Asia. The seminar will provide improved understanding of progress to date in achieving global targets and refined estimates to underlie global models and policymaking.

29 April - Food insecurity Experience Scale - Carlo Cafiero, Statistics Division

With SDG 2, countries commit to “End hunger, achieve food security and improved nutrition and promote sustainable agriculture” by 2030.

Target 2.1 focuses on ensuring access to food for all: “By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round.” A tool with the potential to provide this level of

information by asking people directly about their experience of food insecurity is the Food Insecurity Experience Scale (FIES). The approach used to analyse FIES data comes from Item Response Theory (IRT), a branch of statistics that permits the measurement of unobservable traits through analysis of responses to surveys and tests. As food security itself is an inherently unobservable characteristic, such as attitude or intelligence, it can be measured only by examining its observable manifestations. The specific IRT model applied to FIES data is the Rasch model, which is widely used in health, education and psychology. This seminar will provide the theoretical framework behind the SDG indicator "Prevalence of moderate or severe food insecurity based on FIES" (SDG Target 2.1.2).

6 May - Laboratory: how to measure the Food insecurity Experience Scale - Sara Viviani, Statistics Division

This seminar will provide the practical tools to estimate the SDG indicator "Prevalence of moderate or severe food insecurity based on FIES" (SDG Target 2.1.2). The R package "RM.weights" and related Shiny apps will be shown and discussed. At the end of the session, the students will be capable to autonomously download FIES microdata, and create their own R scripts to analyse them, evaluate their quality and estimate the SDG indicator 2.1.2.

13 May - Estimating the Prevalence of Undernourishment and the Percentage of people who cannot afford a healthy diet. Theoretical and empirical aspects – Carlo Cafiero, Statistics Division

This seminar will discuss some of the theoretical aspects underlying so called "headcount" approaches used to estimate the percentage of people who may be in a certain condition (e.g., poor, undernourished, unable to afford a healthy diet, etc.) by contrasting a distribution (e.g., of disposable incomes, or of food consumption) with a fixed threshold meant to represent a normative statement (e.g., what income level is needed to be considered not-poor or to be able to afford a healthy diet; how much food you need to consume to be well nourished). Though these methods are quite popular, and perceived as being relatively "simple", they hide many dangers that can lead to producing systematically biased estimates of the actual situation.

20 May - Developing Models with data - Rishi Sharma

This seminar will introduce students to concepts of fitting models to data and comparing alternative model structures with fits to the data. The cassava fruit fly interactions will be used as an example to show how model complexity can be developed and show fits to the data.

A lab in R will show a model setup and students will modify the code based on equations provided on subsequent model complexity setups.

27 May - Understanding SDG 14: from theory to practice - Rishi Sharma

An overview of SDG 14 will be provided to the students. We would then develop a simple model using cpue to understand how a population is classified as overfished based on data.

Finally, a dummy dataset will be used to classify a region/countries proportions of stocks overfished. This will be run in a VRE environment using GitHub and Jupiter notebooks on the cloud.