



# GPSS-2024

The Sixth Global Proximal Soil Sensing Workshop

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## THE SIXTH GLOBAL PROXIMAL SOIL SENSING WORKSHOP

Unveiling advances in theory and practice to promote adoption

14-17 October 2024

Sint-Pietersabdij, Sint-Pietersplein 9, 9000 Ghent, Belgium



International Union of Soil Sciences



*sensors*

an Open Access Journal by MDPI



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## Introduction

The workshop is organized by Ghent University on behalf of the Working Group on Proximal Soil Sensing (WGPSS), established in 2008 under the International Union of Soil Sciences (IUSS). Since established the WGPSS group organised five Workshops to discuss technological advances in proximal soil sensing to complement laboratory methods of soil analyses. To overcome the bottlenecks of traditional data acquisition, soil inventory has evolved into the direction of proximal soil sensing. This is according to the paradigm "Measure more, less precise" or, in other words, bring the laboratory measurements into the field to increase the spatial and temporal coverage, but at the cost of measurement precision.

The Sixth Global Proximal Soil Sensing Workshop will continue the discussion from theoretical and practical perspectives, focusing on the applicability of the technology in natural resources management. The Workshop invites participants from academia and industry, working on topics including, but not limited to, soil and environmental sciences, agricultural engineering, archaeology, forensic investigations, sensor development, near surface geophysics, spectroscopy, agronomy, spatial statistics, and artificial intelligence.

## Venue



Sint-Pietersabdij  
Sint-Pietersplein 9, 9000 Gent  
**Oral and poster presentation**



Experimental Farm Bottelare  
Diepestraat 1, 9820 Merelbeke  
**Field demonstration**

## Guidelines

### Oral Presentation

#### Presenter Guidelines:

- **Presentation Format:** Presenters must prepare their slides in PowerPoint (.ppt or .pptx), using a 16:9 horizontal layout.
- **File Naming:** The presentation file should be named "GPSS-2024\_xx\_Speaker's Surname."
- **File upload:** Presenters should bring their presentation on a USB stick and upload it to the conference room's computer.
- **Laptop Use:** Personal laptops cannot be used during the presentation.
- **Time Management:** Each presenter has 20 minutes in total: 15 minutes for the presentation and 5 minutes for audience questions. Please stick to the schedule.

#### Chairman Guidelines:

- **Session Preparation:** Chairpersons should arrive 10 minutes before the session starts and stay for its entirety.
- **Time Management:** Ensure the session stays on schedule.
- **Moderation:** Facilitate discussions and manage speaker-audience interactions during the Q&A period.

### Poster Presentation

- **Dimensions:** Posters should be A0 size (841 x 1189 mm) in a vertical format. Each panel allows for up to 1 m x 2 m of space.
- **Readability:** Ensure the text and graphics are legible.
- **Printing:** On-site printing will not be available, so please make sure your poster is prepared in advance.
- **Setup:** Please hang your poster prior to the designated poster presentation time (refer to the event agenda for details).
- **Viewing:** Visitors are also welcome to view the poster presentation during coffee break.

# Keynote Speech



Proximal soil sensing in agriculture—advancing from today's applications to tomorrow's opportunities

Keith Shepherd (Innovative Solutions for Decision Agriculture, iSDA, UK)

Unveiling advances in theory and practice to promote adoption

Julien Guillemoteau (University of Potsdam, Germany)



Soil sensing technologies as a service, practical experiences

Steven de Meyer (Agrometius, The Netherlands)



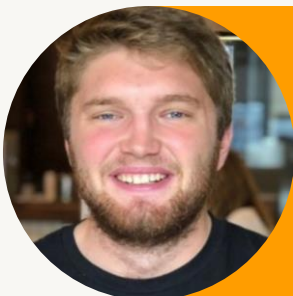
Drone-Borne GPR Innovations for Soil Moisture Monitoring

Sébastien Lambot (Université Catholique de Louvain, Belgium)



A combination of robotics, AI and on-the-fly soil sensors (GPR) for precision irrigation of potatoes in France

Henri DESESQUELLES (Osiris Agriculture, France)



## Day 1 October 14, 2024

# AGENDA

### Welcoming reception

Time: October 14, 2024, 17:30

Location: Pacificatiezaal in the city hall of Gent

Address: Botermarkt 1, 9000 Gent

## Day 2 October 15, 2024

### Oral and poster presentations

Location: Sint-Pietersabdij

Address: Sint-Pietersplein 9, 9000 Ghent

Time	Activity
8:30 – 9:00	Registration
9:00 – 9:05	Opening remark by <b>Abdul Mouazen</b> (Workshop Chair)
9:05 – 9:10	Remark from <b>Asim Biswas</b> (GPSS Working Group Chair)
9:10 – 9:20	Welcoming participants by Gent University
9:20 – 10:00	Keynote presentation: <i>Proximal soil sensing in agriculture—advancing from today's applications to tomorrow's opportunities</i> <b>Keith Shepherd</b> (Innovative Solutions for Decision Agriculture, iSDA, UK)
10:00 – 10:30	Coffee break
10:30 – 12:30	<b>Session 1: Novel sensor development and applications</b> <b>Chair: Kenneth Sudduth</b>
10:30 – 10:50	<i>Validation of a new soil bulk density sensor</i> <b>Karin Pepers</b> (Aeres University of Applied Sciences, the Netherlands)
10:50 – 11:10	<i>Drone-borne gamma-ray spectrometry to measures changes in soil moisture at field scale</i> <b>Ronald Koomans</b> (Medusa Explorations, the Netherlands)
11:10 – 11:30	<i>Measurement of soil particle size distribution and organic matter content using a dual image machine</i> <b>Marc-Olivier Gasser</b> (IRDA, Canada)
11:30 – 11:50	<i>Potential of FT-NIR MEMS spectrometer for monitoring of soil organic carbon for carbon farming accounting</i> <b>Simone Priori</b> (University of Tuscia, Italy.)
11:50 – 12:10	<i>Photoacoustic Fourier Transform Mid-infrared Spectroscopy Estimates Plant-available Phosphorus in Bio-based Fertilizers and Amended Soils</i> <b>Khan Wali</b> (Wageningen University & Research, the Netherlands)
12:10 – 12:30	<i>Online Soil Nitrate Measurement by Using Stop-Measure-Go Method with Internet-of-Things on Palm Oil Plantation in Malaysia</i> <b>Anuar Bin Mohamed Kassim</b> (Universiti Teknikal Malaysia Melaka, Malaysia)
12:30 – 13:30	Lunch break

13:30 – 15:30	<b>Session 2: Modelling and mapping approaches</b> <b>Chair: Fenny Van Egmond</b>
13:30 – 13:50	<i>Advancing Soil Spectroscopy: Optimization of Scan Number and Particle Size in the Moroccan Soil Spectral Database</i> <b>Issam Barra</b> (Mohammed VI Polytechnic University, Morocco)
13:50 – 14:10	<i>Underestimated boundary conditions when recording gamma-ray spectra under field conditions</i> <b>Stefan Pätzold</b> (University of Bonn, Germany)
14:10 – 14:30	<i>Vis-NIR Spectroscopy for On-The-Go Soil Organic Matter Estimation in Agricultural Fields</i> <b>Curtis Ransom</b> (USDA-ARS Cropping Systems and Water Quality Research Unit, USA)
14:30 – 14:50	<i>In-situ heterogeneity representation of paddy soil at mesoscale qualified by laser induced breakdown spectroscopy</i> <b>Fei Ma</b> (Chinese Academy of Sciences, China)
14:50 – 15:10	<i>Uncertainty analysis of farm-level soil organic carbon (SOC) stocks estimated with a handheld near-infrared (NIR) spectroradiometer</i> <b>José Lucas Safanelli</b> (Woodwell Climate Research Center, USA)
15:10 – 15:30	<i>Soil quality as estimated by the use of gamma radiation technology: a case study</i> <b>Rodrigo Ortega</b> (Universidad Técnica Federico Santa María, Chile)
15:30 – 16:00	Coffee break
16:00 – 18:00	<b>Session 3: ProbeField EJP-Soil project</b> <b>Chair: Robin Gebbers</b>
16:00 – 16:20	<i>An Introduction to the ProbeField project: In-field soil spectroscopy in Vis-NIR range for fast and reliable soil analysis</i> <b>Frank Liebisch</b> (CREA, Council for Agricultural Research and Economics, Italy)
16:20 – 16:40	<i>The ProbeField approach for estimating SOC by field vis-NIR spectra corrected for moisture effects</i> <b>Fabio Castaldi</b> (National Research Council of Italy, CNR, Italy)
16:40 – 17:00	<i>Prediction of soil parameters by field- and laboratory obtained vis-NIR spectra after EPO correction</i> <b>Konrad Metzger</b> (Agroscope, Switzerland)
17:00 – 17:20	<i>Harmonization of soil field reflectance measurements from multiple sources</i> <b>Eyal BEN DOR</b> (Tel Aviv University, Israel)
17:20 – 17:40	<i>A Comprehensive Review of Proximal Electromagnetic Sensors' Accuracy and Cost Considerations for Soil Property Prediction and Mapping</i> <b>Carlos Lozano Fondon</b> (Council for Agricultural Research and Economics, Italy)
17:40 – 18:00	<i>Decision trees to assist soil sensing measurement choices</i> <b>Fenny van Egmond</b> (Wageningen University and Research, the Netherlands)
18:00 – 18:20	<i>A protocol for in field collection of soil spectra and alignment with laboratory based SSL's</i> <b>Bo Stenberg</b> (Swedish University of Agricultural Sciences, Sweden)
18:20 – 19:00	Poster presentations
19:30	Banquet

Day 3 October 16, 2024

# AGENDA

## Field demonstration

Location: Experimental Farm Bottelare

Address: Diepestraat 1, 9820 Merelbeke, Belgium.

Transportation: Information will be provided before the demonstration day

Time	Activity
9:30 – 10:00	Arrive and coffee
10:00 – 10:15	Welcome by Bottelare Farm manager
10:15 – 10:45	Keynote speech: <i>Soil sensing technologies as a service, practical experiences</i> <b>Steven de Meyer</b> (Agrometius, The Netherlands)
10:45 – 11:15	Keynote speech: <i>Drone-Borne GPR Innovations for Soil Moisture Monitoring</i> <b>Sébastien Lambot</b> (Université Catholique de Louvain, Belgium)
11:15 – 11:45	Keynote speech: <i>A combination of robotics, AI and on-the-fly soil sensors (GPR) for precision irrigation of potatoes in France</i> <b>Henri DESESQUELLES</b> (Osiris Agriculture, France)
11:45 – 12:00	Open discussion
12:00 – 13:00	Lunch break
13:00 – 15:00	Demonstrations by organizers research teams
15:00 – 15:15	Coffee break
15:15 – 16:00	A PPT presentation by organizers research teams, showing data and maps of geochemical and geophysical sensors integrated in a demo field
16:00 – 17:00	Travel back to Gent
17:00 – 18:30	Dinner with a boat trip in Gent
18:30	End of day 2

**Day 4** October 17, 2024

# AGENDA

## Oral and poster presentations

Location: Sint-Pietersabdij

Address: Sint-Pietersplein 9, 9000 Ghent

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9:00 – 9:45	Keynote presentation: <i>Geophysical methods in soil sciences, agriculture and archaeology: recent advances in surveying and quantitative data analysis</i> <b>Julien Guillemoteau</b> (University of Potsdam, Germany)
9:45 – 10:00	Coffee break
10:00 – 12:00	<b>Session 4: Multi-sensor data fusion technologies</b> <b>Chair: Chengwen Du</b>
10:00 – 10:20	<i>Soil Mapping in Three Dimensions</i> <b>Eric Lund</b> (Veris Technologies, USA)
10:20 – 10:40	<i>Delineate Management Zones using Ground-penetrating Radar and Electromagnetic Induction</i> <b>Sashini Pathirana</b> (Memorial University of Newfoundland, Canada)
10:40 – 11:00	<i>Comparing and contrasting the suitability of proximal soil sensors for peat characterization</i> <b>Triven Koganti</b> (Aarhus University, Denmark)
11:10 – 11:20	<i>Soil mapping of small fields with limited number of samples by coupling EMI and NIR spectroscopy</i> <b>Leonardo Pace</b> (University of Tuscia, Italy)
11:20 – 11:40	<i>Multi-sensor proximal soil sensing platform: Potentials and challenges</i> <b>Gebbers Robbin</b> (Leibniz Institute for Agricultural Engineering and Bioeconomy e.V. ATB, Germany)
11:40 – 12:00	<i>Evaluating combinations of seven sensors for predicting key soil properties at field scale</i> <b>Schmidinger Jonas</b> (Osnabrück University, Germany)
12:00 – 13:00	Lunch
13:00 – 15:00	<b>Session 5: Application of PSS in agriculture</b> <b>Chair: Bo Stenberg</b>
13:00 – 13:20	<i>Qualitative MIR spectroscopy as a powerful tool for site-specific soil characterisation</i> <b>Jean Robertson</b> (The James Hutton Institute, Scotland)
13:20 – 13:40	<i>The Role of Soil Spectroscopy in FAO's SoilFER Initiative</i> <b>Yi PENG</b> (Food and Agriculture Organization of the United Nations, Italy)
13:40 – 14:00	<i>Using proximal vis-NIR soil spectroscopy to assess soil health</i> <b>Kenneth Sudduth</b> (USDA-ARS Cropping Systems and Water Quality Research Unit, USA)
14:00 – 14:20	<i>In-Situ Characterization of Soil Properties using vis-NIR Spectroscopy</i> <b>Asim Biswas</b> (University of Guelph, Canada)
14:20 – 14:40	<i>C:N:P:O ratios in different soils at mesoscale monitored by laser induced breakdown spectroscopy</i> <b>Changwen Du</b> (Chinese Academy of Sciences, China)
14:40 – 15:00	<i>Stenon Fieldlab for real time soil sampling, Tool or Toy?</i> <b>Görres Grenzdörffer</b> (Rostock University, Germany)

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15:00 – 15:30	Coffee break
15:30 – 17:30	<b>Session 5: Application of PSS in anthropogenic targets detection</b> <b>Chair: Eyal Ben Dor</b>
15:30 – 15:50	<i>SensNexus project: detection of microplastics in coastal soils by means of near-infrared spectroscopy</i> <b>Matheus Sousa Silva</b> (Universidade Federal de Santa Catarina, Brazil)
15:50 – 16:10	<i>Mapping and estimating soil toxic elements from rare earth mining area using visible-near infrared</i> <b>Nisha Bao</b> (Northeastern University, China)
16:10 – 16:30	<i>Soil Spectral Library for the Soil Degradation Subsystem of the Hungarian Environmental Information</i> <b>Janos Meszaros</b> (HUN-REN Centre for Agricultural Research, Hungary)
16:30 – 16:50	<i>Time-lapse monitoring with drone-borne Ground-Penetrating Radar unveils spatiotemporal moisture dynamics in peatland root zone</i> <b>Maud Henrion</b> (Université catholique de Louvain, Belgium)
16:50 – 17:10	<i>Forensic soil analysis using laser-induced breakdown spectroscopy (LIBS) and Fourier transform infrared total attenuated reflectance spectroscopy (FTIR-ATR): Principles and case studies</i> <b>Changwen Du</b> (Chinese Academy of Sciences, China)
17:10 – 17:30	<i>Enhanced Prediction of Soil Arsenic Contamination Using Combined Portable X-Ray Fluorescence and Hyperspectral Imaging Techniques</i> <b>Somsubhra Chakraborty</b> (Indian Institute of Technology Kharagpur, India)
17:30 – 18:00	<b>General comments and take-home messages:</b> Sessions Chairs
18:00	Workshop Close



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