



GEORG-AUGUST-UNIVERSITÄT  
GÖTTINGEN



#### WP. 4. PROFESSIONAL TRAINING

Code: GOE

#### **TITLE: Isotopes in Ecosystem Sciences**

In collaboration with the University of Goettingen and the German Soil Scientific Society

**Academic coordinators** *Dr. J. Dyckmans, Prof. Dr. M. Dippold*

<b>Period of the year (2021)</b>	<i>February 22th – 26<sup>th</sup>, 2021</i>
<b>Duration in days/weeks</b>	<i>5 days</i>
<b>Number of class hours x day/week</b>	<i>Total 40 hours</i>
<b>Target participants</b>	<i>Professionals</i>
<b>Number of participants (max)</b>	<i>25</i>
<b>Forms of realization</b>	<i>Due to the ongoing Covid-19 pandemic this workshop will be solely held online</i>
<b>Teachers</b>	<i>Jun.-Prof. Dr. M. Dippold, Dr. J. Dyckmans, PD Dr. R. Well, Dr. C. Banfield, Dr Matthias Gube</i>

The course provides a very broad background for isotope applications in ecosystem components including soils, plants, atmosphere, and microorganisms. Overview of various tracer methods and isotopes applications will be given. The specifics of stable and radioactive isotopes for investigations of ecosystem processes from submolecular to global scale are covered.

### **Topics of the course:**

Introduction into Isotope Chemistry

Stable and radioactive isotopes: Types of ionizing radiation

Measurement of stable and radioactive isotopes

Compound-specific isotope analysis with HPLC and GC

Natural abundance methods: Fractionation and its applications

Possibilities, limitations, limits of detection, artefacts

Data analysis and pitfalls

Radiation protection and peculiarities of working with radionuclides.

### **Applications:**

Global carbon cycles and turnover of soil organic matter ( $^{14}\text{C}$ ,  $^{13}\text{C}$ ,  $\text{d}^{13}\text{C}$ , Bomb- $^{14}\text{C}$ )

Plant soil interactions and rhizosphere research ( $^{14}\text{C}$ ,  $^{13}\text{C}$ ,  $\text{d}^{13}\text{C}$ ,  $^{15}\text{N}$ )

Gas emission from soils ( $\text{d}^{13}\text{C}$  of  $\text{CO}_2$ ,  $\text{CH}_4$ , isotopologes  $\text{N}_2\text{O}$  and  $\text{N}_2$ )

Nutrient ( $^{15}\text{N}$ ,  $^{32}\text{P}$ ,  $^{33}\text{P}$ , K-Rb,  $^{137}\text{Cs}$ ) and water ( $^2\text{H}$ ,  $^{18}\text{O}$ ) uptake into plants

Incubation experiments on soil respiration and decomposition of plant residues and pesticides in soil ( $^{14}\text{C}$ ,  $^{13}\text{C}$ ,  $\text{d}^{13}\text{C}$ )

Migration and translocation studies (Br, Cl,  $^3\text{H}$ ,  $^2\text{H}$ )

Estimation of soil erosion ( $^{137}\text{Cs}$ ,  $^7\text{Be}$ ,  $^{210}\text{Pb}$ )

Autoradiography and phosphor imaging for allocation studies ( $^{14}\text{C}$ ,  $^{32}\text{P}$ ,  $^{33}\text{P}$ )

Studies on sorption and exchange ( $^{32}\text{P}$ ,  $^{33}\text{P}$ )

Paleo reconstruction ( $^{13}\text{C}$ ,  $^{18}\text{O}$ ,  $^2\text{H}$  and  $^{14}\text{C}$  dating)

Microbial growth and metabolism (DNA-/RNA-SIP with  $^{13}\text{C}$ ,  $^{15}\text{N}$  and  $^{18}\text{O}$ , position-specific labelling und metabolic flux modelling)

CVs of the teachers

**Jun.-Prof. Dr. M. Dippold**

2017 Jun.-Prof. of Biogeochemistry of  
Agroecosystems, Goettingen  
2013-2017 Academic Assistant at Agricultural Soil  
Science, Goettingen  
2016 Guest Lectureship University Bern  
2010-2013 Research assistant at Agroecosystems  
Research, Bayreuth

**Dr. J. Dyckmans**

Centre for Stable Isotope Research and Analysis  
(KOSI)  
20 years' experience in stable isotope analysis and  
leading a stable isotope laboratory with various IRMS  
periphery

**PD Dr. R. Well**

Thünen Institute, Braunschweig  
Expert for greenhouse gas emission and nitrogen  
isotopes, in specific N<sub>2</sub>O isotopemeres

**Dr. C. Banfield**

2018 PhD in Soil Science, Goettingen  
May 2017 Head of the joint soil science laboratories,  
focusing on stable and radionuclide applications  
2007-2013 Studies of Geoecology, Karlsruhe

**Dr. M. Gube**

2014 Academic assistant Soil Science, Goettingen  
2012-2014 Post-Doc GRK 1257, Jena  
2008-2009 Post-Doc Microbial Phytopathology, Jena  
2009 PhD Biology, Jena  
2008-2009 Research Assistant Microbial  
Phytopathology, Jena