

## Scientific report on the conference SOM2010

The scientific program of the conference was composed of four sessions treating the following themes:

- 1) Relative contributions of root and shoot C to C storage in soils
- 2) Natural molecular structures as drivers and tracers of ecosystem functions
- 3) Microbial communities (biodiversity, microbial habitat, biota, interactions...) as drivers of organic matter dynamics
- 4) Trophic networks and organic matter dynamics
- 5) Impact of changing environmental controls on SOM dynamics
- 6) Heterogeneity and scaling processes of OM decomposition and stabilization: molecular to regional scales

These themes had been chosen to look at the different stabilisation processes and their importance for organic matter dynamics in soil from different view points. The conference succeeded in bringing together scientists from different disciplines and in stimulating discussions amongst them. This was possible because of the isolated conference venue, the poster after the oral sessions, which attracted many participants and the 'café des sciences', a discussion on the modelling of SOM dynamics, which was held on Tuesday evening. In the following, the scientific content of the six themes is summarized. All participants were invited to submit a paper to a special issue of the journal 'Biogeochemistry'.

### *Session 1: Relative contributions of root and shoot C to C storage in soils*

The first session was based on a number of recent studies showing that soil C seems to be mostly derived from root C. We invited contributions dealing with quantification of above and belowground sources of SOM to shed light on the relative input of root and shoot-derived carbon and its stabilisation processes. We welcomed in particular those studies using molecular and isotopic markers are welcome.

Daniel Rasse (As, Norway) held the keynote lecture in this session and talked about the Preferential storage of root-derived C in soils. He gave us a quantitative overview about the input of root derived carbon into soils in comparison to shoot carbon and emphasised the high susceptibility of root carbon to be affected by SOM stabilisation processes. The other presentations in this session dealt with abiotic parameters affecting root carbon turnover (Jens Leifeld, Zurich, Switzerland), the importance of root traits for their decomposition (Catherine Roumet, Montpellier, France), spatial distribution of root and shoot biomarkers (Sandra Spielvogel, Munich Germany), the role of enzymes for residue degradation (Amin Bilal, Reims, France), the use of rhizoliths for assessing root carbon contribution to deep soil horizons (Martina Gocke, Bayreuth, Germany) and the degradation of root and leaf derived biomarkers (Jens Altmann, Amsterdam, The Netherlands). Moreover, the participants at the conference were able to discuss 26 posters on the subject in the afternoon poster session.

### *Session 2: Natural molecular structures as drivers and tracers of ecosystem functions*

The second session dealt with the chemical characterisation of soil organic matter on a molecular basis. The reason for such a session was the fact that molecular structures of natural organic matter are crucial for the processes leading to stabilization/ destabilization of organic matter in the environment. Development of sophisticated analytical tools made progress in recent years and results could be presented in this session.

The keynote lecture was given by Myrna Simpson (Toronto, Canada). She gave us an overview about the use of modern analytical equipment to study changes in the chemical composition of organic matter affected by climate change. The keynote lecture was followed by talks about the use of infrared spectroscopy for mapping of the chemical composition of SOM on surfaces of preferential flow pathways (Ruth Ellerbrock, Müncheberg, Germany), the stabilisation of microbial biomass carbon (Anja Miltner, Leibzig, Germany), the relationship between SOM structure and dynamics (Eldor Paul, Ft. Collins, USA), the quantitative and qualitative change of black carbon with time (Nadezda A. Vasilyeva, Zurich, Switzerland), the combination of GIS and biomarker analysis (Roman Teisserenc, Montreal, Canada) and the establishment of the Molter online database for soil molecular research (Lauric Cecillon, Paris-Grignon, France). In this session, 24 Posters could be discussed in the afternoon poster session.

*Session 3: Microbial communities (biodiversity, microbial habitat, biota, interactions...) as drivers of organic matter dynamics*

Session three was focused on soil micro-organisms, which are the main actors in the decomposition of organic matter. The session addressed the understanding of the relationship between microbial diversity and decomposition. We aimed with this session to attract presentations on the relationship between microbial communities and C and N dynamics, including the role of microbial diversity and that of constraints on microbial activities due to their habitat.

The keynote lecture was given by Jim Prosser (Aberdeen, UK). He analysed in his talk the question of how much microbial diversity we need in soil. He gave an overview about the historical development of the characterisation of microbial diversity in soil and presented work the effects of reduced microbial diversity for soil functioning. This lecture was followed by presentations on the relationship between plant diversity, carbon compound diversity and functioning and diversity of denitrifiers in grassland soils (Lamia El Moujahid, Lyon, France), on the reasons for up or down regulation of soil microbial respiration after exposure to short term temperature differences (Fernando Moyano, Jena, Germany), on the microbial regulation of carbon cycling at the soil-litter interface (Ellen Kandeler, Stuttgart, Germany), on the impact of mycorrhizal organic nutrient uptake on ecosystem carbon storage (Kate Owin (Wellington, New Zealand), on the effect of wheat addition on microbial resistance and resilience to drying and rewetting in saline soils (Karen Baumann, Adelaide, Australia) and on the microbial biogeochemistry of drought (Joshua Schimel, Santa Barbara, USA). In the afternoon poster session 36 posters on this subject were discussed.

*Session 4: Trophic networks and organic matter dynamics*

The fourth session tried to take into account the fact, that decomposition of organic matter involves organisms from all positions in the soil food web. However, soil food webs are usually studied by other scientists than those studying soil organic matter dynamics (ecology vs. soil science). In this session we welcomed presentations that explored how food webs control the dynamics of C and N in soils, under different land uses and practices. Unfortunately only few contributions were listed in this session, showing, that we could not attract the scientist concerned with soil biology.

The keynote lecture in this session was given by Richard Bardgett (Lancaster, UK), who presented us the importance of trophic interactions for soil fertility involving SOM dynamics and their effect on plant growth. The keynote lecture was followed by a presentation on the modifications brought about by endogeic earthworms on bacterial functional communities

and on the balance between priming effect and crop residues mineralization in a tropical soil Laetitia Bernard, Montpellier, France). The second presentation in this session was on accelerated organic matter decomposition as a result of earthworms' effect on the soil microbial community (Evgenia Blagodatskaya, Bayreuth, Germany). Four posters about this subject were discussed in the afternoon poster session.

*Session 5: Impact of changing environmental controls on SOM dynamics*

Session 5 addressed the fact, that changing environmental conditions are having profound effects on SOM dynamics. The long-term response and the underlying mechanisms of these effects remain uncertain as well as the effects of multiple interacting factors. This session aimed at exploring how single and interacting environmental changes are modifying SOM dynamics and the associated underlying mechanisms.

The keynote lecture was given by Margareth Torn (Berkeley, USA). She presented the results of a Molter workshop where leading scientists discussed soil organic matter turnover in a changing world. The lecture addressed the latest questions and advances concerning soil organic matter dynamics and its relation to soil functioning. The keynote lecture was followed by talks on soil C dynamics and its temperature sensitivity along management-induced SOM gradient (Rota Wagai, Ibaraki, Japan), on the question if there is a need to add a rate modifier for salt in soil carbon models (Raj Setia, Aberdeen, UK), on soil organic and inorganic C dynamics under two contrasting rewetting frequencies (Luis Lopez-Sangil, Barcelona, Spain), on soil organic matter responses to chronic nitrogen additions in a temperate forest (Kate Lajtha, Corvallis, USA), on the interaction of carbonates and fresh organic matter in macroaggregate dynamics and organic matter stabilization in carbonate-rich Mediterranean soils (Oihane Fernández-Ugalde, Pamplona, Spain), on the facilitation of depressing decomposition of organic amendments in soil by oxyhydrate coating (Pan Gen-xing, Najing, China), on the characterisation of organo-mineral complexes in surface and subsurface horizons of an acid loamy soil after sequential density fractionation (Pierre Bonnard, Aix-en-Provence, France) and on the organic matter chemistry across sequential density fractions from two contrasting Oxisol soil depth profiles (Marc Kramer, Santa Cruz, USA). In the afternoon poster session 56 posters were presented on this subject.

*Session 6: Heterogeneity and scaling processes of OM decomposition and stabilization: molecular to regional scales*

Session 6 addressed the different scales at which the processes involved in SOM dynamics and stabilisation and their influencing factors are occurring. The understanding of this complexity and the integration of different levels of organisation across scales for the understanding of C and N dynamics in soil was the focus of this session.

The keynote lecture was given by John Crawford (Sydney, Australia), who talked about the heterogeneity and scaling processes of OM decomposition and stabilization and their integration into models. The keynote lecture was followed by talks on the localization of organic carbon pools in the soil matrix (Liesbeth Bouckaert, Ghent, Belgium), sub micrometric-scale mapping of nitrogen at the surface of soil particles using <sup>15</sup>N labelling and NANOSIMS (P.-J. Hatton, Nancy, France), on the small scale heterogeneity of enzyme activities in the top- and subsoil of a forested Cambisol (Bernd Marschner, Bochum, Germany), on substrate heterogeneity and quality convergence in decomposing litters (Carlos A. Sierra, Irvine, USA), on soil organic matter dynamics and spatial heterogeneity in relation to landscape scale processes (Sebastian Doetterl, Louvain-la-Neuve, Belgium) and on

upscaling peatland biodiversity and carbon dynamics to the ecosystem level (Mike Whitfield, Lancaster, UK). In the poster session on this subject 28 posters were presented.