



EuroSoil2012: Soil science for the benefit of mankind and environment

EuroSoil2012: 4th International Congress of the European Confederation of Soil Science Societies

Bari, Italy, 2–6 July 2012

EuroSoil2012 was convened in Bari, Italy, from 2–6 July 2012 as the 4th International Congress of the European Confederation of Soil Science Societies (ECSSS). Earlier congresses were held in Reading, UK in 2000; Freiburg, Germany in 2004; and Vienna, Austria in 2008. The theme of EuroSoil2012 as ‘soil science for the benefit of mankind and environment’ aimed to cover several broad aspects of soil science with relevance to how humans treat, interact and respond to their environment. With the pedosphere (soil science) at the heart of interactions with the biosphere (plants, animals and microorganisms), the atmosphere (air), the hydrosphere (water) and the lithosphere (rocks and minerals), soil science is a key discipline that attempts to, and must, integrate across a broad wealth of information sources and spatial and temporal scales.

A total of 13 general topics were set by the scientific committee, including typical soils; soil genesis, evolution and classification; land degradation; advanced techniques and modeling; soil amendment and biochars; effects of climate change on soil biogeochemistry; soil organic matter; soil hydrology; soil micromorphology; soil–plant interactions; soil biology and biochemistry; soil pollution and remediation; and soil archeology, history, culture, society, education, economy and policy. Following an open call for proposals to arrange specific symposia, workshops and various special events such as roundtables, short courses, technical meetings and business meetings associated with the theme of the congress, the program of EuroSoil2012 was essentially developed by members of the broader scientific community with guidance by the scientific and organizing committees [101]. Proposals from the scientific community resulted in 63 symposia, five workshops and 16 special events during 5 days in the historic city of Bari, in the Puglia region of Italy. Like the city of Bari as a melting pot of western and eastern cultures along historic trade routes through the Mediterranean region, EuroSoil2012 was also a melting pot of scientific information on soil-related research with total attendance exceeding 1900, representing 66

different countries, not only from Europe but from throughout the world. Enthusiasm at the congress was high, partly as a result of 32% of attendees being students.

The congress was opened with three plenary lectures: ‘Grand challenges in soil and environmental sustainability – the importance of basic biogeochemical research’, delivered by Donald Sparks, University of Delaware, DE, USA; ‘Soil compaction – how far are physical, chemical and biological processes and soil functions irreversibly affected on various scales and what are the consequences’, delivered by Rainer Horn, Christian Albrechts University, Kiel, Germany; and ‘Data and information systems for the assembly of European soil resources’, delivered by Luca Montanarella, European Commission Joint Research Centre, Ispra, Italy. Six concurrent sessions were convened for the remainder of the congress. One of the key themes of the congress was on GHG emissions, soil carbon sequestration and climate change, to which there were several sessions, including:

- Symposium 6.1: GHG emissions from soil under changing environmental conditions – concepts, modeling and observations (convened by Marc Lamers, Jens-Arne Subke, Michael Herbst and Alan Franzluebbers);
- Symposium 6.2: Sustainable agroecosystems in climate change mitigation;
- Symposium 6.3: Soil functions in a changing climate – recent insights from field experiments;
- Symposium 6.4: Lysimeter research and climate change;
- Symposium 7.4: Soil organic matter dynamics and climate;
- Symposium 7.5: Dynamics of subsoil organic carbon in relation to soil properties, climate and biota;

Alan J Franzluebbers*¹ & Nicola Senesi²

¹US Department of Agriculture, Agricultural Research Service, 3127 Ligon Street, Raleigh, NC 27607, USA

²Università degli Studi di Bari ‘Aldo Moro’, Via G. Amendola 165/A, 70126 Bari, Italy

*Author for correspondence:

Tel.: +1 919 208 9344

Fax: +1 919 856 4712

E-mail: alan.franzluebbers@ars.usda.gov



- Symposium 7.6: Mechanisms of carbon stabilization and sequestration in soils;
- Symposium 7.7: Long-term effects of agronomic practices on soil organic matter and crop productivity;
- Symposium 11.1: Impact of climate change on soil biochemical activity, with special emphasis on soil respiration;
- Symposium 11.5: Nitrogen turnover and global change – influence of ecosystem development, climate, land use and xenobiotics on abundance, diversity and activity of soil microbial key players;
- Workshop 11.1: Through the eye of the needle – the soil microbial biomass concept from nutrient cycling to global warming – dedicated to the memory of Professor David Jenkinson.

The following are some insights into the results from presentations. From Grignon, France, widespread research networks across several dozen sites throughout Europe were described as a useful experimental setup to better understand impacts of climate change and management on soil and plant response variables across a large spatial scale. On the other end of the spatial scale, computed tomography was presented as a valuable tool at 15- μm resolution to understand the effects of soil condition on root dynamics in a study from Nottingham, UK.

The impact of manure application on soil carbon sequestration and GHG emissions was analyzed in several studies. From Sapporo, Japan, change in N_2O emissions declined with increasing years of manure application to soil. In a meta-analysis of global literature on manure application to soil, a presentation from Quebec, Canada, showed that retention of carbon in manure was greater in colder than in warmer climates, but that there was no obvious effect of soil texture on carbon retention. An average of 34% retention of carbon occurs with manure application compared with no manure application, but only 20% retention with manure application compared with inorganic fertilization.

Tillage management of croplands was also another commonly reported variable that could affect carbon and nitrogen emissions from soil. From Neuherberg, Germany, automated measurements of N_2O were greater in winter under moldboard plowing than under minimal or no tillage management, while greater N_2O emissions were also associated with increasing nitrogen fertilizer in all tillage systems. However, over numerous measurement events throughout the year, there

was a greater occurrence of high-peak emissions under minimum tillage than under moldboard plowing. From 44 fields in the UK, N_2O emissions were not different between tillage systems, but CH_4 and CO_2 emissions were greater under conventional than under no tillage.

Land conversion from grasslands to crops and vice versa can be a key contributor to soil organic carbon changes in agriculture. From the southeastern USA, significant sequestration of soil organic carbon was observed in several long-term field studies during conversion of eroded cropland to perennial pastures. Grazing by cattle was shown to have positive effects on soil organic carbon at moderate stocking rates, but negative effects at high stocking rates. From Braunschweig, Germany, no difference in N_2O emissions was observed when grassland was converted to maize cropping using physical (plowing) or chemical termination methods, but spikes in N_2O emission did occur with high soil water content and concentrated nitrogen accumulation when terminated chemically.

Dynamics of N_2O emission have been notoriously variable due to a large number of management and environmental factors. An analysis from Freiburg, Germany, suggested that freeze–thaw events can cause 80% of total annual flux of N_2O , more extreme weather events could cause nitrate hotspots in riparian areas and lead to enhanced N_2O emissions, higher temperature could cause conflicting changes in emissions, and the extreme complexity suggests that a landscape approach is needed to better understand overall GHG emissions. Adding further to this complexity, a long-term evaluation under elevated CO_2 in Giessen, Germany, resulted in different interpretations of how environmental factors influenced different GHG emissions in the long term (10 years) compared with the short term (≤ 2 years).

Models are increasingly used to predict changes in soil organic carbon and GHG emissions under conditions not typically suited for large spatial scale measurements or under unique experimental conditions. From Tsukuba, Japan, the RothC model performed well against available field data for soil organic carbon in upland soils, but modifications to the model were needed to match field observations for paddy soils and volcanically derived soils. Across the 47 prefectures of Japan from 1970 to 2020, soil organic carbon was predicted to increase 2 Tg $\text{CO}_2\text{-e year}^{-1}$. From Juehlich, Germany, pedotransfer functions utilizing carbon input and soil clay content were effective in initializing the RothC model without primary data available.

Another significant event that was held concurrently at the EuroSoil2012 congress was a series of business



meetings between the Croplands Research Group and the Carbon and Nitrogen Crosscutting Group of the Global Research Alliance on Agricultural Greenhouse Gases [1]. The international attendance of scientists at the EuroSoil2012 conveniently allowed for these groups to discuss common research goals and objectives among alliance-member countries. Some key issues that were discussed were:

- Evaluation of simple (index type) and complex (process-based) models to better predict N₂O emissions under the diversity of management and environmental conditions around the world;
- Synthesis of known information pertaining to peatlands and agricultural wetlands, which can be large reservoirs for CO₂, CH₄ and N₂O emissions under different conditions;
- Development of research networks to share data and expertise among scientists from different countries.

A total of 2289 presentations (660 oral and 1629 poster) were packed into a full 5 days of the congress. Scientific delegates exchanged ideas in sit-down oral presentations and stand-up poster presentations from early in the morning until late in the evening each day.

References

- 1 Shafer SR, Walthall CL, Franzluebbers AJ *et al.* Emergence of the global research alliance on agricultural greenhouse gases. *Carbon Management* 2(3), 209–214 (2011).

Websites

- 101 4th International Congress of the European Confederation of Soil Science Societies. Soil science for the benefit of mankind

Discussions were intense, due to much useful scientific information being communicated among seasoned colleagues and younger students, all of whom were engaged in one of the key ecosystem elements that most vitally supports mankind and the environment – the soil.

The ECSSS has a tradition of meeting every 4 years, offset by 2 years from an even larger soil science event, the World Congress of Soil Science, which meets in 2014 in Jeju, Korea [102]. The next meeting of the ECSSS will be held in Istanbul, Turkey, in 2016. Both of these upcoming congresses are sure to reveal the many ecosystem services provided by soil, particularly the role of controlling climate through GHG emissions and mitigation, since this topic is so vast in scope and so vital to mankind's existence.

Financial & competing interests disclosure

The authors have no relevant affiliations or financial involvement with any organization or entity with a financial interest in or financial conflict with the subject matter or materials discussed in the manuscript. This includes employment, consultancies, honoraria, stock ownership or options, expert testimony, grants or patents received or pending, or royalties.

No writing assistance was utilized in the production of this manuscript.

and environment. Bari, Italy, 2–6 July 2012.
www.eurosoil2012.eu

- 102 20th World Congress of Soil Science. Soils embrace life and universe. Jeju, Korea, 8–13 June 2014.
www.20wcss.org