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Transfers and Transformations: Our Evolving Biosphere

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Plenary & Keynote Speakers

P.M. Huang Symposium (Monday June 21st)

Antonio Violante, Ph.D.

Dr. Violante is Professor of Soil Chemistry at the University of Naples Federico II, Italy, where he received his academic degrees in Chemistry. Additionally, he has completed postdoctoral training at the University of Wisconsin, USA (1976-1977) working with professor M. L. Jackson and the University of Saskatchewan, Canada (1981-1982) working with professor P. M. Huang. He was invited as Visiting Professor in the Department of Soil Science, University of Saskatchewan in 1985, 1992, and 2003. He was Head of the Dipartimento di Scienze Chimico-Agrarie (1994-2000) and Coordinator of the *Doctoral School in Agrobiology and Agrochemistry* (1990-2002). He taught courses in Agricultural Chemistry, Soil Chemistry, Environmental Biogeochemisty and Soil Mineralogy and trained many M.S. and Ph.D. students and postdoctoral fellows and received visiting scientists worldwide.

Dr. Violante has contributed to promote research on the interface between soil chemistry and mineralogy and soil biology. The areas of research include the formation mechanisms of Al-hydroxides and oxyhydroxides, the surface chemistry and reactivities of short-range ordered precipitation products of Al and Fe, the influence of biomolecules on the sorption/desorption of nutrients and xenobiotics on/from variable charge minerals and soils, the factors which influence the sorption and residual activity of enzymes on variable charge minerals and organo-mineral complexes, and the chemistry of arsenic in soil environments. He was the scientific chairman and chief organizer of International and National Congresses. Dr. Violante is the author of 180 refereed research articles and book chapters and invited reviews, and co-edited seven books. He has international research and teaching experience in Canada, USA, Europe, China and Chile.

He is Fellow of *Soil Science Society of America* and *American Society of Agronomy*. He is chair of Commission 2.5 of the IUSS.

Donald L. Sparks, Ph.D.

Dr. Sparks is S. Hallock du Pont Chair of Soil and Environmental Chemistry, Francis Alison Professor, and Director of the Delaware Environmental Institute at the University of Delaware at Newark. He also holds joint faculty appointments in the departments of Civil and Environmental Engineering and Chemistry and Biochemistry, and in the College of Marine Studies. He received his B.S. and M.S. degrees at the University of Kentucky, Lexington, and his Ph.D. degree in 1979 from the Virginia Polytechnic Institute and State University, Blacksburg, VA.

Dr. Sparks is internationally recognized for his research in the areas of: kinetics of soil chemical processes, surface chemistry of soils and soil components using in-situ spectroscopic and microscopic techniques and the physical chemistry of soil potassium. He has pioneered the application of chemical kinetics to soils and soil minerals including development of widely used methods, elucidation of rate-limiting steps and mechanisms, and coupling of kinetic studies with molecular scale investigations, particularly synchrotron based x-ray absorption spectroscopy. His discoveries on the formation and role of surface precipitates in the retention, fate and transport of metals in natural systems have received worldwide attention and had major impacts in the areas of sorption models, metal speciation and soil remediation/contamination. He is the author, coauthor, or editor, of 267 publications.

Dr. Sparks serves on the Scientific Advisory Committees of the Advanced Light Source at Lawrence Berkeley National Laboratory and the Center for Environmental Molecular Science (EMSI) at the State University of New York at Stony Brook, and the Steering Committee of the Institute of Soil and Environmental Quality (ISEQ) at the University of Delaware. He is the recipient of numerous awards and honors, and is a Fellow in the *American Society of Agronomy*, *Soil Science Society of America*, and the *American Association for the Advancement of Science.*

EVALUATION OF NEW SAINFOIN GERMPLASM FOR USE IN BLOAT-FREE GRAZING SYSTEMS

E. Sottie, University of Lethbridge, Lethbridge, AB, S. Acharya, Agriculture and Agri-Food Canada Research Centre, Lethbridge, T1J 4B1, A. Iwaasa, T. McAllister, Y. Wang, and J. Thomas, University of Lethbridge, Lethbridge, AB

Beef cattle production can be maximized through the use of alfalfa (Medicago sativa) as a monoculture or dominant species in a forage mixture. However, pasture bloat serves as a major deterrent to the grazing of alfalfa-based pasture despite the high growths that are obtainable. Sainfoin (Ononbrychis viciifolia) is known to lower the incidence of pasture bloat when grown in mixed stands with alfalfa. The sainfoin varieties currently available in Canada, grow back slowly after grazing or cutting and die-out quickly when planted in a mixed stand with alfalfa. Three new populations of sainfoin (LRC05-3900, LRC05-3901 and LRC05-3902) were developed at Lethbridge Research Centre (LRC) for their improved ability to compete with alfalfa and grow back after cutting at the same rate as alfalfa. These three new populations and 'Nova' sainfoin were established in mixed stands with AC Blue J alfalfa (in alternate rows) for simulated and actual grazing at Lethbridge in 2008. The field plot arrangement used was a four times replicated completely randomized design. In the simulated grazing trial the three new populations had higher total biomass yields than alfalfa in the stands after three cuts. The yields of LRC05-3900 and LRC05-3902 were significantly ($p<0.05$) higher than alfalfa and they both had yields about 25% more than Nova. After the third cut, the yields of LRC05-3900 and alfalfa were about the same in the stands whereas the yields of the other sainfoin populations were significantly lower ($p<0.05$). Among the sainfoin populations LRC05-3900 seems to have persisted better than others. The alfalfa samples collected from these plots had higher crude protein (24.3 g/kg DM) compared to all the sainfoin populations which had values ranging between 18 – 21 g/kg DM.

KEYWORDS: bloat free grazing, sainfoin, alfalfa

SHINING LIGHT ON BIOGEOCHEMICAL PROCESSES AT SOIL INTERFACES

Donald L. Sparks, Department of Plant and Soil Sciences, University of Delaware

The use of in-situ, molecular scale techniques, especially those that employ synchrotron radiation, has greatly advanced our understanding of biogeochemical reactivity and speciation at soil interfaces. These tools enable one to make measurements at small spatial and rapid temporal scales and simulate natural environmental conditions. The use of small scale techniques in the soil and environmental sciences has resulted in a new multidisciplinary field- molecular environmental science. There are a number of areas dealing with biogeochemistry of contaminants and nutrients where the application of molecular environmental science is resulting in major scientific frontiers. A number of these, involving speciation and reactivity at important environmental interfaces including the soil/water, plant/soil, and mineral/microbe, will be discussed in this paper. Emphasis will be placed on speciation of metal(loids) in soils and plants, surface complexation and precipitation, mineral transformations, and rapid redox processes at mineral surfaces.

KEYWORDS: synchrotron-based spectroscopic techniques, environmental interfaces, kinetics

BIOPHYSICAL PARAMETERS FOR EVALUATING LAND RECLAMATION IN THE ROCKY MOUNTAINS

Lance Steinke, and M. Anne Naeth, Department of Renewable Resources, University of Alberta

The goal of this project is to determine if past reclamation of land disturbances in Jasper National Park have successfully established native plant communities in montane and subalpine natural subregions. Land disturbance creates an opportunity for non-native plant species to invade bare ground. Invasions of aggressive species tend to simplify the composition and function of plant communities. Failure of plant communities of any kind to re-establish is another risk; this is the simplest structure possible. Loss of primary producer populations is linked to reduction in wildlife biodiversity, soil erosion, and a lesser visitor experience at degraded recreation sites. Ecosystem management, based on widely accepted science-based practices, has minimized the impacts of routine human disturbances on biodiversity. However, no monitoring method currently exists to judge whether reclamation practices are effectively maintaining native plant biodiversity and preventing soil erosion. A monitoring method, using key biophysical criteria, is designed to achieve the project goal.

KEYWORDS: land reclamation, biophysical parameters, ecological monitoring, Canadian Rocky Mountains, montane, subalpine