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Contents

Invited Speaker Abstracts & Oral Presentation Abstracts

Invited Speaker Lecture
2 August 2017, 09:35-10:15

Land as ecosystem – mesures and indicators of neutralizing its degradation
Uriel Safriel
Hebrew University of Jerusalem, Israel

The lecture presents a conceptual framework for the land and its components functioning as ecosystm, which generates flows of services whose benefits contribute to components of human well-being. It then addresses the drivers that bring out changes and tradeoffs in the flows of these ecosystem services. These drivers are both environmental, such as climate change, and human, such as agricultural land use. The lecture later describes outcomes of these changes, like 'land degradation' at the global scale, and desertification confined to the global drylands. Human responses to these outcomes, among them a recent option conceptualied as 'land degradation neutrality' and the indicators for its attainment are then presented.

Keywords: Land as ecosystem

Invited Speaker Lecture
2 August 2017, 10:15-10:45

The mosaic of autoimmunity: Why we develop autoimmune diseases. The microbiome and metabolism
Yehuda Shoenfeld
Zabludowicz Center for Autoimmune Diseases, Sheba Medical Center
Incumbent of the Laura Schwartz Kipp Chair for Autoimmune Diseases, Tel Aviv University

Autoimmune diseases are conditions in which the immune system damages normal components of the individual. Initially it was thought that autoimmune disease was the inevitable outcome of the presence of clones of lymphocytes with receptors that recognize self-antigens. Thus tolerance to self, the state of non-autoimmunity, was due to the absence of self-recognizing lymphocytes, the 'forbidden' culprits of autoimmune disease. Autoimmune diseases were found to be multifactorial in their etiology. For practical reasons these factors are classified into four categories: genetic, immune deficiencies, hormonal state and environmental causes.

During the last decade a new factor for autoimmunity has emerged: the microbiome. The body contains populations of bacteria especially in the GI tract.
We have employed two mice models of autoimmune diseases:

1. NZB-W/SLE, genetic
2. Collagen induced arthritis (CIA), an induced model of RA.

We have treated the mice with Tuftsin-phosphorylcholine (TPC) produced from helminthes.
Suppression of the diseases was associated with specific type from GI bacteria, while activity of the autoimmune conditions was characterized by completely separate bacteria.
This result alludes to a future manipulation of active autoimmune diseases by GI bacteria.

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3)Tomer Bashi, Miri Blank, Dana Ben-Ami Shor, Mati Fridkin, Mathilde Versini, Omer Gendelman, Alexander Volkov, Iris Barshak, Yehuda Shoenfeld. Successful modulation of murine lupus nephritis with tuftsin-phosphorylcholine. J. Autoimmunity 2015; 59: 1-7.

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Invited Speaker Lecture
2 August 2017, 11:00-11:30

Dairy: Environment and Sustainability from Cow to Consumer
Judith Bryans
Dairy UK

All food production comes at an environmental cost. It's therefore essential that to consider the environmental impact of foods at all levels from cow to consumer - and back to the land.

The United Nations Sustainable Development Goals challenge nations to look at sustainability on multiple levels and are important in framing the debate around food, nutrition, livelihoods and environmental measures.

The dairy sector is important in global agriculture. It has a role in lifting people out of poverty, in rural stewardship, in empowering women and in providing high quality nutrition and culturally acceptable foods. Like other foods it comes with environmental costs and benefits. To determine the role of dairy in sustainable production and development it is therefore essentially to consider all of these aspects with underpinning evidence.

Invited Speaker Lecture
2 August 2017, 11:30-12:00

Sustainability indicators in the chemical Industry: towards the circular economy
Maija Pohjakallio
Chemical Industry Federation of Finland, Eteläranta 10, 00131 Helsinki, Finland

The chemical industry in Finland has for decades collaborated to promote sustainable development through the voluntary Responsible Care (RC) program that arrived from Canada to Finland in the early 1990's. Presently 95 companies in Finland have committed to the program, representing some 80% of all production in the chemical industry and some 60% of its employees. RC is the chemical sector's international sustainability program, and in total it is carried out in more than sixty countries around the world.

The chemical sector in each country has its specific implementation of Responsible Care program. In Finland the central themes of the program include

- Sustainable use of natural resources
- Sustainability and safety of production and products
- Well-being of the work community
- Open interaction and co-operation

The results of the RC work are monitored through indicator data collected annually from the committed companies. The data indicates that in the Finnish chemical sector e.g. the waste to be disposed of by landfilling has decreased by 60 % and green house gas emission by 36 % from 1999.

The set of indicators has been developed constantly during the 25 years RC program has existed in Finland. The most recently adopted indicators are related to circular economy. The basic principle of the circular economy is to keep products, components, and materials in the society at their highest utility and value for as long as possible: "One man's trash is another man's treasure". Circular economy covers many aspects from resource efficiency to new business models and sharing platforms. The circular economy also calls for a critical re-examination of the way we meet the needs of our society. The chemical industry of Finland is one of the forerunners in the circular economy: industrial symbioses within the sector are in full operation, e.g. in the towns of Kokkola and Porvoo, and side and waste streams from other companies and sectors are being utilised.

The presentation highlights the main results and developments of the RC program in Finland and their links to the circular economy. Furthermore, some case examples of chemical companies using Gaia Biorefiner

sustainability indicators and indicators Gaia has developed for industrial parks to boost the industrial symbioses are presented [1].

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Invited Speaker Lecture
2 August 2017, 12:50-13:20

Learning systems in the environmental management, microbiological processes and future energy production
Erik Dahlquist
Malardalen University, Vasteras, Sweden

In this paper concepts are discussed for advanced control and optimization of micro-biological processes using learning systems. Properties are measured of ingoing raw material to different processes, and by feed back from measurements further down in the process the prediction of the properties are refined by adapting models correlating spectra to this. The prediction of the incoming properties then are used for the multivariable control of the process and for process and sensor diagnostics. A few examples are given from applications in the EU SPIRE project FUDIPO. These examples are from pulp and paper industry, combustion in power plants, biological waste water treatment and oil refineries. In this paper we discuss how the methodology could be used also for bio-refineries and other biological processes.

Introduction

Fifty years ago most processes were operated manually. The number of measurements were very few and unreliable and data were not stored automatically. Then we got more measurements and local control. Thereafter the computers came and we started to log more data. The sensors where connected to the computers and trends could be logged and presented on process computers with screens with displays. Next step was to automate control and introduce new functions like diagnostics, alarms and warnings. You could get production planning in excel sheets and some optimization functions were often introduced.

What we see now is a next step where we try to automate signal analysis, introduce simulation models – both empirical and physical- and use these for on-line control. We try to catch both qualitative and quantitative properties of raw material going into a process, and then predict the properties of the product leaving the production line. By making soft sensors these properties can be determined from correlating raw material properties and operating conditions to the final product quality, mostly measured in lab. The soft sensor then also can be used for process control by modifying the operating conditions to match changes in the raw material properties as described in Skvaril et al [2016].

By comparing deviations between predictions and actual measurements of the same variables and properties we can tune both physical and empirical models. In this way we form a learning system. The system then can be used for process optimization, diagnostics of processes and sensors and for maintenance on demand [Karlsson, 2008]. This latter then also will be part of the production planning by measuring degradation in the process and perform actions like cleaning or maintenance to avoid more serious stops later on. The results from the diagnostic are further sent to the decision support system.

With this system we can both operate the processes in a more optimal way and use the models for learning more about the processes. The improved knowledge can be refined into decisions support systems, which are tuned and refined both quantitatively and qualitatively as shown in e.g. Cai et al [2016]. An example of adaptation of Bayesian nets is shown in Madsen et al [2003] generally and in Widarsson and Dotzauer [2008] for a recovery boiler. We also have been using this methodology for district heating applications as shown in Yliniemi [2015] and Zimmerman et al [2016]. New operators and engineers can train on process understanding and physical simulation models, but the system also can be used to study effect of possible process modifications. In this way we can use the simulation and modelling development tool continuously throughout the life of the production facility, hopefully.

Of course we need interaction also with the operators and process engineers. They will both develop their own skills, and enhance the skills of all staff jointly as the system becomes a storage of common knowledge. When new staff are employed they can learn from the system as well.

The FUDIPO project and possible extensions

The basics of the system described above is being developed in the EU project FUDIPO, Future direction of process industry production planning and optimization, which started 2016 in October and will last for four years.

It is a project in the “advanced manufacturing”, SPIRE (Sustainable process industry Research) program, equally sponsored by EU and European process industries [www.fudipo.eu, 2016].
Here the learning system functions are developed and implemented in five case studies. These are fiber-lines in a pulp mill at Billerud-Korsnas in Gavle, an activated sludge process in Vasteras with ABB and Malarenergi, a combined heat and power plant using biomass and waste as fuel in three CFB boilers, also in Vasteras at Malarenergi, in an oil-refinery at Tupras in Turkey and in micro-gas turbine plants delivered by the Dutch company MTT. The basics of the functions in the FUDIPO project are seen in figure 1.

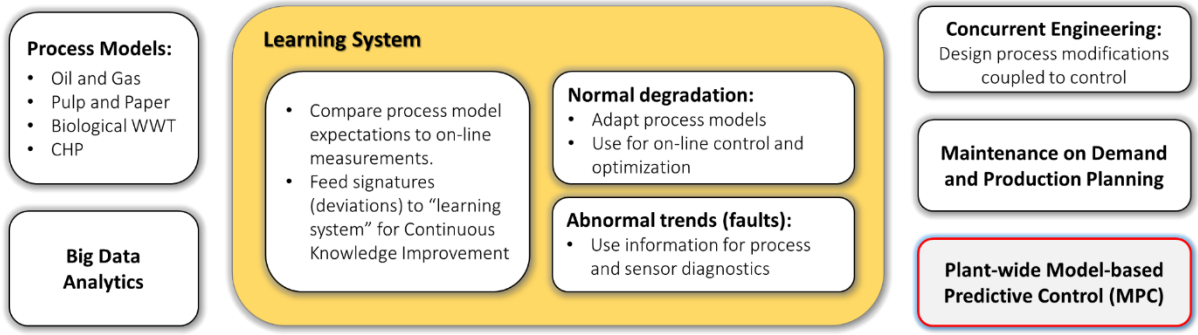


Figure 1. The basics of the functions in FUDIPO project with “learning systems”.
From the experience from these applications we can see how the method can be used for other type of microbial processes as well, aside of the activated sludge process. We have both biogas production from the sludge and the possibility to use organic waste and sludge for production of chemicals in bio-refineries. This can be in association with waste management plants, waste water treatment plants and in pulp mills. An example from pulp and paper industry is shown in figure 2 .

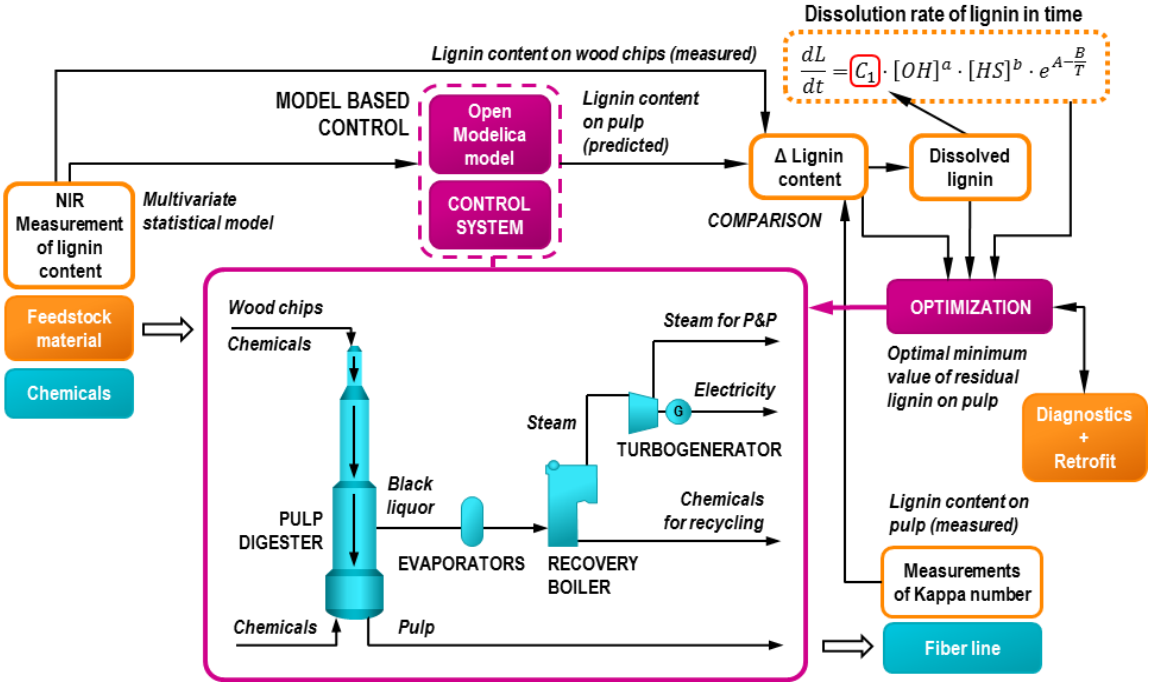
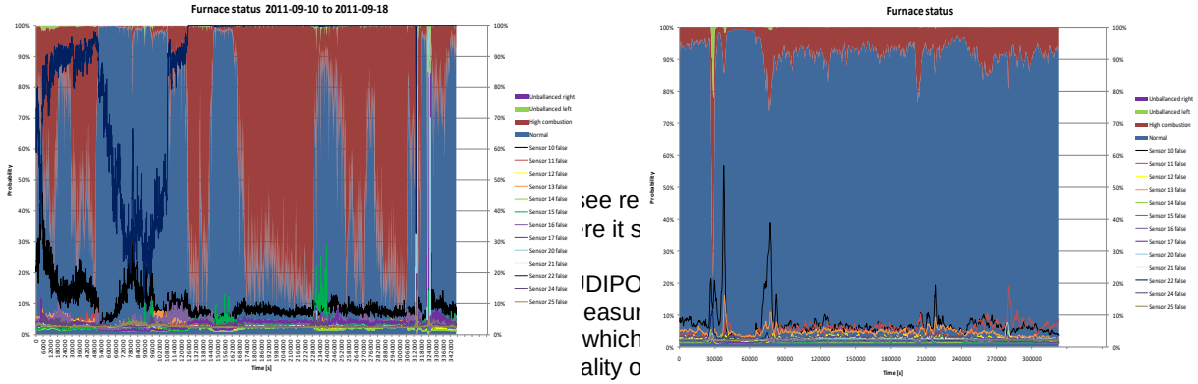


Figure 2. Learning system from pulp and paper applications for a fiber line.
Measurement of fiber properties of incoming wood chips are made using NIR. A physical model is used to predict cooking conditions suitable from these properties: $dL/dt = C_1 * [OH]^a * [HS]^b * \exp(A-B/T)$. Feed back is done from measuring outgoing fibers with respect to kappa number and dissolved lignin in the extraction of black liquor. Both the model parameters (especially C_1, which measures reactivity for lignin dissolution) and correlation to NIR-spectrum are made (lignin content and reactivity). In this way we continuously improve the prediction of the properties of the raw material. As the models become better also the determination of different faults by comparing predicted values to measured values can be made. Deviations between measured and predicted values are fed to a Bayesian Net, which gives us probability for different type of faults like hang-ups and channeling in the actual process, as well as clogging of screens or valves, or just sensor faults of different kind.

In figure 3 we see an example of such a decision support system as probability using a Bayesian net for a CFB boiler.



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PO_4 may be measured directly, aside of the indirect measurement using the spectra. From this we predict the demand for residence time and possible demand for additions of specified components to give good conditions for microorganisms. By degrading sludge anaerobically we will get ammonia and acid that can be separated using membrane filtration. Carbon as organic acids or extra nitrogen as NH4 then can be added if needed to keep the ratio between C/N/P at a suitable level. Aside of controlling the process with C/N/P ratio we also want to be sure that chemicals like medicines are degraded in WWTPs. This may then demand to control the microorganism mix.

An example of the future type of biological waste water treatment is seen the figure 4

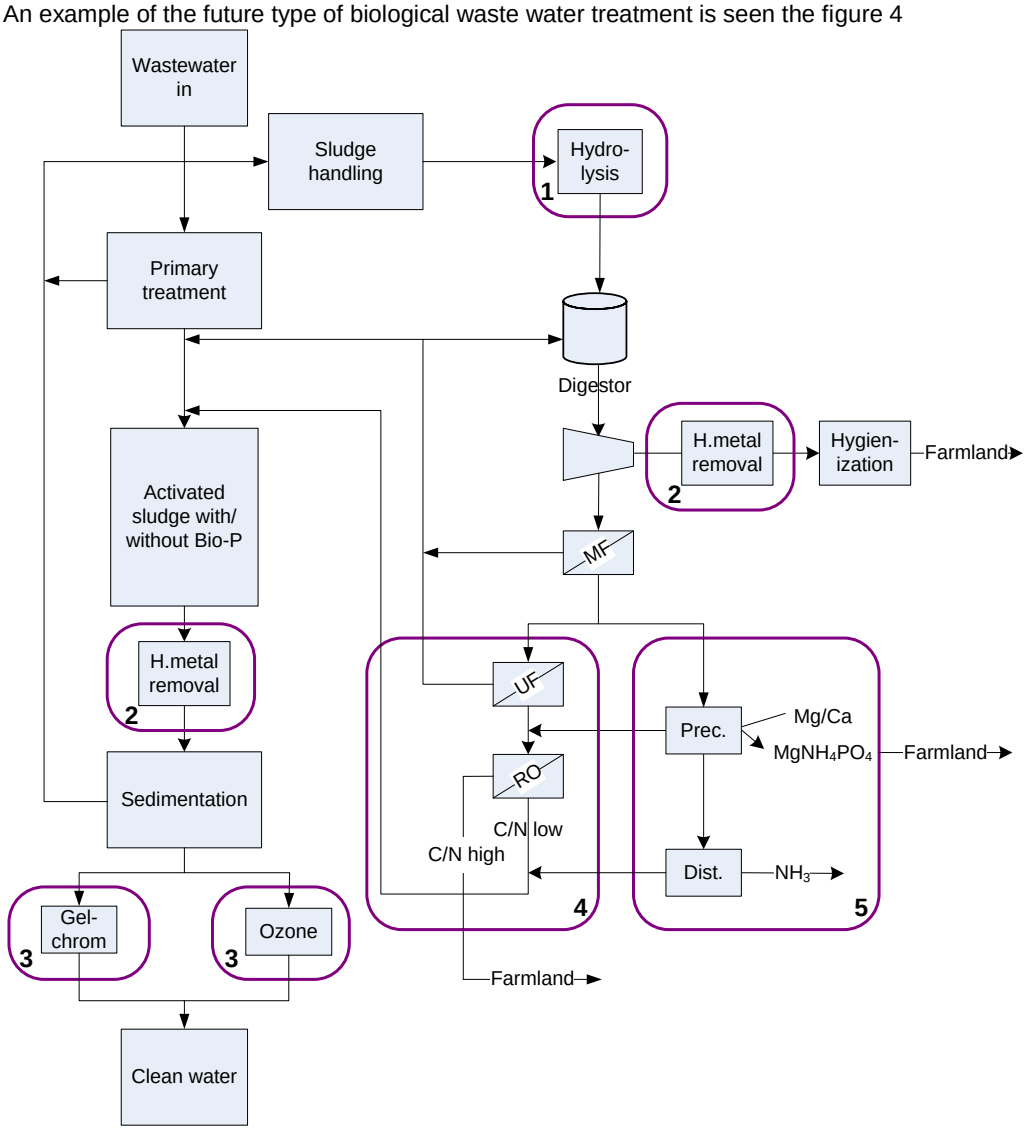

Figure 4. Example of next generation of waste water treatment.

By adding algae to other micro-organisms we can both reduce the need for aeration and improve the removal of some difficult substances from the water. The algae –microorganism mixture also give higher amount of sludge as nitrogen and PO_4 are built into the biomass. Algae will produce oxygen, which is consumed by the microorganisms, but instead need light for their growth. This demand LED-lamps during the dark part of the winter, but with the high efficiency of new type of lamps is reasonable. In Krustok et al [2015] the development of microbial including algae communities has been shown for waste water treatment using algae from lake Mälaren. The system in figure 4 first has activated sludge with Bio-P, which we here refer to combining with algae, which take up P very efficiently, but also N-compunds, which are built into the biomass. Heavy metal removal will be take up in the biomass in the activated sludge, but later removed after hydrolysis/fermentation in the digestor releasing the metals so that they can be absorbed in an ion-exchanger. Medicines and other chemicals can be adsorbed in gels or decomposed with eg ozon, while the digestate from the fermentation is filtered in membrane modules to separate different fractions like ammonia from organic acids. We can then dose these fractions to give a good ratio in the activated sludge process for C/N and also keep the carbon source at a good level. By this we can optimize the conditions for the microorganisms. The feed to the plant is measured using NIR or Raman on separated solids at the entrance, while other compounds with direct measurements (like PO4 and Nitrous compounds).

By following the result of the water treatment process, optimization of the biogas production and how the microorganism flora is developed we can get input to how to control the process in best possible way depending

on temperature, feed stock composition and other more specific variables like heavy metals and medical compounds. In Thorin et al [2014] the effect of co-digestion of microbes with micro –algae is shown. Another possible process would be for bio-refineries. In figure 5 we see an example of this.

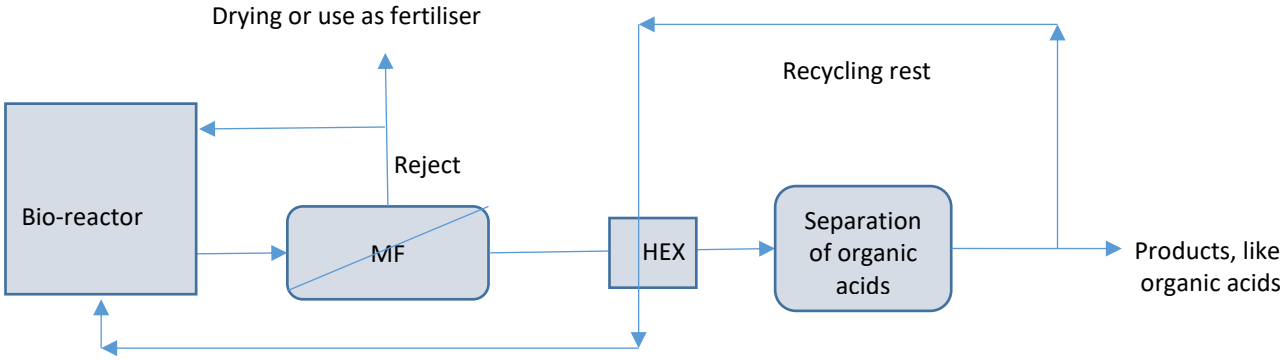

Figure 5. Biorefinery example

As previous we would measure the quality of what is coming in using NIR or Raman and control the flows along the process to optimize the production with respect to product volume, quality and energy use.
In Schwede et al [2013] results from pilot plant with bio-refinery are presented from the ABOVE-project. Here different raw material like slaughter house waste, fruit and other waste crops have been used as feed and production of organic acids, 2,3,-butandiol, butanol and hydrogen among others were produced.
Other examples of microbial processes for environmental applications [Dahlquist and Hakalehto, 2017] as well as for energy applications [Dahlquist, 2016] are presented.

Conclusions

There is a new trend towards measuring more in different processes, but especially to make use of the collected data in a smart way. By modeling processes we can collect data and improve the knowledge about processes by upgrading the models with new information more or less continuously, if the data handling structure is robust. We then can use these models for several different purposes like multivariable model based process control, process and sensor diagnostics, production planning and optimization and decision support. We have shown here both what is on-going for some other processes but also what is planned for bio-processes like biological wastewater treatment and bio-refineries.

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Invited Speaker Lecture
2 August 2017, 13:20-13:50

Indications of climate change in the Finnish forests
Hannu Sakari Ilvesniemi
Natural Resources Institute Finland, Helsinki, Finland

Finland is a country located between the latitudes 60° and 70°. Due to the strong effect of Gulf stream and prevailing western winds our climate here is much warmer compared to most of other places at the same latitudes. The general estimates of the effects of climate change show that the increase in annual average temperature can be much faster in northern areas, but in our case the possible changes in Gulf stream circulation due to the climate change can be more important. In Finland we have been measuring our forest almost over a hundred years. 50 years ago the total volume of trees was c.a. 1 500 M m^3 and the annual volume growth 50 Mm^3. Now the corresponding figures are 2 300 M m^3 and 105 Mm^3, respectively. When the causes of this change have been analyzed, indicating that main reason is the improved forestry practices, but some 30 % can be related to climate change. According to the surveys dating back to the 1950's large changes in the cover and species composition of ground vegetation occurred until the 1980's, but the rate of change has reduced during the last decades. The main reason for the changes since the 1980's is the increased standing volume of trees, leading to reduced amount of light at the ground level. Signs of climate changes causing these changes have not been shown. The possible effects on soil microbiology are still largely unknown, although presumably substantial on litter decomposition and nutrient availability. For the forest ecosystems changes the average annual temperature is not the only important factor, but e.g. extended drought periods during the growth period or lack of ground frost during winter can increase the risk of pests and pathogens, forest fires or storms. Also, the carrying capacity of soils can be reduced.

Keywords: climate, growth, pathogens, biodiversity, drought

Oral Presentation
2 August 2017, 13:50-14:20

Moss analyses indicating atmospheric pollution across different spatial scales
Winfried Schröder, Stefan Nickel
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Monitoring of atmospheric deposition can be achieved by chemical transport modelling, collecting deposition with technical samplers and using bioindicators such as lichens, plant needles/leaves, moss and soils. In the European Moss Survey (EMS), moss samples were collected every five years from up to 7300 sites across Europe, and concentrations of heavy metals (since 1990), nitrogen (since 2005) and persistent organic pollutants (since 2010) in moss were chemically analyzed along with quality control and statistical evaluation according to a harmonized methodology. This presentation concentrates on heavy metals and nitrogen (N). In Germany, the results of chemical analyses was added by data on characteristics of sampling sites and their surrounding environmental factors that could influence pollutant concentrations in moss. The georeferenced data on heavy metals and N concentrations and potential predictors was compiled using GIS allowing for statistical analysis including the calculation of minimum sample size needed for reliable statistics and geostatistics. The results proved that the EMS allows reliable statistics for heavy metals and N across the European Continent, participating countries, as well as for several ecological land classes covering Europe. Geostatistics enabled to map spatial patterns from measurements, i.e. to fill up the space between the measurement sites by spatial estimation. The correlations indicated that the organisms used fairly well indicate atmospheric deposition and, therefore, should be used to enhance the spatial resolution of deposition maps and, subsequently, deposition and critical loads maps. The indicative power of moss data was compared with results yielded both with other biomonitors and chemical transport modelling.
Acknowledgement: The authors thank the Federal Environment Agency of Germany for funding.

Keywords: Atmospheric deposition, biomonitoring, geostatistics, heavy metals, mapping, nitrogen.

Invited Speaker Lecture
2 August 2017, 14:20-14:40

Working with nature to preserve nature: using natural molds to sustainably improve biofuel production
Samira Basyouni Khamis, Guofen Li, Clara Pogner, Monika Schmoll
AIT Austrian Institute of Technology, Department Health and Environment, Bioresources, Tulln, Austria

For biofuel production, cheap sources of carbohydrates are required in order to produce ethanol by fermentation. Thereby, the use of starch from food crops generates a competition between fuels and food supply. Alternatively, for second generation biofuels, cellulosic plant material from agricultural or municipal wastes can be used to avoid this competition. However, the degradation of this recalcitrant material requires a highly efficient enzyme mixture that increases the production costs.
We are working with Trichoderma reesei, a filamentous ascomycete with GRAS status (generally regarded as safe) and the most frequently used organism for production of plant cell wall degrading enzymes. Its enzyme mixture is used for conversion of the polymer cellulose to the monomeric glucose, which can be comsumed by yeasts to produce ethanol. For sustainable production, it would be desirable to optimize the efficiency of this enzyme mixture and at the same time avoid accumulation of residues which require costly treatments prior to deposition (like genetically altered production organisms). Additionally, production of the enzymes directly at the site of application would be a benefit.
Therefore we isolated natural fungi from Austrian soil and identified 12 strains of the species Trichoderma reesei among them. Several of them showed efficient production of plant cell wall degrading enzymes. The possibility to perform sexual crosses with Trichoderma reesei strains was discovered only a few years ago and enables us to naturally breed these fungi to enhance enzyme production. Thereby we aim to increase the production of efficient cellulose degrading enzymes and at the same time shift the nutrient preference of the strains to hemicellulose, whose degradation products are not utilized by natural yeasts for ethanol production. The resulting strains will additionally checked for absence of harmful metabolites to ensure that the residues can be composted and/or used as organic fertilizers.

Keywords: biofuel production

Invited Speaker Lecture
2 August 2017, 14:40-15:00

Importance of mycorrhiza for the northern coniferous forests and forestry
Sannakajsa M Velmala, Taina Pennanen
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Fungi are essential for the terrestrial life on earth. They play a major role in ecosystem processes such as soil carbon cycling, plant nutrition, and pathology. Boreal forests cover one third of the whole forest area on earth. Fennoscandian boreal forests are dominated by evergreen tree species such as pine and spruce. Cold climate, short growing season, acidic soil, slow decomposition of organic matter, and low nitrogen input via fixation are characteristic of these forests. Trees are dependent on their root association with symbiotic ectomycorrhizal fungi to acquire water, and nutrients from organic sources. Ectomycorrhizal fungi may also protect trees against various abiotic stresses and even pathogens.

Norway spruce is the most important tree species in Finland. Roughly 100 million spruce seedlings are planted yearly. However, the mortality rates after planting are high. The aim is to improve the early development as well as the quality of containerized spruce seedlings, and to study the usage of ectomycorrhizal fungi as integrated pest management in forest nurseries. We have also investigated the specificity of this interaction by assessing the effects of host genotypic variation on ectomycorrhizal symbiosis.

Good nursery practices are pivotal for profitable forestry. It has been shown that usage of less fertilization during in nursery enable the development of a diverse ectomycorrhizal fungal community. Ectomycorrhizal colonization leads to a larger root to shoot ratio. Seedling with larger roots and right size shoots are more suitable for planting machines, and are much more likely to survive and grow well after outplanting. Thus large root size and the high ectomycorrhizal fungal diversity can be used as measures of seedling quality. We have also found ectomycorrhizal fungal isolates that promote seedling growth in the early years after outplanting. In addition some ectomycorrhizal fungal species are valuable edible mushrooms. Furthermore, ectomycorrhizal fungi also seem to provide protection against Heterobasidion root and butt rot.

Keywords: mycorrhiza, Picea abies, forest nursery, fungal diversity

Oral Presentation
2 August 2017, 15:00-15:30

Food wastewater treatment and energy recovery using single chamber microbial fuel cells
Shaoan Cheng, Weijun Ding
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Shortening the enrichment stage of nitrifying bacteria is important for practical application of biological nitrogen removal processes. In this study, a biological environment was created to enhance nitrifying bacteria attachment and growth on carriers surface of a single-chamber air-cathode microbial fuel cells (MFCs). Results showed that the pre-started-up MFCs with exoelectrogenic bacteria in phosphate buffer (PBS) allowed for a mature nitrification process after 16 days when the slaughterhouse wastewater was added as nitrifying bacteria source. In contrast, the non-prestarted-up MFCs required 36 days. The dominant populations in pre-started-up MFCs were the known high extracellular polymeric substance (EPS) producers, which were believed to provide a suitable condition for the fast formation of nitrifying biofilm. After inoculation, the pre-started-up MFCs achieved an average ammonium removal of 94 ± 1.3%, while 87.4 ± 2% removal was observed in the non pre-started-up MFCs. The current produced by MFCs had minimal effect on nitrification process. 16S rRNA analysis showed that *Nitrospira* was the dominant nitrifying bacteria and several genera of denitrifying bacteria appeared on both glass fiber separator and carbon brush anode surfaces. These results demonstrate that the pre-started-up MFCs can provide a suitable environment for nitrifying and denitrifying populations to rapidly form a mature biofilm for efficient ammonia removal.

Keywords: microbial fuel cell; nitrifying biofilm; biological environment; ammonia removal; energy recovery

Oral Presentation
2 August 2017, 15:45-16:05

Monitoring of cardiac activity of benthic invertebrates as a tool for bioindication of aquatic environmental pollution
Sergey Victorovich Kholodkevich[1], Tatiana Vladimirovna Kuznetsova[2], Anton Sergeevich Kurakin[2], Andrey Nikolaevich Sharov[2]
[1]Scientific Research Center for Ecological Safety RAS, Saint-Petersburg, Russia; St.-Petersburg State University, Saint-Petersburg, Russia
[2]Scientific Research Center for Ecological Safety RAS, Saint-Petersburg, Russia

Unbiased assessment of the ecological state of water ecosystems is unmanageable without the use of biological methods aimed at environmental pollution assessment. The considerable interest in the development of such methods is represented by biomarker approach. Material and Methods Changes in heart rate (HR) beating had been considered as an integrative measure of physiological condition of the selected invertebrates. An analysis of the prospects of innovative technologies based on bioelectronic systems implementation for the monitoring of environmental safety state of aquatic systems in the case of the Gulf of Finland areas was carried out. Assessment of biological effects of environmental pollution was performed by testing indigenous invertebrates using method of functional loading (salinity changes). Prolonged HR recovery and high coefficient of HR variation for group of representatives of local biota site are signs of stressful impact on these organisms, affected by environmental pollution. The actual investigation approach may become a new step in elaboration of aquatic environmental safety and ecosystem health assessment. In view of the statement: “Healthy animal - healthy ecosystem” such physiological biomarkers in cooperation with application of core-indicators carried on individual organisms level can be expanded at the population level and, thus, indirectly contribute to the ecosystem health assessment. Authors note that the method of non-invasive cardiac activity monitoring of selected invertebrates can be used not only for the advancement of bioindication, but also could be useful in decision of general problems of comparative physiology of invertebrates and effects screening of new emergent pollutants. This research approach could become a new step in comprehension of aquatic environmental safety and ecosystem health assessment, based on health status evaluation of key species in different aquatic environment.

Keywords: bioindication, ecosystem health assessment, invertebrates, heart rate, biomarker approach,

functional loading

Oral Presentation
2 August 2017, 16:05-16:35

Exploring potential human health impacts of active microbiome in natural and man-made water environments

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While health effects of waterborne infections in developing and developed countries are a major public health concern, the structure and dynamics of microbial communities in water are not well understood. In recent years, our view and understanding of water microbiome has increased tremendously by using culture-independent molecular approaches such as next generation sequencing (NGS) and quantitative PCR (qPCR). Bioinformatics provides vast opportunities to unveil significant new knowledge on microbiome members and their complex relationships with contaminants in water. This work focuses on characterizing active bacterial communities and opportunistic pathogens in different water systems such as drinking water distribution and surface water bodies with distinct pollution sources. The specific aim is to characterize active microbiome and identify novel indicators of water quality. While majority of microbes in water environment are expected to be harmless to human health, pathogens (such as Legionella and Mycobacterium) and adverse biological functions of bacteria (such as mercury methylation of sulfate reducing bacteria) may occur. The severity of potential health risks is dependent on factors like ecosystem structure and activity of the microbiome. Indeed, microbiota contributes the major biomass in the water environments and has crucial role in functions of aquatic ecosystems. The current NGS applications create thousands of sequences from a single sample providing microbial diversity, taxonomy and potentially activity information on thousands of living entities. In this study, bacteria were characterized using NGS and reverse transcriptase (RT)-qPCR of 16S ribosomal RNA (rRNA) and ribosomal RNA genes (rDNA) extracted from water samples. Metabolically active bacterial cells usually contain higher numbers of ribosomes than dormant cells. Thus, the application of rRNA:rDNA ratios might give a relative estimation of activity levels of microbial groups present in water. The new rRNA method revealed that not all bacterial community members were active in the studied water environments.

Keywords: bacterial 16S rRNA gene, drinking water distribution system, metal mine, next-generation sequencing, sewage discharge, water microbiome

Oral Presentation
2 August 2017, 16:35-16:55

The assessment of the procedure used for detection and identification of *Listeria monocytogenes* in samples collected in a fish processing plant

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Listeria monocytogenes is an ubiquitous microorganism extremely dangerous for public health. It is said, that four out of thirteen described serotypes of *L. monocytogenes* are responsible for majority of food-borne listeriosis outbreaks. To avoid handling raw fish contaminated with this pathogen (either primarily or secondarily) is one of the main concerns of the fish processing industry. The aim of this preliminary study was to assess the suitability of two types of multiplex polymerase chain reaction (m-PCR) for a microbiological monitoring. One of them was used to distinguish *L. monocytogenes* from other *Listeria* spp., and the second one was applied to differentiate the *L. monocytogenes* serovars isolated from food-related sources. The experiments were conducted in 2015. The procedure was implemented on a trial basis as a part of microbiological monitoring in a fish processing plant. Samples from processing line, raw and finished product were taken using a swab method. Microbiological Air Sampler MAS-100 Eco™ (Merck, Germany) was used to collect air samples from corresponding sampling points. *L. monocytogenes* was identified according to a PN-EN ISO 11290-1:1999/A1:2005 standard. The m-

PCR experiments (targeting specific virulence genes) presented herein were carried out on samples characterised as *L. monocytogenes*-positive on ALOA medium. *L. monocytogenes* was found in the air, as well as in samples taken from processing line, raw material and finished product. We concluded that the presence of the bacteria could be the effect of the amount of processed raw material, the number of employees working in processing rooms during a shift, and the intensity of the production process. Although the results have shown that m-PCR can be a useful tool for differentiation *Listeria* spp. (including *L. monocytogenes*) found in air and food-related samples, the study needs further development.

Keywords: molecular biology, public health, food-borne pathogen

Oral Presentation
2 August 2017, 16:55-17:15

Characterization of the groundwater microbiome in proximity to unconventional oil and gas extraction using matrix-assisted laser desorption/ ionization time-of-flight mass spectrometry

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Groundwater is the major source of drinking water and therefore its quality is of extreme importance. Recently, an increased concern for environmental safety and human health has been given to the possible contamination of groundwater by unconventional oil and gas development processes (UD). However, little is known about the impact(s) of UD on the groundwater microbiome. When subject to environmental stressors such as pollution, the bacterial diversity and dynamics change. Therefore, understanding the factors that modulate diversity within microbial ecosystem and allow the proliferation of pathogenic bacteria is essential. The primary goal of this work was to study the potential impacts of anthropogenic contamination on microbial communities in groundwater overlying unconventional oil and gas development. Matrix-assisted laser desorption/ionization (MALDI) time-of-flight mass spectrometry (TOF-MS) was used for the high-throughput identification of bacteria. Each groundwater showed a unique microbiome. Mainly denitrifying and heterotrophic bacteria from the Phylum *Proteobacteria* were recovered. Pathogenic bacteria, such as *Aeromonas hydrophila*, *Bacillus cereus*, *Pseudomonas aeruginosa*, and *Stenotrophomonas maltophilia* were identified, increasing the concern for health safety. In fact, many of the identified bacteria showed resistance to different antibiotics tested. Higher bacterial diversity was observed for the water samples with higher values of total nitrogen, chloride, and sulfate indicating that these elements are valuable metrics for the quantification of microbial diversity. TOC, on the other hand, was reflective of bacterial abundance. The presence of C1-C3 compounds may be an indication of hydrocarbon degradation by bacteria as they usually break them down to compounds with lower carbon number as supported by the presence of methanol in the water samples. While these data do not provide a definitive link between UD activity and groundwater microbiome, they do provide a measurement of bacterial diversity and quantity in groundwater located near anthropogenic activities.

Keywords: Oil and gas development activities, groundwater, microbiome, pathogenic bacteria, biogeochemical cycles, matrix-assisted laser desorption/ionization time-of-flight mass spectrometry

Oral Presentation
2 August 2017, 17:15-17:35

Change in nutrient loading pattern due to coupled effect of change in concentration and hydroclimate forces

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Increases in nutrient loading into large riverine systems over the past 40 years is of major interest because of

long-lasting negative effects on the water quality of downstream waterbodies. We know little of this phenomenon with respect to long-term relationships between water quality metrics and trends in river flow. Here we present a multi-decadal (1937–2014) examination of nutrient transport patterns of the South Saskatchewan and Red Deer Rivers, two large rivers of the Hudson Bay watershed, Canada. Using a combination of both parametric and non-parametric methods to characterize relationships, we show a slightly increasing trend in annual volume of water reaching a mid-watershed reservoir (Lake Diefenbaker) concomitant with a change in seasonal variability of flow events from the 1970s to the present. Both total nitrogen (TN) and total phosphorus (TP) flux increased during the period of record. Similarly, TN concentration increased, while TP concentration decreased. On average, the high-flow season (Mar–July) transported 95% of annual TP flux, 75% of annual TN flux, and 65% of annual flow into Lake Diefenbaker. Inter-annually, high-flow season contributions decreased with respect to water volume, but increased with respect to both TN and TP flux; that is, the high-flow season is making up less of the annual water volume for each year, but more of the annual nutrient flux. We believe that changes in variability but also timing of hydroclimatic forces are responsible for the observed anomaly in nutrient transportation pattern. Examination of long-term flow data show that higher flows and more precipitation during the high-flow season are most likely responsible for increasing nutrient load to the reservoir regardless of overall decreases in nutrient concentration.

Keywords: Nutrient transportation, phosphorus, nitrogen, eutrophication, climate change, lake Diefenbaker

Oral Presentation
2 August 2017, 17:35-17:55

Development of a biomonitoring strategy that uses diatom communities to monitor changes in the phospahte and nitrate status of Swaspruit River, South Africa

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Response of diatom communities to changes in trophic status of Swartspruit River was determined by optimization of phosphate and nitrate concentrations on diatom cultures under laboratory conditions. Diatoms from Swartspruit River were cultivated in control media (WC) and in optimized phosphate and nitrate media. The diatoms were identified by light microscope (x1000) and by Molecular methods using 18S rDNA and V4 subregion of same gene and sequenced by next generation sequencing. All diatom species flourished in the control medium but the abundance and diversity varied with modification in PO42- and NO32- concentrations. Principal component analysis (PCA) of the optimized phosphate cultures using an ordination biplot depicted 45.62% variations in the data. The F1 axis describes 31.56% and F2 axis describes 14.06%, an indication that optimization of phosphate concentrations encouraged fluctuations in diversity and abundance of diatoms. Oligo-mesotrophic cultures, which displayed separation on F1 axis on the biplot favoured large diversity of diatoms dominated by Fragillaria, Nitzchia, Encynopsis, Ropalodia, Navicula and Gomphonema species. The eutrophic – hyper-eutrophic cultures had lower diversity of diatoms in which *Gomphonema pavulum*, *Planothidium frequentissimum*, *Melosira varians*, *Sellaphora popula*, *Aulacoseira spp*., *Cyclothella spp*., *Triblionella spp*. and Roicosphenia species dominated. Comparably, PCA for the nitrate cultures depicted 37.93% variations. The F1 axis describes 21.72% and F2 axis describes 16.21% variations. The results showed that nitrate optimization within mesotrophic to hyper-eutrophic conditions displayed correlation with specific diatom species. Cultures depicting mesotrophic conditions favoured the abundance of Amphora, Diademis, Encynopsis, Gyrosigma, Hantzchia, Navicula, Nitzchia, and Rhopalodia spp. PCA ordination biplot showed that the eutrophic–hyper-eutrophic cultures (N7– N12) favoured the growth of Roicosphenia, Navicula, Gomphonema, Aulacoseira, Cyclothela, Rhoalodia, Pseudostaurosira, Surrirella, and Triblionella species. The study showed a dynamic shift in diatom community composition with change in phosphate and nitrate levels under laboratory conditions.

Keywords: Diatoms, eutrophication, fresh-water, nitrate, phosphate

Oral Presentation
3 August 2017, 08:40- 09:00

Study of the minipuberty and somatic development risks of infants exposure to Bisphenol A
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Many surveys have shown that children are ubiquitously exposed to bisphenol A (BPA) and many laboratory studies have shown BPA exposure have adverse effects related to estrogenic disruption, while the evidence in infants has not been observed. Early pregnancy women were recruited by the Maternal and Child Health and Family Planning Service Center, Daishan, China, from March 2012 to December 2014. After delivery, 59 mothers offered their baby (0-6 months old) urine samples collected by the disposable diapers. Urinary BPA, estradiol (E2), testosterone (T), follicle-stimulating hormone (FSH), luteinizing hormone (LH) and creatinine were analyzed, respectively. The partial correlation and multivariable linear regression were applied to assess the associations of BPA with E2, T, FSH and LH for each of the development stages, i.e., the newborn, 14-days, 28-days, 42-days, 3-months and 6-months, respectively. The data showed that the selected urinary hormone surges may be used as minipuberty biomarkers to indicate the HPG activity. It was also observed that the levels of gonadotropins and sexual steroids may have associations with infants' later on somatic development, especially for male infants. After adjusted by creatinine, maternal age, end-of-pregnancy weight, parity, smoking, delivery mode and infant body mass index, BPA was positively associated with E2 both in male (for 14-, 28- and 42-days stages) and female (for 14-, 28-, 42-days and 3-months stages) infants, positively associated with E2/T ratio both in male (for 14- and 28-days stages) and female (for 14-days stage) infants, positively associated with T in female (for 3-months stage). Life stage 14-42 days after birth, especially around 14 days, may be the highly sensitive period for infant HPG activity. Exposure to BPA contamination during this period will, to some extent, interfere with the infants' sexual steroid balance, which may have the further consequence on their later on somatic development.

Keywords: Bisphenol A, infant, minipuberty, growth, risk

Oral Presentation
3 August 2017, 09:00-09:20

Bisphenol A and Phthalate exposure in Turkish children aged 8-9 years from Ankara, Turkey
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This study aimed to determine the levels of urinary Bisphenol A (BPA) and five phthalate metabolites in children aged 8-9 years in a sample representing urban and rural areas of Ankara in Turkey. Children were selected by household sampling. Urine samples were collected in glass vials in the morning and were stored at −20 °C until analysis. BPA analyses and phthalate metabolites including mono-n-butyl phthalate (MnBP), monomethyl phthalate (MMP), monoethyl phthalate (MEP), monobenzyl phthalate (MBzP), mono-2-ethylhexyl phthalate (MEHP) were measured using LC–MS/MS. Of 771 enrolled children, 74.4% were from urban area, 50.6% male. Urinary BPA concentrations were detectable in 87.3%. Measurements above the limit of quantification (LOQ) was 99.1% in MnBP, 99.1% in MBzP, 99.7% in MEP, 100% in MEHP and only 5.6 % in MMP. A median (25p-75p) concentration of creatinine(cr)-corrected BPA concentrations was 6.0 (1.5-15.8) µg/g-cr. MnBP, MBzP, MEP, and MEHP was detected in urine with a median (25p-75p) concentration of 124.2 (68.1-203.7), 8.5 (4.7-17.0), 27.7 (14.6-53.2), 18.8 (11.0-32.5) µg/g-cr, respectively. Gender didn't affect the quartiles of BPA/cr concentrations and the highest 4th quartile of BPA and phthalate metabolites. Urban children had higher frequencies of the 4rd quartile of creatinine corrected BPA, MEP, MnBP and MEHP than rural children (respectively, 29.8%, 11.2%, $p<0.001$; 27.0%, 19.8%, $p=0.044$; 27.4%, 18.8%, $p=0.017$; 28.7%, 14.7%, $p<0.001$). Findings indicated that residence of children would affect the exposure of BPA and phthalates.
Acknowledgement: This survey was funded by TÜBİTAK SBAG-107S407.

Keywords: Bisphenol A, phthalates, metabolites, exposure, urine, children

Invited Speaker Lecture
3 August 2017, 09:20-09:50

Organic and wild food for improved health
Carina Tikkanen-Kaukanen
University of Helsinki, Ruralia Institute and Finnish Organic Research Institute

From organic food several bioactive components can be found: from milk, oats, barley, wild berries and organic honey. Production volume, dry matter intake, hormones of organic cow milk are affected by the feed like blue lupin and red clover in feed. Important bioactive organic milk components include exosomes, which are specific information packages for a calf. Organic raw milk components, especially from whey and from colostrum may have importance in allergy prevention. In addition to beneficial microbiota in organic raw milk the possible bacterial pathogens may cause biohazards. In order to avoid them the bioactive components have to be isolated or fractionated from the organic raw milk. Bioactive polyphenols can be found from organic oats and barley (antioxidant and scavenging activity), wild berries, stem bark and organic honeys. Wild berries, other wild natural products and organic honeys have huge alternative potential to antibiotics against bacterial infections in humans and in animals and when fighting against antimicrobial resistance. Organic certification of forests will bring several health and wellbeing collection products for costumer use, like herbs, mushrooms (e.g. chaga mushroom), sap and resin.
The research among organic and wild food for human health and wellbeing has to follow the recent up-to-date modern technology including plasebo-controlled, double-blind, randomized, cross-over clinical trials as far it is possible. This is important in scientific and consumer point of view and when delivering the research results to health professionals. The healthy lifestyle as a whole including organic diet has to be surveyed taking into consideration different social aspects of the consumers. In future the focus of the research has to be directed to long term over generation harmful effects of the pesticides using the best suitable methodology available.

Keywords: organic, milk, oats, barley, honey, berries, forest collection product, health, wellbeing, antimicrobial, polyphenol, pesticide

Oral Presentation
3 August 2017, 09:50-10:10

Zinc deficiency in Mali - food production and human health
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Zinc deficiency is common in many agricultural soils found in Africa and Asia. Zinc deficiency affects the crop yield as well as secondary human health. Especially wheat cultivation can suffer from zinc deficiency. Zinc is important for the immune system in man and not least in children. Zinc is quite mobile and get lost from surface soils with time. The soils conditions are also important, a high pH tend to immobilise the zinc and affect plant uptake. Investigations along the river Niger at five sites in Mali revealed almost ubiquitous zinc deficiency with low total concentrations of zinc but also depending on alkalinity of soils. Zinc tended to be higher in and around villages due to that food was brought from fields and that the animal excreta was deposited in the vicinity of villages when the animals were brought into the villages in night time. A new secondary source of zinc was identified in the form of used dry batteries which were also deposited in and around villages. As much as 400 g/ person and year of zinc are used by the population in their radios and other utensils. In Bamako, the capital of Mali, periurban agriculture is steadily growing. The cycling of organic waste partly in the form of urine from urine separating toilets co-composted with household waste gives an organic soil amendment that is enriched in zinc and that improves the cultivated vegetables. The co-composting of urine and organic waste is due to the difficulty of storing urine during the dry part of the year with less need for nutrients in cultivation. One advantage of the composting is that the product is hygienised in the composting process when the temperature comes up to around 60-70℃.

Keywords: soil, zinc, wheat, health, periurban agriculture

Invited Speaker Lecture
3 August 2017, 10:25-10:55

Dampness and Mold Hypersensitivity Syndrome
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Indoor air related dampness microbiota is detrimental to human health. It may cause a variety of symptoms that are far beyond those that are officially accepted, asthma in the first place. Because of a variety of clinical manifestations I suggest to call this disorder as **Dampness and Mold Hypersensitivity Syndrome (DMHS)**. This name points to the fact that we deal with a multi-organ **syndrome** that may involve central, autonomous and peripheral nervous system, gastro-intestinal tract, upper and lower respiratory system with the development of bronchopneumonitis, cardiovascular system, irritation of mucosa and skin, inflammation in joints, misbalance of immune and endocrine systems and many basic biochemical reactions of the body. The syndrome is a toxicosis caused by mycotoxins and volatile organic compounds (VOCs). The second important message is that disease may present as **hypersensitivity** which is not limited to allergy. In fact, allergy is not the leading symptom. Hypersensitivity relates e.g. to multiple chemical sensitivity (MCS), in some instances to electromagnetic sensitivity and in very severe cases to light hypersensitivity. All these hypersensitivity manifestations will develop through the activation of the so-called TRPV and TRPA sensory receptors. The third important message is that indoor mold may initiate all these symptoms that are in fact the result of chronic inflammation and an oxidative stress reaction. And the fourth message is that indoor **dampness microbiota** is an etiological trigger.

In an epidemiologic survey we have recently linked DMHS to cancer and autoimmune diseases, especially to hypothyroidism. Although we still miss complete understanding of this multi-facet disease, we can say with certainty that DMHS is a clinical entity, it is an emerging environmental disaster but due to litigation problems it is denied and neglected. This disease should be recognized by medical community and adequate treatment should be guaranteed to all patients.

Keywords: Dampness and mold hypersensitivity syndrome, indoor air, environmental hazard, microbiota, molds

Invited Speaker Lecture
3 August 2017, 10:55-11:25

Biofilms and bacteriophages, an endless battle between micro and nano worlds (two case studies)
Robert Armon
Technion, Israel Institue of Technology, Israel

Groundwater wells containing large concentrations of ferrous Fe face serious clogging problems as a result of biotic Fe oxidation, making cleanup and rehabilitation an economic burden. The goal of this study was to test an experimental combined treatment (chem. and biol.) for prevention or rehabilitation of clogged wells. *Sphaerotilus natans* (an iron-oxidizing bacterium) freshly isolated from a deep well was grown to form biofilms on 2 systems: coupons and sand buried miniature wedge wire screen baskets. A combined chemical-biological treatment, applied at lab. scale using glycolic acid (2%) and isolated bacteriophages against *S. natans* (SN1 and ER1-a newly isolated phage) at low multiplicity of infection (MOI), showed inhibition of biofilm formation and inactivation of the contaminant bacteria. Beside complete inactivation of S. natans planktonic bacteria by phages, earlier biofilm treatment with glycolic acid revealed efficient exopolysaccharide (EPS) digestion allowing phages to attack bacteria and lyse them. This combined treatment revealed clean model stainless steel wedge wire for ≤60 days. A model ultrafiltration (UF) continuous recycled system fed with previously sterilized effluents (two sources) was exptl. inoculated with three bacterial species: *Pseudomonas aeruginosa*, *Acinetobacter johnsonii* and Bacillus *subtilis* (separate and combined). The corresponding specific lytic bacteriophages were supplemented vs. control (bacteria without phages) and the exptl. set-up was operated for >80 h. The seeded phages lytic activity reduced membrane biofouling by an av. of 40% to >60% compared to control. Concentration of phage numbers increased accordingly and some were found in permeate, however inoculated bacteria were not detected in permeate. Combinations of one, two and three bacterial species in parallel with their specific phages, revealed significant and efficient inactivation rates as well reduced biofouling as detected by high resolution

electron scanning microscope (HSEM) and permeability test. The results suggest on potential use of specific lytic phages to prevent UF membrane biofouling.

Keywords: bacteriophage, biofilm, clogging, filtration, water

Invited Speaker Lecture
3 August 2017, 11:25-11:55

Future solutions for healthcare, nutrition, and circulation by the microbiome
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Microbes include a wide variety of living organisms, united by the small scale. However, their influences in the industries, circulation and healthcare are immense. These tiny creatures keep ecosystems functioning inside and outside man. They form microbiomes in soil, intestines and everywhere. If we could understand their interactions, not such classify them, we could discover the very basic mechanisms of the digestive function, pathophysiologies of complex diseases, functions of the biosphere and the biorefineries, ecosystem services. In our research with the PMEU device (portable Microbe Enrichment Unit) it has been possible to screen these events in real time, and to simulate them. During biorefinery piloting experiments (eg. ABOWE project), the interactions of the UMC (Undefined Mixed Cultures) have been utilized for the production of valuable end products, such as mannitol, valeric acid and 2,3-butanediol, out of the side streams. We have also revealed some features of the ecological succession in the alimentary tract, and its linkages to the numerous health issues, such as IBS, stroke, malnutrition, etc. Understanding on the strive for balances in the microbial communities could help in finding out the relevant contributions of microbiomes on our lives.
In soil improvement we have seen, how the addition of a single strain can decisively alter the composition and function of the entire soil ecosystem. For example, the supplementation of organic fertilizers with an autonomous Nitrogen fixing bacterium Clostridium pasteurianum strain, Aurobion™ increases the greenhouse production by about 50% in two months.
Similarly, the incorporation of probiotic bacteria into a prebiotic mix could in our digestive tract attenuate trouble-making excessive microbial actions, as evidenced by simulation studies with the PMEU.

Keywords: Microbiome, pathophysiology, digestation, biorefineries, mixed cultures, Portable Microbe Enrichment Unit

Invited Speaker Lecture
3 August 2017, 11:55-12:15

Investigation of Pediatric Microbiological Samples and Intestinal Enterobacterial Microbiota by Portable Microbe Enrichment Unit (PMEU)
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INTRODUCTION: New methods were validated for characterization of intestinal microbiota of infants and investigation of blood culture and urine samples.

MATERIALS-METHODS: Portable Microbe Enrichment Unit (PMEU; Finnoflag Oy, Kuopio and Siilinjärvi, Finland) was used for characterization of enterobacterial intestinal microbiota from fecal samples collected from infants at different ages. Direct plate culture on BBL CHROMAgar Orientation (Becton, Dickinson & Company, New Jersey, USA) was compared with plate culture performed after pre-enrichment of the samples in the PMEU (4,6).

PMEU Scentrion® (Finnoflag Oy) (2) equipped with an ultrasensitive vapour detector was compared with a standard method (BacT/ALERT® PF, bioMerieux, France) in the investigation of blood culture and urine samples

(5) in Kuopio University Hospital. Blood culture samples from 56 neonatal patients were enriched by the PMEU Scentrion® and by the standard method in parallel, and thenafter similarly plated (3).

MAIN OUTCOME AND RESULTS: 2,6-fold amount of different enterobacterial phenotypes were detected from fecal samples pre-enriched in the PMEU before plating than from parallel samples plated directly without enrichment.

Results of blood culture samples were comparable between study and standard methods. 26 patients had a clinical diagnosis of sepsis. Bacterial growth was detected in six blood samples. 20 patients were empirically treated although no bacterium could be identified.

CONCLUSIONS: The PMEU enrichment method proved its usefulness in the detection of the enterobacterial intestinal microbiota of infants. More representative numbers of species and strains was detected by the study method. In personalized medicine it has also been used for the investigations on various aspects of human intestinal microbiome (1). It is possible to make screening of individual microbiota of an individual patient with this technique.

PMEU Scentrion® was capable of providing early signs of bacterial growth in blood samples with increased efficiency. In clinical studies, this kind of enrichment unit turned out especially useful for investigation of naturally sterile samples, like blood, urine and liquor.

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Keywords: blood culture, infant, intestinal microbiota, microbiome, Portable Microbe Enrichment Unit, sepsis

Invited Speaker Lecture
3 August 2017, 13:00-13:40

Biodiversity and Human Health – Ilkka Hanski Memorial Lecture
Tari Haahtela
Skin and Allergy Hospital, Helsinki University Hospital, Helsinki, Finland
University of Helsinki, Finland

The world is urbanizing faster than ever, and UN predicts that even 70% of the human populations live in cities by 2050. At the same time non-communicable diseases, e.g. allergies, asthma, inflammatory bowel diseases, diabetes, neurological and mental disorders, obesity and cancer are on increase everywhere in the urban environments. The human immune system has run to an adaptation crisis not having time to adjust to the fastly changing life-style and environment. Immigration studies indicate that already in 10 years people from very different environments start to acquire same health problems as the original population.
Biodiversity loss (tigers, rhinos, whales,…) worries us, but the problem seems to be far away from the rushing and growing cities.The threat is, however, close to us, in and on us. Loss of macrodiversity affects microdiversity, immune response and risk for many diseases. For example, traditional farming and life-style with diverse bacterial endotoxin exposure modifies gene expression, immune responses and protects from asthma. Increase of age-adjusted prevalence of Alzheimer disease strongly associates with urban environments.
We are protected by two nested layers of biodiversity, consisting of microbes residing in our bodies and those of the environment we live in. The diversity and composition of the inner layer is dependent on microbial colonization from the outer layer, a process that depends on our behaviour and environment. To preserve our

inner biodiversity – which closely interacts with the immune system – we need to preserve the outer biodiversity and change our everyday practices. Development of diverse microbiota is mostly promoted in early childhood, but the interaction of the outer and inner layers never stops.
Everything we eat, drink, inhale and touch affect online the composition of our microbiota and immunoregulatory circuits. Changes in life-style, e.g. increased use of processed food, lead to reduced human gut microbiota (dysbiosis), immune dysfunction (poor tolerance), inappropriate inflammatory responses and finally symptoms and disease. Innate immunity needs constant, life-long exposure with harmless microbes, “old friends”, to create and maintain tolerance. The clinical manifestation – what kind of a disease we aquire – is then largely dependent on our individual genetic architecture.
The number of our own cells is about the same as the number of bacteria in the body. The human genome consists of around 23,000 genes (our first genome), compared to the genomes of our microbiota where around 3 million genes are encoded (our second genome). We have externalized many protective and life supporting functions to this second genome.
Loss of environmental biodiversity is one, if not the most dangerous global megatrend. The cross-talk of environmental metagenome and human genome is effected through the genome of human microbiome. This interplay determines health and disease, which is especially true in terms of non-communicable diseases, where immune dysfunction and low-grade inflammation play a role.
Escalating urbanization cannot be stopped, but we can slow down the environmental destruction and bring elements of natural biodiversity into urban life. *Biodiverse revolution* is a must for human survival. The driver could be the selfish gene: concern of our own health and health of children. Taking human health on the political agenda can fuel effective implementation of the new knowledge.
This is also the legacy of Ilkka Hanski, innovator of the *biodiversity hypothesis of human health* in a process where ecology, microbiology and medicine shook hands. Hanski was world famous for his metapopulation theory explaining how animal and plant species survive, or become extinct, in fragmented habitats. In 2011 he was awarded the Crafoord Prize in biosciences, ecology´s version of the Nobel Prize. In 2015, he received the honorary title of Academician of Science from the Academy of Finland. Also the medical community ows much to him.

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Invited Speaker Lecture
3 August 2017, 13:40-14:10

Microbiome and Nutrition Potentially Influencing Alzheimer´s disease pathology
Nittaya Marungruang, Frida Fåk Hållenius
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The gut microbiota has an important role for host health and can affect energy absorption, metabolism and the immune system. Together with Dr. Taoufiq Harach, Dr. Tristan Bolmont and Prof. Theo Lasser from Ecole Polytechnique Federal de Lausanne, Switzerland, we investigated whether germ-free mice were protected from Alzheimer's disease pathology. APPPS21$^{-/-}$ mice lacking bacteria had 70 % less amyloid beta plaques in the brain. We next sequenced bacterial 16S rRNA genes in conventionally raised APPPS21$^{-/}$ mice and control wildtype littermates and found that the gut microbiota composition was altered in the Alzheimer's disease mice, with decreased levels of *Akkermansia* and *Allobaculum* and increased levels of *S24-7* and *Rikenellaceae.* Microbiota transplantation experiments from diseased mice to gem-free mice further indicated a role of the gut microbiota in Alzheimer's disease pathology. The diet can modulate the gut microbiota and can be used as a tool to alter the gut microbiota composition. By altering the physical and chemical properties of dietary fibers, specific effects on the gut microbiota community can be achieved and health effects can be optimized. In addition, by profiling the gut microbiota composition before, during and after dietary interventions, we have identified key members of the microbiota that can be directly related to specific biomarkers, such as blood pressure, blood cholesterol levels and low-grade systemic inflammation. Future work entail profiling of the gut microbiota in patients with Alzheimer's disease as well as mechanistic studies in mice to enravel the pathways linking the gut microbiota to inflammatory processes in the brain.

Invited Speaker Lecture
3 August 2017, 14:10-14:40

Biochar as promising tool for carbon sequestration: Effects on Environment and Agriculture
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The target rise in global mean temperature of less than 2 °C can only be achieved with the help of carbon (C) sequestration technologies, of which the sustainable use of highly stabile biochar as a soil amendment material is currently the most efficient (Woolf et al. 2016). Biochar is a porous carbonaceous solid material produced by heating the biomass in oxygen-limited conditions, to be used for means that do not allow the photosynthetically-fixed C to be quickly released back to the atmosphere. The long-term efficiency of biochar-bioenergy systems compared with pure bioenergy systems depend largely on the enhancements biochar use as a soil amendment bring along to agriculture and environment, but so far there are no long-term studies published of biochar effect on soil and environment from longer tem (i.e. more than five years) field experiments (Woolf et al. 2016).
We explored the effects of biochar on soil biota, soil physical and chemical properties as well as on the growth and yields of agricultural crops on field scale in case of different fertilizer strategies on two contrasting Boreal soils over eight years. Furthermore, we are exploring the possibilities of using biochar for developing an environmentally-friendly best practice for recycling the nutrients reached to waterbodies with lysimeter and field experiments in the watershed of the Baltic Sea.
We report the effects of biochar on the environment and agriculture, and present also the state-of-art of the best practices of biochar use as a soil amendment and tool for C sequestration, including the recent developments of community-based biochar practices from Nepal, Sweden and Finland.
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Woolf, D., Lehmann, J. and Lee, D.R., 2016. Optimal bioenergy power generation for climate change mitigation with or without carbon sequestration. Nature Communications, 7, p.13160.

Keywords: Agriculture, Biochar, Environment, Phosphorus, Soil, Waterbodies

Oral Presentation
3 August 2017, 14:40-15:05

What's next? Shifting focus from emissions to innovation
Pia Henrietta Kekäläinen[1], Chris Carstens[1], Sam Van Wesenbeeck[2]
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The greatest threat of a catastrophic rise in global temperatures comes from the world's reliance on the fossil fuels responsible for greenhouse gas emissions. Global climate change and depletion of the oil supplies, which soon will no longer be able to meet global energy demand, will inevitably coax world economies to progressively abandon oil and fossil fuels as the primary energy source. As generating energy from biomass and using clean and efficient carbonization technologies could significantly contribute to solving both problems, this could be a scenario worth considering and investing in. Under oxygen-deprived conditions, carbonization thermally transforms biomass into bio-oil, syngas and charcoal. The application of the charcoal by-product to soils may be the key to sustainability, as the carbon in the soil-applied charcoal is removed from the atmosphere and sequestered for thousands of years, a win-win scenario for simultaneously producing bioenergy, permanently sequestering carbon, while improving soil fertility and water quality. Leaving the use of charcoal as an energy generator and its climate-smart benefits aside, it is also an industrial commodity that can conveniently replace fossil fuels in a myriad of uses and industrial applications, in both the metallurgy industry as a smelting fuel for iron ore and in the silicon chip industry as a. The exclusive use of residual waste as a feedstock during the Carbo Culture process is significant, in that it makes less heavy demands on forest resources and avoids deforestation altogether. Moreover, converting agricultural residues, forestry waste and biomass into high-quality charcoal is likely to bring down the greenhouse-gas emissions that would otherwise have been released by the natural decomposition or burning of the waste. By further increasing productivity and efficiency, Carbo Culture's process takes pyrolysis one step further. It permits to obtain formidable biocarbon yields in an exceptionally short time-span, while recovering the pollutants

Keywords: charcoal, biocarbon, biochar, biomass, waste, carbonization

Oral Presentation
3 August 2017, 15:05-15:30

Benchmarking nationally representative nitrogen and phosphorus farm-gate balances and use efficiencies of Irish farms to encourage sustainable management
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Agriculture faces considerable challenges of achieving sustainable intensification which minimises nitrogen (N) and phosphorus (P) losses and meets international obligations for water quality and greenhouse gas emissions. Reducing nutrient balance (NB) surpluses, and increasing nutrient use efficiencies (NUE), are critical in reducing diffuse pollution and improving farm profitability (a win-win). To set targets and motivate improvements in Ireland, nationally representative benchmarks were established. Annual farm-gate NBs (kg/ha) and NUEs (%) for N and P were calculated for 1479 nationally representative farms from 2008-2015 using import and export data (fertiliser, forage, concentrates, livestock, milk, wool and crops) collected by the Teagasc National Farm Survey (part of the EU Farm Accountancy Data Network). Benchmarks for each sector were established by calculating median values and 90th percentiles (top performers). For dairy, mixed livestock, suckler cattle, non-suckler cattle, sheep and tillage sectors, median N balances were 149.8, 101.1, 38.1, 50.3, 30.8 and 54.6 kg/ha, respectively, and median P balances were 5.6, 4.6, 2.2, 3.0, 1.7 and 4.8 kg/ha. Median N use efficiencies were 21.3, 20.2, 16.8, 22.1, 26.6 and 57.0%, respectively, and median P use efficiencies were 59.1, 60.5, 55.7, 64.0, 62.3 and 75.7 %. National-scale maps were generated by extrapolating results using farm population weightings. Within

certain farm categories, large differences between median and benchmark values showed that farmers have considerable room for improvements. Results provide the foundation for a national benchmarking tool that compares a farm's performance against national averages and sets farm-specific benchmark targets and recommendations for improving nutrient management. Accounting for environmental losses and relating balances to soil test P is needed in future work to establish benchmarks that are within agronomic optimums, as certain farms with farm-gate surpluses may actually be mining soil nutrient reserves which is unsustainable long-term.

Keywords: Benchmark, nutrient balance, nutrient use efficiency, sustainability, agriculture, nitrogen

3 August 2017, 15:30-15:50

Waste management through life cycle assessment to shift to a circular economic development
Nongnuch Poolsawad, Ruthairat Wisansuwannakorn, Wanwisa Thanungkano, Jitti Mungkalasiri
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The national recycling rate is one the most commonly used waste management indicators, which proposed by United Nation Sustainable Development Goals; however, the indicator addresses to the decoupling natural resource use and environmental impacts from economic growth is rapidly capturing attention. Interestingly, waste reduction and resource efficiency are the core of decoupling growth within the concept of the circular economy (CE). Undoubtedly, Life cycle assessment (LCA) is the efficient tool that can be used to quantify the environmental performance, benefits from recycling and also circularity of resources to encourage circular economy project. This paper conducted in the perspective of waste restoration and resource decoupling that considered both types of cycles. The cycle of material restoration into the biosphere to rebuild natural capital, after being cascaded and technical cycle which covers products, components and materials are restored into the market through repair, reuse and eventually recycling. Furthermore, the study identified two life cycle models in particular that are major contributors to environmental impacts: linear and circular models. It stands to reason that circular model creates opportunities for eliminating the dependence on virgin materials and improving the environmental impact performance. So, sanitary ware product was assessed to reveal quantification of the benefits from recycling and circularity of resources. However, a closer look at the end of life of product, which substituted for raw material in different type of products such as concrete and re-entered to biosphere to land reclamation that shown the ability of the natural resource base to supply food also habitat. Moreover, material substitution was identified as key strategies to reduce environmental impacts when compared with the linear. The results highlighted how important it is to understand the details of the recycling systems, and how to achieve the maximum efficiency. CE is an effective indicator that does exactly that.

Keywords: waste management, circular economy, resource decoupling, LCA

Invited Speaker Lecture
3 August 2017, 16:50-17:15

Wastewater discharge-a source of parasitic contamination of surface water.
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Evidence supporting the assertion that wastewater effluent discharged in surface water contains high concentration of parasites that could affect environmental and public health is accumulating. In this study, we investigate the epidemiology of three protozoan parasites of public health significance: *Entamoeba histolytica, Giardia duodenalis*, and *Cryptosporidium parvum*. They are major pathogens in food and waterborne transmission of infections and are able to persist in the environment due to the robustness of the cysts and oocysts. Increasing scientific data implicates effluents from wastewater treatment plants and livestock farming, including straying animals for the contamination of surface waters. Thus, the multipurpose use of surface waters for agriculture, drinking water and recreational purposes poses definite public health risks.

A reliable tool for monitoring surface waters for parasite contamination is the analysis of mussels, owing to their capacity to filter large volumes of water. This investigation targets mussels at point of wastewater discharge, recreational areas and along the catchments of two major rivers in Germany. Aim is to gain an in-depth understanding of the transmission dynamics of the pathogens by examining the links between wastewater discharge and the presence, prevalence, and spread of the pathogens, as well as the role of Mussels in the sanitary assessment of water quality.
Results so far show the presence of oocysts and cysts in Zebra mussel (*Dreissena polymorpha*) and Asian clam (*Corbicula fluminea).* Out of 97 samples analyzed 65 were shown to be infected by parasites corresponding to an infection rate of 67%.
There is need to build a detailed epidemiological knowledge of the target parasites to make existing experimentally established principles more directly applicable to practical prevention.

Keywords: protozoa, mussels, wastewater, epidemiology.

Oral Presentation
3 August 2017, 17:15-17:40

Mapping biological activity in soils disturbed by mining processes
Pablo Leon Higueras[1], Paula Zamorano[1], Juan Antonio Campos[1], Marta María Moreno[2], Sara González Mora[2], Jesús Daniel Peco[1], María Mercedes Madrid[3]
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Large stacks of gangue, slagheaps of material from the milling process and subsequent mineralogical processing, wide surfaces affected by acid drainage and dunes of fine material accumulated by wind with steep slopes are the distinctive elements of the current landscape in the so long abandoned mining area known as San Quintín mines (Ciudad Real, Spain). All the area is affected by dissemination of sulfide minerals that leads to the formation of both insoluble and water-soluble metal bearing sulfates, hydroxysulfates and hidrous oxides. The reactions generally lead to the generation of acidic solutions that eventually affect all the living organisms linked to the soil. A detailed study of substrate parameters is underway in order to provide knowledge of those factors to be taken into account when applying phytoremediation-based remediation programs. For this purpose the area has been divided into a grid and a thorough systematic sampling of the surface layers has been carried out. At each sampling point, the biological activity has been assessed through the measurement of four soil exoenzymes (Dehydrogenase, acid and basic phosphomonoesterase, urease and β-galactosidase). With the results obtained, a map of the biological activity distributed throughout the surface was made in order to provide sound information aimed to the establishment of bioremediation criteria.

Keywords: Soil, mining, enzymatic activity, bioremediation

Oral Presentation
3 August 2017, 17:40-18:00

Natural colonizing patterns and composition of plant cover in soils affected by sulfide-metal mining
Juan Antonio Campos, Juan Bautista Gallego Fernández, José Ángel Amorós, Marta María Moreno
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After more than 50 years of abandonment, a metal-sulfide mining area is being gradually colonized by plant populations resilient enough to withstand extremely hard edaphic conditions. The vegetation of these habitats is of great interest due to its particular physiological adaptations to endure both high heavy metal concentrations and acidic environment. Moreover, the climatic Mediterranean conditions, with extremely hot and dry summers, confer additional ecological values to these populations. A thorough study of the transition and composition of plant populations from the most contaminated core to less disturbed outer zones may yield clues about the eco-physiological behavior of these species to be subsequently used in bioremediation actions. The objective of our work was to study the different species of plants able to overcome the constrain of this habitat as well as the patterns of colonization in relation to the different types of substrate. The different species establish in different areas depending on the origin of the edaphic material. For this purpose, 5 zones were delimited: (1) a fine sludge raft (silts); (2) a coarse sludge raft (sands); (3) gangue stacks; (4) an area affected by acid drainage and (5) a

transition area. The area affected by the acid drainage (4) and the stacks of gangue (3) are completely bare of vegetation with only some scattered patches of *Spergularia rubra* (L) C. Presl. in association with *Agrostis tenerrima* Trin. As the harsh conditions are softened by the substrate or the input of surrounding material, dragged by wind or by rainwaters, the plant biodiversity increases with the gradual appearance of new species. Remarkable cases are the slopes with *Scrophularia canina* L. and the dense population of *Phragmites australis* (Cav.) Trin. in the fine sludge raft.

Keywords: Phytoremediation, contaminated soils, resilient substrate vegetation, sulfide mineral

Oral Presentation
3 August 2017, 18:00-18:40

Cadmium remediation potential of Linseed (*Linum usitatissimum* L.) in association with plant growth promoting rhizobacteria (PGPR) isolated from industrial waste water

Muhammad Tariq Javed, Muhammad Shahid, Muhammad Sohail Akram, Rabia Gilani, Noman Habib, Naeem Iqbal
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Soil cadmium (Cd^{2+}) stress adversely affects the plant growth, yield and physiology. Plant growth promoting rhizobacteria are able to increase the plant growth and productivity by inducing variation in metabolic pathways. In present study, we reported the isolation and characterization of Cd-tolerant rhizobacteria from wastewater of Chakera (Industrial area of Faisalabad, Punjab, Pakistan) and were coded RS-13 and RS-15 on the basis of their limits of Cd tolerance/litre medium. The strain exhibited significant potential of phosphate solubilization, indole-3-acetic acid production and 1-aminocyclopropane-1-carboxylic acid deaminase activity. A pot experiment was conducted to investigate the effect of Cd stress on physio-biochemical and growth attributes of Flax (*Linum usitatissimum* L.). Three Cd concentrations 0, 5 and 10 mg/kg of soil with and without PGPR inoculation (RS-13 and RS-15) were applied. Inoculation of RS-13 & RS-15 with *L. usitatissimum* plant, in the absence of Cd stress, prompted a significant increase in plant biomass together with decreased reactive oxygen species and enhanced activity of cellular antioxidant enzymes. The RS-13 and RS-15 inoculation also significantly accumulated macro- and micro-nutrients in roots and shoots, and increased chlorophyll and protein contents in comparison with non-inoculated plants. It was concluded that RS-13 and RS-15 mitigated *L. usitatissimum* from Cd-induced cellular oxidative damage, enhanced growth and thereby cause sustainable plant production. A decrease in Cd uptake was noticed in *L. usitatissimum* inoculated with RS-13 and RS-15 as compared to un-inoculated ones. Regardless of bacterial inoculation, plants exhibited low values of bio-concentration (BCF) as well as translocation factor (TF) (<1) for Cd. The BCF and TF were <1, indicating that all studied bacteria-plant combinations was suitable for Cd phytostabilization. The present study reveals that the bacterial isolates RS-13 and RS-15 improved the growth of *L. usitatissimum* and also have great potential to be utilized as inoculants in phytostabilization scenarios of metal-contaminated soils.

Keywords: Antioxidants, bioconcentration factor, phytostabilization, reactive oxygen species, *Linum usitatissimum*, translocation factor

Invited Speaker Lecture
4 August 2017, 08:05-08:35

Species diversity indices (indicators) for community ecology and conservation

Yaron Ziv
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Ecologists and environmental scientists use species diversity indices for many years for both basic and applied science. A species diversity index serves to characterize the richness of a given community based on the observed number of species and their abundance distribution. However, the classic indices, e.g., Shannon and Simpson, are sample-size- and sampling-effort- biased, and therefore fail to provide objective tools for comparing different communities and ecological scales. In addition, it is currently apparent that the coefficients of the species-area relationship cannot always be used for meaningful interpretation of scale and biological determinants. Contemporary approaches provide proper tools to overcome the biases of the classic indices and species-area curves. I will present three approaches: (1) Use of probability-based functions (species-richness estimators) to estimate the number of species expected in a community where no sampling constraints exist,

based on the community's relative abundance distribution and its individual-species accumulation curve; (2) Use of spatial-oriented random occupancy distribution to predict the species-area relationship of a community under no scale and context constraints; (3) Use of Alpha / Beta / Gamma diversities to separate between scale-oriented variation in species richness, in order to identify the source of the dominant factors affecting species assemblages. Finally, I will present examples for each approach and focus on their contribution for both pure and practical studies.

Keywords: Species diversity index, species-area relationship, abundance distribution, occupancy distribution, Alpha-Beta-Gamma diversity

Invited Speaker Lecture
4 August 2017, 09:05-09:35

Arctic agriculture under climate change – opportunities and risks in Northern Norway.
Ievina Sturite
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In Northern areas, climate research shows that the main predicted climate changes include increasing temperatures, precipitation and increased frequency of certain types of extreme weather events. However, it may result in both new opportunities and risks for agriculture. The extended growing season will have largely positive effects on agriculture in northern areas through introduction of new crops and larger biodiversity, greater production potential and expansion of suitable areas for cultivation. On the other hand, climate change will be accompanied by plant diseases, new insect species, invasive weeds and increased use of pesticides and fertilizers. Enhanced use of chemicals may result in negative environmental effects due to increased risk of pollution. More precipitation in autumn and fluctuating winter temperatures may cause ice –encasement or dehardening of plants that further may lead to poor winter survival. Increased problems with winter survival will require smart renewal strategies of temperate grasslands in spring and willingness of farmers to focus on best agronomical practice. Unstable winter climate may also increase nitrogen (N) gaseous emissions in form of nitrous oxide (N_2O) that is strong climate gas. The main drivers of N_2O emissions are microbial processes of nitrification and denitrification in soil. Several studies indicate that N_2O emission rates depend on soil physical environment and management practises. Soil compaction is a common form of soil structure degradation and increased anaerobic microsites. In changing climate, maintaining good soil properties can be a challenge. Thus, climate change will not only give new opportunities for farmers in Northern Norway and in Arctic agriculture generally but will also bring risks resulting from climate change. Individual farmers' willingness together with policy makers to adapt climate change will be also important factors.

Oral Presentation
4 August 2017, 09:35-09:55

Soils, water and food production - challenges facing India
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Feeding a growing human population is a great challenge. In India water for agriculture is a crucial problem. India has a large fraction of groundwater irrigation and the groundwater levels are going down in many regions of India, especially in the states of Haryana, Punjab and Rajasthan. Several problems are associated with the declining groundwater levels. Irrigation has caused alkalinisation of soils which in turn has several consequences such as decreased availability of micronutrients like zinc and increasing fluoride in groundwater. Another problem in India is excessive soil erosion leading to loss of nutritious surface soil amounting to several tons/ha per year. The erosion is closely interlinked with the fraction of groundwater recharge relative to the direct runoff to streams and rivers. In Tamil Nadu of southern India there are 40 000 ponds ("tanks") for arresting runoff and recharging groundwater. When well drilling in hard rocks became efficient tanks were left to decay. Water harvesting is advocated by Centre for Science and Environment. Local water harvesting initiatives are growing fast. Structures in addition to tanks are other types of check dams, levelling of land, agroforestry, contour farming mentioning a few. The runoff to rainfall ratio can be decreased below 1% and the soil erosion to below tenths of kg/ha per year when using a suitable selection of measures. System for Rice Intensification (SRI) implies that the fields are

allowed to dry up between the irrigations. This is practiced in Bihar and in the Cauvery Delta where about half of the rice is cultivated with SRI. 40 % of the water is saved and crop yield is often higher due less denitrification. The measures can be immediately set in action to increase groundwater recharge, minimizing soil loss and increasing crop yields to meet the increasing food requirement in India.

Keywords: water, groundwater, soil, erosion, remediation, food

Oral Presentation
4 August 2017, 10:10-10:30

Using endophytic bacteria to reduce PAH contamination inside plants
Xuezhu Zhu
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Greatly increasing accumulations of polycyclic aromatic hydrocarbons (PAHs) have been found in multiple environments. Due to their high hydrophobicity and affinity for fatty tissues, the PAH contents in plants increased. Although microbial degradation has been thought as one of the main applications for PAH remediation in the environment, most bacteria could not effectively degrade PAHs in environment. Remarkably, plant-endophytic bacteria symbioses have the nutrients and a niche provided by plants, protecting them from competition with other native bacteria. Our research was focused on isolation high PAH-degrading endophytic bacteria and investigation on their potential in protecting plants against PAHs contamination. Pyrene-degrading endophytic bacteria were isolated from plants grown in PAH-contaminated soil. The capacities of endophytic strains to degrade pyrene were tested in vitro, and colonization efficiency was tested in vivo by inoculation of endophytic strains on seedlings. Eight strains of endophytic bacteria (2 strains of *Stenotrophomonas sp*., 2 strains *Serratia sp. Pseudomonas sp.*, *Paenibacillus sp.*, *Pantoea sp.*, *Bacillus sp.*) were isolated from plants grown in PAH-contaminated soil. In vitro test, these strains could degrade more than 95% phenanthrene from media within 7 days. Among them, *Serratia* sp. and *Paenibacillus* sp. could degrade more than 50% of pyrene from media within 7 days. In inoculation test, *Serratia* sp. successfully colonized into roots and leaves of inoculated plants, and reduced plants interiorPAH contamination. In roots and shoots of the inoculated plants, increasing activities of polyphenoloxidase, peroxidase, and catechol 2, 3 dioxygenase were observed, suggesting that high PAH-degrading endophytic bacteria could enhance the biodegradation of PAHs insideplant tissues. PAH-degrading endophytic bacteria have the protective potential forplants against PAH contamination to mitigate the threat of pyrene to human health via food consumption.

Keywords: Endophytic bacterial strains, pyrene, phenanthrene, catechol 2,3-dioxygenase, colonization

Invited Speaker Lecture
4 August 2017, 10:30-10:50

Quantitative Quantum Mechanical NMR Analysis: the Superior Tool for Analysis of Biofluids
Reino Laatikainen
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Modern quantitative NMR spectroscopy (qNMR), with newest NMR technology and software tools, offers an easy, efficient, powerful and even economical tool for samples from biological origin: The qNMR sample preparation is very easy (just filter if necessary and add a buffer), there is no need for laborious calibration typical for other analytical tools because NMR signals are proportional to the number of protons in sample and no pure reference compounds are needed. The spectra offer also *chemical confidence* which means that the individual components of sample can be identified with high confidence on the basis of spectral information. Even unexpected unknown components can be quantified and characterized or even identified from the spectral information. After the sample preparation and nearly automatical NMR measurement (up to 480 spectra without break and operator) our **ChemAdder** software (http://chemadder.com) allows quantitative analysis of the spectra with a few clicks, from the spectra to concentrations (mg/ml) and a graphical diagram. Our approach based on Quantum Mechanical Spectral Analysis (QMSA)[1] makes it superior when compared with the former methods used to transform NMR information to quantitative data. The advantages of the approach are described and its application to analyses of serum, volatile fatty acids from biowaste and slaughterhouse waste are used as examples [2,3].

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Invited Speaker Lecture
4 August 2017, 10:50-11:20

Mass spectrometry in the research of environmental molecules: frog skin peptides – antibiotics of the next generation

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Modern mass spectrometry is the most powerful, sensitive, and informative tool for the analysis of structures and quantities of chemical compounds. It handles anything beginning from isotopes of chemical elements and finishing with the most complex biopolymers. Nowadays mass spectrometry has become a key-method of bio-medical studies including proteomics.
Modern studies in the field of the diseases of the XXI Century make the investigators look at the living representatives of flora and fauna in order to understand their mechanisms of immune defense and protection from the deteriorating environment and pathogenic micro organisms. Amphibians as one of the leaders of immune resistance live on the Earth for hundreds millions of years. Their dorsal glands produce a cocktail of biologically active compounds, mainly peptides, which may successfully fight micro organisms and even predators. Skin secretion of amphibians contains wide spectrum antibiotic and neuro peptides, critical for the immune response and active at the levels of 10-9 M. They can also show antifungal and antiviral activities, stimulate insulin synthesis, inhibit NO synthesis, and be analgesics. The mechanism of action of antibiotic peptides is completely different in comparison to that of the existing pharmaceuticals: amphipatic α-helix destroys phospholipid bilayer, leading to the lysis of the pathogenic cells. Since this mechanism prevents development of the pathogens resistance, antimicrobial peptides are very perspective pharmaceuticals of future generations.
Skin secretions of various frog species were obtained by mild electric stimulation. Their LC-ESI-MS/MS analysis was carried out with Thermo ICR and Orbitrap mass spectrometers (Thermo Scientific). CID, ECD, HCD, and ETD were applied in MS2 and MS3 modes to achieve the targeted sequence coverage. To sequence SS-containing peptides crude secretions were preliminary reduced (DTT+ iodoacetamide) or oxidized with performic acid.
The developed de novo sequencing algorithm involves the analysis of three versions of original samples of the frogs' skin secretion: intact, carboxamidomethylated and oxidized ones. The combined analysis allows achieving complete sequence coverage of all frog peptides including long (up to 50 aa) ones. It resolves the problems of S-S bonds, cyclization of short peptides, the presence of isobaric (e.g. lysine/glutamine) amino acid residues in the sequence. An efficient approach of easy and reliable differentiation between isomeric Leu/Ile involves production and isolation of primary z. ions, followed by radical site initiation of their fragmentation with formation of w-ions, characteristic of the isomeric amino acid residues. The resulting spectra are very selective with targeted w ions usually being the most abundant. Extracted ion plotting often applied in environmental tasks demonstrated its efficiency to detect all peptides related to a certain family. More than 200 new natural peptides were sequenced in terms of the present study. Their biological activity against microorganisms was studied. Thus activity of brevinin 1Tb measured with PMEU Spectrion® (Portable Microbe Enrichment Unit) technology appeared to be in the nanomole range, i.e. that of the modern antibiotics.
Peptidome representation with 2D-maps based on the simple mass spectrometry parameters shows itself as a very convenient method to distinguish frogs of closely related species, and making mass spectrometry a powerful tool for taxonomy studies. Moreover the applicability of the proposed approach to differentiate the frogs of the same species but different populations was successfully demonstrated. It involves changes in the sequences of similar peptides due to diversity of natural habitat. The animals face different microbes and synthesize the most efficient peptides to fight them. Therefore interspecies and intraspecies biomarkers revealed by mass spectrometry may be very helpful for future taxonomy and biodiversity studies.

Keywords: environmental molecules

Invited Speaker Lecture
4 August 2017, 11:20-11:50

Toward integrative and holistic watershed-level risk assessment: Integrating micro-scale and landscape scale environmental indicators
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Large scale, holistic risk frameworks (Cumulative Risk Assessment, Total Environment Framework, One Health, Environmental Impact Assessment, Health Impact Assessment) integrate data from multiple sources, multiple scales and multiple time frames into a single analysis for management and action, stressor prioritization, and policy analysis. Ecosystems are complex systems with multiple levels of biological organization, interacting food webs, interacting habitat needs, and impacts. A diversity of potential indicators are needed to analyze stressor impacts on ecosystems in mixed human / natural environments. Stressors inherently vary by concentration and magnitude of impact across an ecosystem, but the overlay of human infrastructure both add additional stressors and alter the spatial, time and intensity scales of ecosystem specific stressors. Data about ecosystems and their multifunctional components are often sparse, focused on one (or a few) species, are obtained at different times (e.g. years, seasons), aggregated over different time frames (e.g. hourly, monthly), and collected using disparate methods. More inclusive and holistic risk assessment frameworks and methodologies emphasize the need to integrate data from dissimilar data sources with dissimilar units of scale, time, and analysis potential. We will compare the use and types of environmental indicators that are used, and are useful in a set of large scale assessment and risk frameworks. We use the Charleston Harbor Watershed (i.e. Cooper River Basin) in South Carolina as a case study to illustrate the challenges associated with integrating classic ecosystem and human infrastructure and human-focused data into a holistic watershed-level risk assessment.

Keywords: cumulative risk assessment, complex systems, One Health, EIA, HIA

Oral Presentation
4 August 2017, 11:50-12:10

Dicofol levels in the mouth of the Pearl River Delta and its environmental implications
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The Pearl River Delta (PRD) is one of the most industrialized regions in the world and several reports indicate alarming levels of aquatic pollutants such organochlorine pesticides (OCPs) in the area. One of the most commonly used OCPs was dichlorodiphenyltrichlorethane (DDT), also listed as one of the main persistent organic pollutants (POPs) by the United Nations Environment Program (UNEP) at the Stockholm Convention. Although the application of technical DDTs in agriculture has presumably been banned since the late 1970s and 1990s, no apparent decline in DDTs concentration has been detected in China, indicating new inputs of DDTs. This new input is attributed to the use of Dicofol as acaricide for controlling mites that damage cotton, fruit trees, and vegetables, as well as, antifouling agents used in paints for ships in southern and eastern China. Dicofol is usually synthesized from technical DDT and after the synthesis reaction, DDT may remain as an impurity, which can be a serious source of pollution in the south-eastern regions of China, where Macao and Hong Kong are located. The present work aimed to evaluate the environmental concentrations of the active metabolite of Dicofol (4,4'-Dichlorobenzophenone or 4,4'-DBP) in waters in the western and eastern mouths (Macau and Hong Kong, respectively) of the PRD. Water samples were collected at 10 sites in Macao and Hong Kong, during low and high tides. Samples were then extracted and 4,4'-DBP concentrations were analyzed using GC-MS/MS. Preliminary results showed that 4,4'-DBP concentrations are 3- to 10-folds higher than the European Directive (2013/39/EU) limits, established for surface waters. Risk assessment was evaluated based on the risk quotient

method, that revealed that dicofol in water posed a low risk (QR < 0.1) to fish, being the values in HK slightly higher than in Macao region.

Keywords: pesticide, surface waters, 4,4'-Dichlorobenzophenone, China, risk assessment

Oral Presentation
4 August 2017, 12:10-12:30

Biochemical and ecotoxicological responses of aquatic species to environmental and anthropogenic stressors

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A recent IPCC (Intergovernmental Panel on Climate Change) report predicted the occurrence, at the next 100 years, of changes in seawater salinity, raise in temperature and water acidification. Added to these climate changes, an intensive agriculture production with an excessive usage of fertilizers and pesticides near coastal wetlands will have severe impacts to the aquatic communities and thus, to the ecosystem. It is known stressors affect organisms' physiological conditions with recent works concerning alterations in the fatty acid (FA) profiles associated with environmental and contamination events that become more frequent. FA play a key role in immune and physiological functions and are associated with the prevention of some diseases, shown to be good bioindicators to assess the organisms' impacts under stress conditions. At this study the biochemical (namely fatty acids) and ecotoxicological responses of the marine diatom *Thalassiosira weissflogii* and the estuarine bivalve *Cerastoderma edule* to natural (salinity and temperature) and chemical (herbicide and metal) stressors' was determined. The results obtained confirm environmental and chemical stressors affect the FA profile of aquatic species with sharp changes in the FA content of the studied species, mainly in polyunsaturated FA (PUFA) and highly unsaturated FA (HUFA), reflecting then in lower quality food. DHA showed the lowest concentration or was absent in all salinity treatments at the highest temperature (25 ºC) and also under the exposure to both pollutants on the microalga, with the bivalve reporting a similar pattern when exposed to saline and copper treatments. Saturated FA (SFA) and monounsaturated FA (MUFA) increased on both species exposed to salinity concentrations, allowing to maintain homeostatic ionic balance and basal functions. Since synthesizing PUFA and HUFA becomes too energetically costly, the organism may not complete the elongation processes presenting higher concentrations of SFA and MUFA.

Keywords: Fatty acids, bio-indicator, climate changes, pollutants, aquatic species, estuaries

Oral Presentation
4 August 2017, 13:15-13:35

Feeding city population on dying waters - how can we move into the future?

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Urban and Peri urban Agriculture (UPA) is important to the overall health and resilience of households and communities. A study was done on UPA along riverbanks within the Larger Nairobi metropolitan, Kenya. The objectives of the study were to identify the hotspots with UPA, assess water quality (WQ) and identify environmental key signatures. The methods used included transects walks, use of aerial maps, collection and analysis of water and benthic samples. The physicochemical quality for most streams was generally acceptable for irrigation as assessed against national standards except for the main Nairobi river. River water is

microbiologically unsafe for use in irrigation especially with the current techniques of water application with involve wetting the plant and thus exposes the consumers to the risk of contamination. The study established that the commonly grown crops in UPA are tomatoes, kales, spinach, African leafy vegetables, cucumber, butternut, lettuce, French beans, sugarcanes and arrowroots. The benthic quality was determined during the critical irrigation periods when there is not rain and all the irrigation water for crops came for the rivers. While benthos indicative of moderate (like odonata) to severely polluted waters (like physa) were identified, macroinvertebrates dominant in clean waters were generally missing. Sites along the main Nairobi River had no benthos identified. The genera Chironomus, a bioindicator of environmental stress was present in all other sites. Genera physa associated with low dissolved oxygen concentrations and high nutrients levels was the second most distributed group. The lack of clear association between the physico-chemical quality and both benthic and microbiologically quality calls for a shift in environmental indicator monitoring. Or, maybe the combined chemical/benthic method is not right for dynamic ecosystems and there is therefore need to move from these to others ecological indicators, but it is not clear at what cost for struggling economies.

Keywords: sustainable, appropriate, water quality, ecological impact

Invited Speaker Lecture
4 August 2017, 13:35-14:00

Sustainable City Development -case Hiedanranta
Reijo Väliharju
City of Tampere, Hiedanranta Programme

World's people population is growing fast and we are still over using resources that Earth can give to us. Peoples are also moving to Cities. It is estimated that 70 per cent of the world's population will live in cities by 2050. But cities are also genes of economic growth and means new possibilities for peoples to have better level of living. Urbanization's advantages means also sustainability challenges. For example cities cause today over 70 per cent of global greenhouse gas emissions and cities are consuming 60-80 per cent of global energy.

Nestled on the shore of Lake Näsijärvi, Hiedanranta is a future city district that is being developed with a new concept in collaboration with city residents, businesses and organizations. The plan is to build homes for 25 000 residents and facilities for 10 000 jobs in Hiedanranta. The Tampere tramway will pass through the area in the future. Hiedanranta is located some 3…4 kilometers from the city Centre.

The new generation water and energy systems and local nutrient cycle (urban agriculture and related ecosystems) are among the elements of the resource-smart Hiedanranta. The resource-efficient Hiedanranta is created through initiatives that generate local value and can be linked to more extensive networks and promote their development. In the circular economy, assessing the entire production, delivery, and operator chain is important. A successful initiative combines economic, technical, cultural, and spatial factors.

The Hiedanranta area serves as a piloting platform for new technologies and methods. We invite businesses whose R&D efforts focus on digitalization, sustainability, circular economy, energy solutions or food production to join us. There are currently some 20 different development projects ongoing in Hiedanranta.

The sanitation solution for the Kulttuuritila Kuivaamo venue has been implemented entirely by means of a dry toilet system with a total of 13 toilets and, additionally, five dry urinals in the men's room. The system is a significant pilot project on a Finnish and Nordic scale. During the summer of 2017, an algae growing plant will be built in Hiedanranta to be used by Tampere University of Technology to study the cultivation of microalgae from the urine collected from the dry toilet system. We are also starting new sanitation project to use bioreactor to turn sanitation waste to energy and change sanitation nutrition to useful form.

Due to the industrial history of the area, there is an abundance of waste fiber at the bottom of Lake Näsijärvi, and its utilization in earth construction and as an energy source is currently under investigation. Waste fiber is big question because there is about 1,5 milj. m3 fiber in lake and people can't use lake. Water depth is just 0,3-1,5 meter and you can't swim or sail in that part of lake. Waste fiber also smell very bad and you can noticed it by lake side.

Finnoflag Company has tested in laboratory to use microbes and their entsyms to process waste fiber to produce valuable chemicals from waste fiber. Also Finnoflag test has shown that after microbes has work in waste fiber

bad smell has disappear and waste fiber biogas potential has raised and material is also much more easier to convert to biological fertilizer.

Invited Speaker Lecture
4 August 2017, 14:00-14:30

Agroecological symbiosis (AES) for energy self-sufficiency and plant nutrient recycling in farming and food production

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By agroecological symbiosis (AES) we refer to a model of arranging food production in the mode of industrial ecology and industrial symbiosis (Koppelmäki et al. 2016). Industrial ecology refers to a concept in which the use Graedel 1996, Graedel & Allenby 1996). Deriving from this basic concept, industrial symbiosis Chertow (2000) refers to an arrangement in which the partner industries following the industrial ecology principle are in close physical proximity that allows for localized co-evolution and maximal energetic and material efficiency through it. We have been contributing to co-creation of a pilot AES in Palopuro village, in city of Hyvinkää, Finland. In this AES, the three key agri-food industrial partners are a relatively big cereal farm of 400 ha, a bakery of size fitting to the scale of cereal production in the farm, and a local energy supplying company. Several satellite partners joined the AES during its creation in 2015-2017.
The core of the energy and material flows of the Palopuro AES is planned to become a biogas plant of dry fermentation type. The plant will have, as its main feedstock, silage from lays for which the farm allocates 20% of its arable area. These lays are of dual purpose. As the lays contain legumes for fixing nitrogen biologically, they produce all the nitrogen needed for the plant production in the AES. At the same time, the silage harvested from the lays creates a feedstock that is sufficient to make the AES a net producer of (bio)energy (Tuomisto & Helenius 2007). The above ground harvestable part of phytomass production, including the recyclable N, P, K and other plant nutrients in it, is recycled through the biogas plant: the digestate serves as fertilizer.
In broad analysis of sustainability, the AES seems to provide multiple positive outcomes, including economic and socio-cultural criteria (the latter: through localizing food production). In terms of ecological sustainability, the AES allows clear indicators for sustainable energy, and for sustainable nutrient flows and reduced nutrient loading. In addition, in the specific case of Palopuro AES, introduction of the bioenergy-biofertilizer leys to the otherwise monocultural cereal production increases rotational diversity, and contributes to biological diversity of the farm. The AES, by using organic fertilizers and leys in the rotation, turns the arable soil from a source of carbon to a sink of atmospheric carbon.

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Keywords: agroecological symbiosis

Invited Speaker Lecture
4 August 2017, 14:30-15:00

Biofortification technologies for the development of functional agriculture
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Uneven distribution and varying bioavailability of trace nutrient elements in agricultural soils significantly influence the nutritional values of agricultural products. Malnutrition has become one of major public health issues in the world. To increase the biologically effective contents of micronutrient elements accumulated in agricultural products, various specific agronomic practices and techniques have been developed and applied in agricultural food production in order to meet human nutritional requirements. The biofortification strategy has been promoted to improve the nutritional quality of agricultural products through novel agronomic practices, such as plant breeding, genetic engineering, and soil nutrient amendment management. The development and uses of biofortified agricultural products or functional foods has become an important aspect of future sustainable agricultural production. This presentation will provide an overview of agronomic approaches that are currently effectively enhance the nutrient contents or particularly the content of biologically effective nutrient chemical compounds accumulated in food crops. The presenter will use selenium biofortification to demonstrate the effectiveness of different biofortification approaches to enhance the nutritional values of biofortified crops and animal products. Selected limiting processes for nutrient bioavailability in soils, plant uptake and translocation, as well as biological transformation of nutrient element from one chemical form into another and its importance of biotransformation in developing functional agriculture will also be discussed.

Keywords: biofortification, nutritional values, food crop, selenium, malnutrition

Invited Speaker Lecture
4 August 2017, 15:15-15:45

Co-morbidity of pigs and humans associated with changes in food chain - Mg, Se, Si, grain fats
Timo Töysä
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Mg is a co-factor in more than 300 enzymatic reactions, e.g. synthesis of glutathione (GSH). Selenium (Se) is needed for glutathioneperoxidase (GPx) and with vitamin E for proper GSH synthesis, for cellular protection besides with other anti-oxidants as/and silicon.
Hepatopatia diaetetica (HeD) and microangiopathy (MAP) ("fatale syncope") of pigs are associated with inadequate diet deficient in vitamin E and selenium. HeD is associated with muscle degeneration. MAP is associated with vascular lesions especially in the capillaries and small muscular vessels of the myocardium. MAP has been reported to respond on magnesium. MAP and HeD statistics are from National Veterinary institute and represented as per cents of annual autopsies.
Between 1950-84 [Ca+NPK] mineral fertilization increased 5-fold and associated with delayed Mg-supplementation in 1958-76. During this period human CHD (35-64-y, 1/100,000) and pig MAP exceeded their lowest value of the 1950's and non-CHD made positive deviation against its trend-line. Agricultural soil Mg was lowest in 1966-70.
In 1955-91 Mineral fertilization ratio Mg/(Ca+Mg+K) "explained" 33-83 % ($p < 0.001$) human CHD and non-CHD, pig MAP and HeD (with inverse associations). CHD associated stronger with MAP (42 %, $p < 0.001$) than with HeD, but non-CHD stronger with HeD.
In 1969-90 myocardial degeneration (MyCD) of middle-aged humans was explained 78.5 % ($p < 0.001$) by HeD and 24 % ($p = 0.021$) by MAP. In the 1980's a drop in human MyCD associated with Se fertilization.
HeD peak (and rapid CHD increase) between 1957-62 associated with land clearing northeastwards, new harvesting and post-harvesting procedures, obviously increased grain fat peroxides and dilution of Se (and Si) were counteracted by new post-harvesting procedures, grain cultivation shift southwestwards and Se supplementations since 1962.

Conclusions: Changes in food chain associated significantly with human and pig mortality. Interaction between agricultural science, veterinary and human medicine could promote each other.

Keywords: Human and animal health, magnesium, selenium, silicon, grain fats

Invited Speaker Lecture
4 August 2017, 15:45-16:15

Biological nitrogen fixation returns to modern cropping systems

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For thousands of years, even though farmers did not know it, biological nitrogen fixation (BNF) by legumes was an essential component of cropping systems. During the 20th century, this importance waned, as the Haber-Bosch process enabled industrial nitrogen fixation for fertilizer production, feed-requiring draught animals were replaced by mechanization, and human diets shifted towards meat from vegetable protein. In this century, environmental indicators suggest that there is too much reactive nitrogen in use, too much meat is eaten in many countries, there is too much reliance on importing plant protein from South America, and crop rotations are too narrow, so there is a need for restructured cropping systems that include nitrogen-fixing grain legumes to provide food and local feed. Multinational research has shown that the inclusion of grain legumes is economically viable in most European arable systems and environmentally beneficial in all, while the economic and environmental benefits of forage legumes in grassy pastures or silages are even clearer. The legume in pure stand requires little N fertilizer and in a mixed stand reduces the overall N fertilizer requirement. The potential for loss of the residual fixed N through nitrate leaching and nitrous oxide emission often needs to be reduced by management intervention. Increased local production of legumes raises protein security, but may displace other profitable crops. If those displaced crops are feed crops, there is a synergistic interaction with national dietary recommendations of many countries to reduce the proportion of meat protein in the diet and to replace part of it with plant protein, which is most efficiently achieved with nitrogen-fixing legumes. Thus we see an increased role for BNF to feed the growing number of flexitarians and others interested in healthy food, to reduce protein-feed insecurity and the use of synthetic nitrogen fertilizer, to introduce crop and non-crop biodiversity, as well as to break disease and pest cycles in the mainstream cereal crops.

Keywords: Fabaceae, legumes, cropping systems, sustainability

Poster Abstracts

PP Number	Topic	Poster Title	Presenter	Country
PP001	Atmospheric pollution and climate change, and their monitoring	MiR-26a Functions as a Tumor Suppressor in the Particulate Matter-bound Metals-triggered Lung Cancer Cell Metastasis by targeting LIN28B	Yi Lin	China
PP002	Atmospheric pollution and climate change, and their monitoring	Pulmonary metabolome indicators of airborne fine particulate matter	Jie Zhang	China
PP003	Atmospheric pollution and climate change, and their monitoring	Fine particulate matter 2.5 exerted its toxicological effect by regulating a new layer, long non-coding RNA	Qiansheng Huang	China
PP004	Atmospheric pollution and climate change, and their monitoring	Composition, sources apportionment and risk assessment of particulate organic matter at industrial, urban and forest areas of northern Algeria	Khedidji Sidali	Algeria
PP005	Atmospheric pollution and climate change, and their monitoring	Climate change and agroecosystems: phenological development of crops as indicator of changes in climatic variables	Gintarė Sujetovienė	Lithuania
PP006	Avoidance of soil destruction, erosion and degradation - increasing sustainability and resilience	Minimizing Erosion And Agro-Pollutants Transport From Furrow Irrigated Fields To The Nearby Water Body Using Spatially-Explicit, Agent Based Model And Decision Optimization Platform	Usama Al Dughaishi	Oman
PP007	Avoidance of soil destruction, erosion and degradation - increasing sustainability and resilience	Leaching characterization of heavy metals and arsenic through soil profiles	Young Tae Jo	South Korea
PP008	Avoidance of soil destruction, erosion and degradation - increasing sustainability and resilience	Thermochemical Valorisation of Waste – Pyrolytic Conversion of Horse Manure	Stefano Caro	Finland
PP009	Avoidance of soil destruction, erosion and degradation - increasing sustainability and resilience	Mulch residues in soils: impact on the environment	Carmen Moreno Valencia	Spain
PP010	Avoidance of soil destruction, erosion and degradation - increasing sustainability and resilience	Recycling phosphorus from the waterbodies into plant production: sediment Fe/P ratio is the key	Mina Kiani	Finland
PP011	Avoidance of soil destruction, erosion and degradation - increasing sustainability and resilience	Soil Quality Assessment for Different Land Use in the Panchase Area of Western Nepal	Subin Kalu	Finland
PP012	Avoidance of soil destruction, erosion and degradation - increasing sustainability and resilience	Carbon footprint of plantation tending and utilization of the recycled resource	Fang Chih Chang	Taiwan

PP013	Circulation economy and sustainable agriculture - screening of their indications	Qualitative and Quantitative LCA Indicators for Evaluation of Environmental Efficiency and Feasibility	Seong Rin Lim	South Korea
PP014	Circulation economy and sustainable agriculture - screening of their indications	Amelioration of Agricultural Acidic Soil by using Bauxite Byproduct and Characterization by Leaching Test	Jun Kim	South Korea
PP015	Circulation economy and sustainable agriculture - screening of their indications	ABOWE piloting and proof-of-technology in circulating agricultural, forest and food industry side streams	Ari Jääskeläinen	Finland
PP016	Circulation economy and sustainable agriculture - screening of their indications	Supercritical Carbon Dioxide Extraction as a Separation Method for Microalgal Lipids	Mikko Immonen	Finland
PP017	Diversity of natural habitats and human impacts on it	Superoxide dismutase and peroxidase enzyme activities as indicators of heavy metal abiotic stress in Biscutella auriculata L	Jesús Daniel Peco	Spain
PP018	Diversity of natural habitats and human impacts on it	APPRAISAL OF METAL MOBILIZATION BY SPECIES OF GENUS "Suillus" IN A MEDITERRANEAN MIXED FOREST	Marta M. Moreno Valencia	Spain
PP019	Food improvement: enhancing cleanliness and nutritive qualities - removal of recalcitrant compounds	Optimizing risk communication and risk management for food safety to mitigate burden of disease	Heli Lehtomäki	Finland
PP020	Human microbiome in relation to health, nutrition and environmental challenges	Childhood Myopisation and Other Indications of Environmental Change on Visual Development	Annamari Immonen	Finland
PP021	Human microbiome in relation to health, nutrition and environmental challenges	Bioaccessibility of Heavy Metal contents in High-Cost Versus Low-Cost Children's Toy Samples Sold in Kuwaiti Market using Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES) and Unified BARGE Method	Ali Alboloushi	Kuwait
PP022	Microbes in soil, water and industrial processes	Does the soil bacterial community responds to fertilizer-cropping managements?	Honghong Li	Finland
PP023	Microbes in soil, water and industrial processes	Effects of biochar on earthworms in two long-term field experiments in Finland	Jure Zrim	Finland
PP024	Screening of oceans, waterways and sources	Environmental DNA indicators for the rapid and cost-effective bioassessment of the impacts of marine industries	Jan Wojciech Pawlowski	Switzerland

PP001
Atmospheric pollution and climate change, and their monitoring

MiR-26a functions as a tumor suppressor in the particulate matter-bound metals-triggered lung cancer cell metastasis by targeting LIN28B
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Ambient air pollutants, specifically particulate matter (PM) with absorbing toxic chemicals, can penetrate deeply into the respiratory system, thereby leading to the occurrence and exacerbation of respiratory diseases in humans, such as asthma, cough, chronic obstructive pulmonary disease and lower respiratory infection. Considering increasing incidence of lung cancer, the International Agency for Research on Cancer (IARC) has classified PM in outdoor air as Group I carcinogen and confirmed that exposure to PM causes lung cancer. Given that PM-associated toxicity and its biochemical mechanisms depends to a large extent on its components, and toxicological studies on in vitro cell models are crucial to investigate the underlying mechanisms, we treated A549 cells, a pulmonary epithelial cell model, with water-soluble extracts of PM10 collected from the city of Beijing in China for 48 h. Our findings showed that 25 and 50 μg/ml PM10 water-soluble extracts down-regulated miR-26a to induce inflammation, stimulate epithelial-tomesenchymal transition, and accelerate metastasis and invasion in A549 cells. Subcutaneous injection of the PM10 extract-treated A549 cells significantly promoted lung tumor growth and liver metastases in nude mice. Functional interaction analysis indicated that miR-26a directly acted on the 3'UTR of LIN28B in A549 cells, contributing to increased migration and invasion capabilities. Importantly, we also found that removal of metals by chelation significantly rescued PM10 water-soluble extracts-mediated inflammatory and carcinogenic response. Taken together, the present study confirmed that PM10-bound metals led to lung cancer cells metastasis through down-regulation of miR-26a that directly or indirectly control LIN28B, IL6 and STAT3 expression.

Keywords: Particulate matter (PM), Metals, Lung cancer, Metastasis, Inflammation, miR26a

PP002
Atmospheric pollution and climate change, and their monitoring

Pulmonary metabolome indicators of airborne fine particulate matter
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Along with the rapid industrialization and urbanization, increasing atmospheric pollution characterized by high levels of fine particulate matter (PM2.5) has been reported nationwide in China, but the complicated mechanism of PM toxicity remains obscure so far. Metabolite is the terminal product of gene expression, and plays a critical role in cellular communication process. Furthermore, oxidative stress and inflammation are closely related with downstream metabolic pathways. In order to understand the comprehensive pulmonary response to PM2.5 stress, a non-targeted high-throughput metabolomics strategy was adopted to characterize the overall metabolic changes and relevant toxicological pathways. PM2.5 samples were collected from Tangshan, one of the most polluted cities in China. Adult male rats were treated with PM2.5 suspension once a week at the dose of 1 mg/kg/week through intratracheal instillation in three months. Aqueous and organic metabolite extracts of the lung tissues were subjected to metabolomics analysis using ultra-high performance liquid chromatograph/mass spectrometry. Along with a significant increase of oxidative stress, significant metabolome alterations were observed in the lung tissues of the treated rats. Nineteen metabolites were found decreased and 31 metabolites increased, which are mainly involved in lipid and nucleotide metabolism. Integrated pathway analysis suggests that.PM2.5 can induce pulmonary toxicity through disturbing pro-oxidant/antioxidant balance, which may further correlate with metabolism changes of phospholipid, glycerophospholipid, sphingolipid and purine. These findings improve our understanding of the toxicological pathways of PM2.5 exposure.

Keywords: Fine particulate matter, pulmonary toxicity, lipid metabolism, purine metabolism

PP003
Atmospheric pollution and climate change, and their monitoring

Fine particulate matter (PM2.5) exerted toxicological effect by regulating a new layer, long non-coding RNA

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Fine particulate matter (PM2.5) exposure, especially to its organic components, induces adverse health effects on the respiratory system. However, the molecular mechanisms have still not been fully elucidated. Long non-coding RNA (lncRNA) is involved in various physio-pathological processes. In this study, the roles of lncRNA were investigated to reveal the toxicology of PM2.5. Organic extracts of PM2.5 from Nanjing and Shanghai cities were adapted to treat human bronchial epithelial cells (BEAS-2B). RNA sequencing showed that the lncRNA functioned as antisense RNA, intergenic RNA and pre-miRNA. The mRNA profiles were also altered after exposure. PM2.5 from Nanjing showed a more serious impact than that from Shanghai. In detail, higher expression of n405968 was positively related to the elevated mRNA levels of inflammatory factors (IL-6 and IL-8). Increasing levels of metastasis associated lung adenocarcinoma transcript 1 (MALAT1) were positively associated with the induced epithelial-mesenchymal transition (EMT) process. The higher content of polycyclic aromatic hydrocarbons (PAHs) contributed to higher toxicity in Nanjing than in Shanghai. Antagonism of aryl hydrocarbon receptor (AHR) or inhibition of CYP1A1 diminished the effects stimulated by PM2.5. Our results revealed new information about the toxicology of PM2.5 based on lncRNA.

Keywords: PM2.5, RNA sequencing, long non-coding RNA, MALAT1, AHR

PP004
Atmospheric pollution and climate change, and their monitoring

Composition, sources apportionment and risk assessment of particulate organic matter at industrial, urban and forest areas in northern Algeria

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The diel cycles of organic compounds enriched into particulate matter with aerodynamic diameter lesser than 10 µm (PM10) were determined between March and May of 2014 in industrial, urban (on a university campus) and forested areas located in Bouira Province, Northern Algeria. Concentrations of n-alkanes, polycyclic aromatic hydrocarbons (PAHs) and highly-polar organic compounds (HPOCs) were determined to estimate the health risk associated to PM10. The normalized contents of n-alkanes, PAHs and HPOCs) reached 53%, 7%, and 40%, respectively, providing insights about their potential sources. In particular, the carbon preference index (CPI) and the percentage of natural waxes (WNA) of n-alkanes were used to discriminate the natural emission, while the diagnostic ratios between the concentrations of individual PAHs were applied to identify the main anthropogenic sources. This study indicated that PM10 primarily came from road traffic and industrial manufacture sources. The concentration of BaP remained below the WHO guideline value (1 ng/m^3) during the period of this investigation, ranging from 0.02 to 0.27 ng/m^3 at all sampling sites. In contrast, the total carcinogenic power was relatively high in Bouira Province, particularly for those industrial employees and college students. Finally, illicit substances such as ∆9-tetrahydrocannabinol THC (up to 0.19 ng/m^3) were also detected for the first time in Algeria.

Keywords: PM10, n-alkanes, PAHs, Bouira Province, sources apportionment

PP005
Atmospheric pollution and climate change, and their monitoring

Climate change and agroecosystems: phenological development of crops as indicator of changes in climatic variables
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Though the number of climate change related agro-phenological investigations are under fast growth, attention to spring crops is incomparably less than to winter ones. The aim of this study was to investigate long-term temporal and spatial trends of spring barley phenology, and to project changes in timing and duration of different phenological phases for this century. The advancement was specific feature for the most analysed phenological phases of spring barley with exception of the almost unchanged timing of harvest. These changes resulted in the extension of total vegetation period of spring barley by more than 12 days over the investigated period (1961-2015). Since Lithuania is situated on the coast of Baltic Sea an increase in temperature was characteristic along with increase in distance from the sea over the last 55 years. The spatial trend of changes in the timing of investigated phenological phases is not so evident indicating that other than temperature climatic factors are also significant to phenology of spring barley. Projected changes in the occurrence of phenological phases of spring barley differs significantly from analysed historical changes, and advancement of all phenological phases is projected according to both RCP 2.6 and RCP 8.5 climate change scenarios. Shortening of total vegetation period by 5 days is foreseen for far future (2071-2100) according to RCP 8.5 climate change scenario.

Keywords: spring barley, phenological development, climate change scenarios

PP006
Avoidance of soil destruction, erosion and degradation - increasing sustainability and resilience

Minimizing erosion and agro-pollutants transport from furrow irrigated fields to the nearby water body using spatially-explicit, agent based model and decision optimization platform
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Maintaining water quality in agricultural watersheds is a worldwide challenge, especially where furrow irrigation has been practiced. The Yakima River Basin watershed in south central Washington State in the U.S. is an example of these impacted areas with elevated load of sediments and other agricultural products due to runoff from furrow-irrigated fields. Within the Yakima basin, the Granger Drain watershed (area of 75 km²) is particularly challenged in this regard with more than 400 flood-irrigated individual parcels (an area of 21 km²) growing a variety of crops from maize to grapes. Alternatives for improving water quality from furrow-irrigated parcels include vegetated filter strip (VFS) implementation, furrow water application efficiency, polyacrylamide (PAM) application and irrigation scheduling. These alternatives were simulated separately and in combinations to explore potential Best Management Practices (BMPs) for runoff-related-pollution reduction in a spatially explicit, agent based modeling system (QnD:GrangerDrain). Two regulatory scenarios were tested to BMPs adoption within individual parcels. A blanket-style regulatory scenario simulated a total of 60 BMPs combinations implemented in all 409 furrow-irrigated parcels. A second regulatory scenario simulated the BMPs in 119 furrow-irrigated parcels designated as “hotspots” based on a standard 12 Mg/ha seasonal sediment load. The simulated cumulative runoff and sediment loading from all BMP alternatives were ranked using Multiple Criteria Decision Analysis (MCDA), specifically the Stochastic Multi-Attribute Acceptability Analysis (SMAA) method. Several BMP combinations proved successful in reducing loads below a 25 Nephelometer Turbidity Unit, NTU, (91 mg/L) regulatory sediment concentration. The QnD:GrangerDrain simulations and subsequent MCDA ranking revealed that the BMP combinations of 5 m-VFS and high furrow water efficiency were highly ranked alternatives for the blanket and hotspot scenarios with separate analysis in JSMAA software (an open source software for SMAA computations). Targeting the hotspot parcels with 10 m-VFS was the highest ranked alternative among blanket and hotspot scenario alternatives.

Keywords: BMPs, erosion, MCDA, optimization, watershed

PP007
Avoidance of soil destruction, erosion and degradation - increasing sustainability and resilience

Leaching characterization of heavy metals and arsenic through soil profiles
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Spreading of contamination from the polluted site could be caused by several mechanisms such as particle movement, leaching with rainwater and so on. Understanding the mechanism and speciation change of heavy metals during leaching is important for tracing their contamination source. Hence, leaching column test is a fundamental tool for predicting the contamination pathway through the soil profile. In this study, we investigated the leaching characteristics of heavy metals (Pb, Zn, Cu) and arsenic (As) using a column leaching apparatus with rain water (pH 6.3-6.85). For the column experiment, a polycarbonate tube (90 cm long with a 1.6 cm internal diameter) was used which was divided into five layers. One top layer was packed with contaminated soil while other four underlying layers were packed with fresh soil. About 1 cm of ceramic wools was placed at between layers. The water was supplied at a flow rate of 9 mL/day using a peristaltic pump for 30 days. After being leaching test is completed, the soil sample from each layer of column was collected for chemical analysis. Results of the column leaching experiment revealed that tendency to be adsorption or redistribution was different for each trace metal. The leaching percentage of As, Zn, Pb and Cu in contaminated soil (column topsoil) were 28.6, 58.1, 5.0, 22.7%, respectively. Cu, As and Zn was highly leachable from the contamination source while Pb was relatively highly exchangeable (based on sequential extraction results). The content of oxidizable fraction decreased while the content of metals associated with the carbonate fraction was increased. A considerable amount of Pb was accumulated in the first-underlying soil and a significant amount of Cu, Zn, As was found in the leachate.

Keywords: heavy metals, arsenic, soil, leaching, adsorption, sequential extraction

PP008
Avoidance of soil destruction, erosion and degradation - increasing sustainability and resilience

Thermochemical Valorisation of Waste – Pyrolytic Conversion of Horse Manure
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The efficient and sustainable disposal of waste represents one of the major challenges for the human beings in the next future. The thermochemical valorization of livestock manure into biochar has received much interest thanks to its greenhouse gases extenuation and amendment power. In this study, horse manure has been processed under pyrolytic condition at different temperatures, heating rate and residence times. In the first phase a set of preliminary analysis aimed to assess the physical and chemical properties of the horse manure have been carried out. Analogously, after the pyrolysis, the biochar has been analyzed. Both from the chemical and physical point of view. The results showed that the major impact on biochar yield, pH, BET, heavy metals content, PAH content, CHNSO content was due to the HHT (Highest heating temperature). Although residence time and heating rate do not display a noticeable trend for most of the parameters.

Keywords: Pyrolysis, biochar, horse manure, waste disposal

PP009
Avoidance of soil destruction, erosion and degradation - increasing sustainability and resilience

Mulch residues in soils: impact on the environment
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Mulching is an agricultural technique consisting on modifying the conditions of agricultural soils by covering the soil surface with different kinds of materials. This technique is used worldwide by horticultural farmers due to the numerous advantages it offers. Thus, mulches control weed growth, reduce or eliminate soil erosion, usually

enhance commercial yields, create a microclimate which can improve the efficiency of fertilizers and water use, improve the physical structure of the soil, raise soil temperature and therefore favour a faster development and an earlier harvest. On the other hand, the microclimatic conditions under mulches can accelerate the mineralization of the soil carbon stocks, with the consequent negative impacts. Plastics in general and polyethylene in particular are the most widely used materials for this purpose basically as result of their good mechanical properties and affordable prices. In contrast, the huge problems derived from the use of these low-degradable materials, associated with the accumulation of plastic residues in soils, has led to the search of not-polluting, biodegradable materials which disappear in the short term without leaving undesirable residues. However, the lifetime of these residues in soils depends, in addition to the type of soil and the environment conditions, on the composition of the biodegradable material. In this context, the aim of this work was to evaluate the time-permanence of several biodegradable mulch materials of different composition (corn, potato starch-based, polylactic acid and paper) after their incorporation into the soil in field conditions, through objective measurements such as weight and surface. Finally, after six months of analyzing the buried mulch residues, a general conclusion indicate that potato starch-based and paper mulches would be the most advisable from an environmental point of view due to the scarce amount of remaining residues in the soil.

Keywords: mulch, residues, biodegradable, starch, paper, polyethylene

PP010
Avoidance of soil destruction, erosion and degradation - increasing sustainability and resilience

Recycling phosphorus from the waterbodies into plant production: sediment Fe/P ratio is the key
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The demand for phosphorus (P) by agricultural crops is mostly covered by the application of non-renewable mineral P-fertilizers. The finiteness of rock phosphates and increases in fertilizer prices within the past decade have underlined the need for recycling P in agriculture. Further, excessive fertilizer applications often go beyond the actual crop demand which, in turn, leads to the P and N transfer from agricultural fields into water bodies, leading to their eutrophication. Sediment removal itself has been considered an effective method for lake restoration, however; much concern is related to the sediment disposal. Therefore, there is a need to develop efficient ways to reuse sediments as soil conditioners on agricultural lands to preserve P and respond to crop demands. The aim of this research was to compare different ways of sediments applications to soil to examine nutrient retention in topsoil and to quantify their effects on root growth, yield, and nutrient uptake by ryegrass in a lysimeter experiment. Six different sediment application methods were tested either in combination with organic fertilizer or without in January 2017. The 1-m height lysimeter columns were filled with different combinations of soil and sediment including pure topsoil, a 75cm layer of sediment directly on topsoil, a 25cm twin-layer of topsoil and biochar underlain by the sediment, and a layer of 10, 15 or 25cm of topsoil underlain by the sediment. The aboveground biomass and height of ryegrass was recorded during the growing season. We found that the treatment containing 75cm of sediments on topsoil had the greatest ryegrass aboveground biomass and height. Our small case study results can be upscaled to larger lakes with similar sediment properties which will aid in reducing transformation of nutrients to water bodies and facilitate the disposal of dredged sediments in agriculture and environmental engineering.

Keywords: sediment, biochar, nutrient recycling, phosphorus, lake restoration

PP011
Avoidance of soil destruction, erosion and degradation - increasing sustainability and resilience

Soil quality assessment for different land use in the Panchase area of western Nepal
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Soil quality management helps to maintain biological productivity; air and water quality; and human habitation and health. As improper land management can deteriorate soil function, the evaluation of soil quality for different

land use is necessary. To evaluate soil quality for different land use types in the Panchase area, soil quality index was computed on the basis of the soil management assessment framework. Protected forest has the highest soil quality index (0.95) followed by community forest (0.91), pasture (0.88), khet (0.81), and bari (0.79) *khet and bari are the types of agricultural lands*. Available phosphorus and soil organic carbon played major roles in making significant differences in the SQI among the different land use types. Less anthropogenic impact and vegetation in forest land might have resulted in better soil quality, whereas attempts to increase productivity in cultivated land might have degraded the soil quality. The proper application of fertilizer and giving priority to organic farming is recommended to improve soil quality.

Keywords: land use; soil management assessment framework (SMAF); soil quality; soil quality index (SQI)

PP012
Avoidance of soil destruction, erosion and degradation - increasing sustainability and resilience

Carbon footprint of plantation tending and utilization of the recycled resource
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Carbon emission of the tending processes for the artificial forest is an important research topic. Thi study evaluated the use of tending waste wood (miscellaneous tree) to produce waste-derived fuel. Results show that the energy consumption and pollutant emission of new planting processes were higher than those of tending processes. The pollutant emission of new planting processes were CO_2: 405.0 kg/ha, CH_4: 50.1 g/ha, and N_2O: 27.1 g/ha. The pollutant emission of tending processes were CO_2: 277.7 kg/ha, CH_4: 36.3 g/ha, and N_2O: 19.0 g/ha. The main contents of the recycled materials included carbon, oxygen, and hydrogen. The contents of nitrogen and sulfur in the waste-drived fuel were lower than the EU standards for waste-derived fuel. Thus, the recycled materials could be considered as a carbon neutral resource and were not the emission sources of NO_x or SO_x. In the future, the tending waste wood-derived fuel could be used as an alternative fuel for small boilers.

Keywords: Tending, carbon footprint, miscellaneous tree, waste-derived fuel, resource

PP013
Circulation economy and sustainable agriculture - screening of their indications

Qualitative and quantitative LCA Indicators for evaluation of environmental efficiency and feasibility
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Life cycle impact assessment (LCIA) is performed to quantitatively evaluate all environmental impacts from products, systems, processes and services. However, LCIA does not always provide valuable information for choice among alternatives with different specifications, functionalities and lifetimes. In this study, qualitative and quantitative indicators were proposed to evaluate environmental efficiency and feasibility on the basis of analogies to financial and economic indicators. Incremental evaluation using a reference is employed to obtain the environmental indicators. The environmental efficiency indicators are conceptually based on the ratios of environmental benefits returned to environmental burdens required: environmental return on investment, environmental payback period and environmental internal rate of return. The environmental feasibility indicator is the sum of all incremental environmental burdens and benefits: i.e., environmental net present value. All of the environmental indicators can be used to compare and rank the environmental efficiencies or feasibilities of alternatives. The environmental efficiency indicators can be applied to a new environmental labeling. The concept of eco-efficiency labeling was developed by combining the environmental efficiency indicators with financial indicators. A case study was performed to demonstrate the necessities of the environmental indicators. LCA and environmental labeling can be augmented and supplemented by application of these environmental indicators.

Keywords: environmental efficiency, environmental feasibility, environmental indicator, life cycle impact assessment

PP014
Circulation economy and sustainable agriculture - screening of their indications

Amelioration of agricultural acidic soil by using Bauxite byproduct and characterization by leaching test
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Approximately 120 million tons of red mud are being generated worldwide annually as a bauxite by-product. In Korea, about 2.7 million tons of red mud produced and it shows highly alkalinity (pH = ~12) due to residual Sodium hydroxide. On the other hand, soil acidity is a serious problem in Korea with adverse effects on soil productivity and plant growth caused by acidic rain (pH = 4.2-4.8). Liming is a common practice to increase the pH of acidic soils. In this regard, red mud could be useful with respect to soil pH. Therefore, we investigated the effectiveness of red mud for neutralization of soil sample with an initial pH of approximately 5. In this study, acidic soil was amended with red mud in the range of 1-10 % (wt.), after curing for 5 days. A column leaching test was carried out with rain water (pH = 5.6). After curing, the treatment results indicate that the soil pH was increased from initial pH of ~5 to in a range of 7.5-8.0 at 1% (wt.) of red mud, while a strong alkaline pH value was achieved after curing at 10 % (wt). In addition, the soil exchangeable cations (or CEC) were also improved from 6.9 cmolc/kg to 23.9 cmolc/kg with red mud at a rate of 5% (wt.). The results of heavy metals analysis revealed that all the trace metals' concentration in red mud were very low, indicating no contamination threat to amended soil. Approximately 0.04-0.05 mg/L of leaching rate was observed for Al, while the concentration of Fe was not detected in the leachate when treatments of acedic soil with 1~3 % (wt.) of red mud. Overall, the amelioration of acidic soil with 1 % (wt.) of red mud might be suitable, since soil pH was in the acceptable range.

Keywords: Amelioration, Acidic soil, Bauxite byproduct, characterization, neutralization, pH

PP015
Circulation economy and sustainable agriculture - screening of their indications

ABOWE piloting and proof-of-technology in circulating agricultural, forest and food industry side streams
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Researching and developing a microbiological process for large volumes cannot take place in laboratories only, but larger pilot scale is required. Versatility of the biological systems using mixed substrates was utilized in the EU Baltic Sea Region Programme's ABOWE project. Non-aseptic approach was chosen to be developed to lower investment costs and the multifunctional process was hence controlled by simultaneous adjustment of several functions with coherent effects on the production of the desired substances. The project team constructed the pilot plant accordingly from the basic ideas, innovated by Adjunct Professor Elias Hakalehto (Finnoflag Oy, University of Eastern Finland, University of Helsinki) and it was then tested in three countries successfully. In the first experiments in Finland from cartonboard production wastes promising results were obtained in the form of continuous hydrogen flow. In Poland, carboxylic acids were produced from potato processing waste and municipal waste. Also H_2 and CH_4 were produced. The results confirm, that the biorefinery offers a clear advantage over other traditional biowaste treatment technologies in terms of useful products. In Sweden, wastes from an ecological chicken farm and slaughterhouse were bio refined to gases and chemical goods, from the carboxylates and also from protein and lipid containing wastes. These results implied to the high versatility and flexibility of the bioprocess. The digestate from the biorefinery process turned out a promising raw material for biogas production. Further improvements to the process and to the equipment could elevate the yields and productivities. The ABOWE pilot plant fulfilled its purpose in giving proof-of-concept on biorefining of biowastes into useful products. The important new front has been opened, where the challenges of the microbial bioprocessing are to be solved with a combination of seed cultures with undefined mixed culture (UMC). Both ecological and economic feasibilities of the process type were studied and estimated.

Keywords: waste, biorefinery, biochemicals, biofuels, hydrogen, fertilizer

PP016
Circulation economy and sustainable agriculture - screening of their indications

Supercritical carbon dioxide extraction as a separation method for microalgal lipids
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Microalgae are microscopic unicellular or filamentous organisms that belong to the groups of plants, cyanobacteria, or protozoa. As a rapidly multiplying source of renewable biomass, microalgae are currently cultivated for food, feed valuable bioactive compound production, and increasingly for biofuels. Supercritical fluid extraction (SFE) using CO2 as solvent is a potential method for separating lipid fraction from algal biomass without the use of toxic organic solvents and with naturally solvent free outcome extract. The objective of the study was to research the possibilities of SFE as a separation method for microalgal lipids, especially compared to accelerated solvent extraction (ASE). The ASE-method had been optimized to completely extract microalgal lipids for analytical purposes. The aim was also to explore the impacts of SFE parameters to the efficiency and selectivity of the extraction. The SFE yield was invariably smaller compared to ASE yield. However, a lot of variation could be observed when different extraction parameters were used and especially between different algae species. The majority of lipid yield was extracted already during the first 10 minutes of SFE. After that the extraction yield was relatively low. EPA was relatively recalcitrant to SFE, which refers to the assumption, that EPA is mainly bound to polar lipids, such as phospho- and glycolipids. The overall lipid contents of investigated microalgae species were somewhat low or similar compared to those appearing in the literature, so presumably the portion of polar lipids was relatively high in the samples. However, in many studies, found in the literature, the algae have been cultivated specifically to accumulate lipids and/or gravimetric methods have been used for lipid quantification. These factors should be observed in the comparison. The SFE appears to be a more efficient extraction method for neutral lipids and for those microalgae species that don't possess very thick cell walls.

Keywords: microalgae, supercritical extraction, accelerated solvent extraction, lipid yield

PP017
Diversity of natural habitats and human impacts on it

Superoxide dismutase and peroxidase enzyme activities as indicators of heavy metal abiotic stress in *Biscutella auriculata* L.
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The abiotic stress derived from the presence of heavy metals in soil triggers an increase of reactive oxygen species (ROS) in plants that negatively affect their metabolism. However, higher plants have enzymatic mechanisms to soften the increase of ROS as superoxide dismutase (SOD) and peroxidase (POX). Although SOD and POX are widely distributed in most plants, strong differences among the different species can be detected and for this reason they could be used as indicators of the negative effect that heavy metals exert on plants. The genus Biscutella are plants belonging to the Brassicaceae family, which have been observed inhabiting soils contaminated with heavy metals. In this study, the effect of Pb, Cu and Cd on the antioxidant mechanisms (SOD and POX) and growth of *Biscutella auriculata* was investigated, characterizing the expression pattern of both enzymes by their electrophoretic separation. Plants grown in hydroponic system were subjected to various treatments of 0.125 mM of Pb, Cd and Cu. The SOD and POX activities were determined by electrophoretic separation on polyacrylamide gel (PAGE) under native conditions. The results of these enzyme activities and the morphological parameters showed different degrees of toxicity among the heavy metal treatments. The SOD and POX measurements revealed in gel, exhibited different levels of activity and band patterns for each one of the treatments. Finally the SOD isoform present in this species was identified, being the Fe-SOD the only present.

Keywords: Oxidative stress, heavy metal, antioxidant enzymes, phytoremediation

PP018
Diversity of natural habitats and human impacts on it

Appraisal of metal mobilization by species of genus "suillus" in a mediterranean mixed forest
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Ectomycorrhizas not only facilitate plant nutrition and drought protection but also play an important role in the whole ecosystem through their interaction with mineral soil particles. Numerous studies have established that ectomycorrhizae possess special abilities to attack minerals and to release and mobilize the elements contained therein. The hyphae of this kind fungi grow outward from the mantle into the surrounding ground, acting as scavengers that penetrate microsites and dissolve substrates by excretion of organic acids. This behaviour is of special interest when mobilizing metals that could drive changes in the electrochemical environment or could be toxic to organisms. The objective of our present study is to estimate the amount of metals mobilized by this kind of fungi. For this purpose we have selected three species of genus Suillus, very abundant in the forests of Pinus pinaster in the authors' region of Spain. The genus Suillus is formed by the ectomycorrhizas species of conifers that can appear in a surprising number, especially during rainy autumn seasons. These mushrooms are not harvested for human consumption, which make them an ideal species of choice for scientific study. Systematic sampling was carried out over a two year period in order to determine the biomass per hectare of each species. The elemental content was determined by X-ray fluorescence spectroscopy and the results are expressed in terms of milligrams of metal mobilized per hectare.

Keywords: aluminium, rubidium, cerium, Ectomycorrhizas fungi

PP019
Food improvement: enhancing cleanliness and nutritive qualities - removal of recalcitrant compounds

Optimizing risk communication and risk management for food safety to mitigate burden of disease
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Food-related hazards are the leading cause of health loss in EU in 2015 (32,700 disability-adjusted life years (DALY)/million) and the second in Finland (31,500). These losses are created by the entire food system, which operates within economic, biophysical, and socio-political contexts. Authorities have identified dozens of chemical and microbial hazards, but the respective impacts on public health have not been quantified. An international estimate for all dietary causes is 29.7% of all health losses in Finland. FOODFIGHT develops a risk model for the food risks using population attributable fractions and incidence data from national and international health registers, combined with hazard specific exposure data to estimate public health impacts of each of the identified chemical and microbial risk factors. The health impacts will be reported as attributable cases as well as quantified as DALYs accounting for both morbidity (years lived with disability, YLD) and mortality (years of life lost, YLL). Same metrics are used to quantify the preventable fraction for improving and targeting risk management. Results are linked to (1) economic cost estimation via value of life year (VOLY) and value of statistical life (VSL) methods supplemented with treatment, medication and lost productivity methods for morbidity, and (2) risk perception and risk communication. Challenges in the burden estimation of chemical and biological risk factors differ significantly. For the biological factors such as norovirus, campylobacter, salmonella etc. the association of health impact with the exposure is obvious in properly diagnosed cases and challenges lie in underreporting. For the chemical exposure like heavy metals, polycyclic aromatic hydrocarbons, and dioxins there is also a substantial uncertainty in identifying relevant health endpoints and estimating the attributable fraction of these outcomes for the exposures. Nevertheless, using comparable metrics such as YLL and YLD, allows for balanced optimization of risk management efforts.

Keywords: food contaminants, microbial hazards, chemical hazards, public health impacts, optimization, perceived risks

PP020
Human microbiome in relation to health, nutrition and environmental challenges

Childhood Myopisation and other indications of environmental change on visual development
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With respect to our everyday life, one of our most important organs is the eye. This vulnerable structure is directly exposed to a multitude of environmental stress factors, such as UV-light or dryness. The human eye is a kind of specified extension of the central nervous system and therefore it is protected by blood-ocular barriers. A child's visual development is a very multiform and complex process, which is influenced by hereditary factors as well as by health and environmental factors. In this literature review, the focus is on environmental factors, which may alter the normal visual development process. Childhood myopisation i.e. the extensive axial growth of the eye is today the 'hot topic' among eye care professionals. It is an excellent example of the environmental change. The amount of myopic refractive error among children is increasing worldwide and it cannot be explained with genetics only. McCullough and Saunders have reviewed the myopia studies in the 21st century and discovered that genetics and sedentary lifestyle increase the risk of developing myopia (1). Currently, there is no evidence, that near vision activities would increase myopia, but regarding the impact of daylight, systemic vitamin D, neurotransmitters and hormones, there is ongoing research. In the article called 'the Myopia Boom' (2) Dolgin describes how the myopia situation in East Asia is especially bad. In several Chinese cities, 80-90% of teenagers are nowadays myopic. And myopia is not just a pair of spectacles but multiplies the risk of getting glaucoma, cataract, retinal detachment or myopic maculopathy later in life.

Keywords: Human eye, visual development, environmental change, myopia

PP021
Human microbiome in relation to health, nutrition and environmental challenges

Bioaccessibility of heavy metal contents in high-cost versus low-cost children's toy samples sold in Kuwaiti market using Inductively-Coupled Plasma Optical Emission Spectroscopy (ICP-OES) and unified BARGE method
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The objectives of this project were to quantitatively present and compare heavy metal contents in high-cost versus low-cost children's toy samples sold in the state of Kuwait market using Inductively-Coupled Plasma Optical Emission Spectroscopy (ICP-OES). A total of 43 samples were tested for the presence of Aluminum (Al), Arsenic (As), Barium (Ba), Cadmium (Cd), Cobalt (Co), Chromium (Cr), Copper (Cu), Lead (Pb), Antimony (Sb), Selenium (Se), and Zinc (Zn). The results were compared to the Gulf Cooperation Council (GCC) Standards which prevent the use of carcinogenic, mutagenic, and toxic metals in toys manufacturing unless they do not exceed the allowable limits provided. The tested samples covered all categories regulated under GCC Standards which are Dry, brittle, powder-like/pliable toys, liquid or sticky toys, and samples scraped-off surface of toys. Average concentrations of Al, Ba, Cu and Zn in expensive samples of crayons were 11242, 1940, 848, and 4040 mg/kg, respectively, and average concentrations of Al, As, Ba, Se, and Zn in cheap samples of crayons were 21757, 4.96, 2961, 68, and 19260 mg/kg, respectively, which exceeded the allowable limits by GCC Standards. Similarly, steel toy samples exceeded the allowable limits of As and Zn with average concentrations of 48 and 954074 mg/kg, respectively, where samples of marbles exceeded the allowable limits of Pb with average concentration of 245 mg/kg. Next, the risks associated with children's exposure to heavy metals found in studied samples of toys via two exposure routes (saliva dissolution and direct ingestion) will be assessed using Unified BARGE Bioaccessibility Method which is an in vitro method for simulating the human digestive procedure using synthetic digestive fluids.

Keywords: children toys, toxic heavy metals, –bioaccessibility, barge method, Kuwait market

PP022
Microbes in soil, water and industrial processes

Does the soil bacterial community responds to fertilizer-cropping managements?
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To assess the response of the soil bacteria community to different fertilizer-cropping managements, we established a three-year field experiment in Finland. In our split-plot design, fertilizer treatment (non-fertilized control, industrial fertilizer, manure) is the main factor and cropping treatment (fallow, red clover, timothy, mixture of red clover and timothy) is the subplot factor. We tracked the nitrogen budget by soil NO_3^- and NH_4^+ content and plant nitrogen content measurements at different time points. The soil bacterial community was analyzed by amplicon sequencing targeting the V3-V4 region of 16S rRNA gene. Combined with the environmental parameters (pH, EC, water content, local weather), our study aims to answer the following questions: (1) What are the nitrogen transfer efficiencies of the treatments; (2) How does the soil bacterial community respond to the different cropping-fertilizer treatments; (3) How do the bacteria contribute to the nitrogen transfer and do they change the soil ecological environment; (4) Can we design sustainable agricultural practices in which soil bacteria are used as indicators?

Keywords: Soil; bacterial community; fertilizer-cropping treatments; nitrogen transfer

PP023

Effects of biochar on earthworms in two long-term field experiments in Finland
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Biochar is an efficient tool available for carbon sequestration and mitigation of climate change. Furthermore, some biochars can also improve soil properties and increase crop yield. Before the concept of using biochar as soil amendment can be implemented in a bigger scale, it is useful to know how biochar affects in the long-term key components of soil decomposer web, earthworms being one important indicator of effects on soil animals. For these reasons, the aim of this study was to elucidate in boreal conditions the effects of different levels of biochar application and nitrogen fertilization on earthworm abundance, biomass and community composition in two separate field experiments, four and five years after the biochar application. Spruce (*Picea abies* L.) H. Karst. and pine (*Pinus sylvestris* L.) biochars were applied in Stagnosol and Umbrisol soils in 2010 and 2011 at rates of 10 t/ha and 30 t/ha, respectively. The species composition of earthworm community was on both soils typical for Finnish arable soils with the dominance of endogeic species, *Aporrectodea caliginosa* Sav., followed by epigeic *Lumbricus rubellus* Hoff. The total earthworm density and biomass was higher in Stagnosol field compared to Umbrisol field but the proportion of earthworm species was similar in both study sites. Biochar and fertilizer treatments or their interaction had no statistically significant effects on the species composition in either field. Significantly higher earthworm densities were measured in 2015 compared to 2011 in Umbrisol field. This change may be attributed to no tillage management practice, the change of cropping from barley to timothy and red clover and optimal climate conditions, where the average monthly precipitation over the last two years was higher than the long-term average. There were no detected effects of biochar on earthworm suggesting biochar to be a safe method for carbon sequestration in Southern Finland.

Keywords: earthworms, biochar

PP024
Screening of oceans, waterways and sources

Environmental DNA indicators for the rapid and cost-effective bioassessment of the impacts of marine industries.
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Monitoring biodiversity is essential to assess the impacts of increasing anthropogenic activities in marine environment. Traditional biomonitoring involves sorting and morphological identification of organisms, which is cost and time demanding. Several recent studies show that the environmental DNA metabarcoding could be used as an alternative to the conventional morphotaxonomy-based biomonitoring. The metabarcoding approach consists in monitoring biodiversity using high-throughput sequencing of environmental DNA (eDNA). This approach can be applied to detect the invasive or harmful species, but also to analyse community changes related to various environmental impacts. In our study, we applied eDNA metabarcoding to the environmental impact assessment of the activities of marine aquaculture. We measure its impact on marine benthic communities by analysing the eDNA isolated from surface sediment samples. We use multitaxon approach that allows us to target large number of potential environmental indicators, including microbial and meiofaunal species. This approach combined with the supervised machine learning algorithms provides a very powerful tool to predict the ecological status of the environment. Our pilot studies conducted on the impact of salmon farms yield very promising results by providing similar environmental impact assessments as those obtained by conventional macrofauna based surveys. The main advantage of our approach is to use the entire eDNA dataset as source of environmental indicators instead of only those eDNA sequences that could be assigned to selected indicator morphospecies. Its main limitation is that the method has to be calibrated based either on chemical parameters or independent macrofauna-based bioassessment. However, once calibrated, our eDNA approach can be easily standardized and applied in routine biomonitoring, as a complementary tool allowing fast and cost-effective assessment of environmental impacts.

Keywords: marine bio-indicators, artificial intelligence, taxonomy-free approach