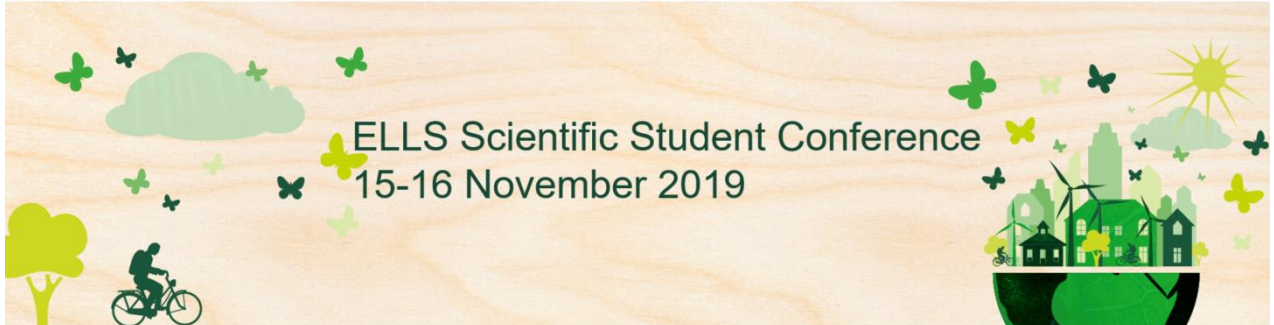




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Oral

The future use of natural resources

O10 - Livelihood Changes of Resettled Communities in the Koh Kong Province, Cambodia

The future use of natural resources

Julian Neef¹

¹ University of Hohenheim

Abstract: Transnational large-scale investments in land have been criticized for being conducted in an opaque manner. Questions remain about how they contribute to rural development and poverty alleviation. The Royal Government of Cambodia issued a new land law in 2001 which allows long term land leases in Cambodia. The Chinese Union Development Group, as part of the Chinese Belt and Road Initiative, signed a deal with the Royal Government of Cambodia in 2008 and leased 45,100 hectares in the Koh Kong province in Cambodia for the construction of a commercial development zone. More than 1,400 families in 12 coastal, predominantly fishing villages had been relocated to 10 newly created villages deep inside the Botum Sakor National Park in 2011. Using the Sustainable Livelihoods Framework, this study examines the livelihood changes of resettled communities at the household level, six years after the relocation. I conducted 35 interviews with relocated people, one interview with a commune chief, and two interviews with representatives from local NGOs. My findings show that the livelihoods of the relocated people have worsened in regards to almost all of the aspects considered by the Sustainable Livelihoods Framework. The unsuitability of the relocation site for farming and housing did not allow the relocated people to pursue livelihood strategies they could survive on. Instead, they turned to illegal logging and were at the mercy of their own government, which established a corruption scheme for forest access and benefited from the relocated people's hardship. Without access to natural resources, infrastructure and knowledge on good farming practices, people were unable to sustain their livelihoods. As a result, many villagers abandoned their homes and migrated from the relocation site to larger Cambodian cities or neighboring Thailand.

Acknowledgements: I would like to thank my first supervisor Prof. Dr. Andrea Knierim from the University of Hohenheim and my second supervisor Dr. Chanrith Ngin from the University of Auckland. I owe thanks to my advisor at the University of Hohenheim Dr. Maria Gerster-Bentaya for her guidance and provision of important ideas for the success of this thesis. Furthermore, I want to thank all the people from local and international NGOs in Cambodia who tried to help me despite difficult political circumstances. Additionally, I want to thank Dr. Nyda Chhinh from the Royal University of Phnom Penh for providing valuable advice and helping me to find a research assistant. Having had issues with my research permit only a day before I departed this help was invaluable for me.

O11 - The effect of dry olive residue-based biochar on the risk element mobility and nutrient status of the contaminated soil

The future use of natural resources

Kateřina Vejvodová¹

Jiřina Száková¹

¹ Czech University of Life Science in Prague

Abstract: The Mediterranean areas depend on their production of olives and olive oil, with Spain taking the lead in olive oil production. A two-phase extraction system is used which creates a by-product known as “alpeorujo”, which undergoes a second centrifugation to extract any residual oil, creating dry olive residue (DOR) as a waste product. The DOR is rich in mineral and organic matter and phytotoxic compounds (phenolic compounds, organic acids, high molecular mass polyphenols and glycoproteins) that can inhibit growth of microorganisms and plants.

A possible way to decrease the phytotoxicity of the waste can be to transform it into biochar via pyrolysis and use it as an amendment for contaminated soils and to improve the nutrient status of soils. DOR from Spain was transformed into biochar at 350°C and 500°C in order to evaluate its effect on the mobility of As, Cd, Pb and Zn and Ca, Mg, P and K availability. A pot experiment was conducted over 3 months to observe the effect of each biochar on three levels of contaminated soil obtained from Přeboram (low, medium and high levels of contamination). The biochar was applied at a 2% and 5% application rate. *Triticum aestivum* was grown in the soils to observe the availability and mobility of the risk elements. The different application rates and pyrolysis temperature were seen to influence the accessibility of the risk and essential elements in soils and *Triticum aestivum* plants.

Soil properties and especially pH was found to statistically affect the bioavailability of risk elements in the soils, however the treatments were less significant. A greater significance was found for the essential elements, where soil, biochar production temperature and plant parts were statistically significant in improving essential element concentrations in plants ($p < 0.01$; $p < 0.001$). The correlation analysis found a positive correlation between the risk elements in soils indicating the similar source of soil contamination. The negative correlations among the risk elements and nutrient levels in plants indicate that the increase in the risk elements has led to the decrease of some of the essential element concentrations in plants.

Acknowledgements: I would like to express my sincere gratitude to prof. Ing. Jiřina Száková, CSc and Univ.Prof. Ing. Walter Wenzel, Dr.nat.techn. for their guidance, supervision and support. Their constructive advice and continued confidence helped shape this research work and encouraged me to broaden and develop my knowledge of the topic.

O12 - Green infrastructure, ecosystem services, and the enablers and barriers for their implementation within wine-grape vineyards

The future use of natural resources

Anna-kate Goodall¹

Wendy McWilliam¹, Olaf Schelezki¹

¹ Lincoln University

Abstract: Viticulture in many cases is a monocultural productivist cropping system. This results in a loss of biodiversity, ecosystem services and resiliency within the agricultural system. Green infrastructure provides an opportunity for viticulturists to gain ecosystem services and increase biodiversity within their farming systems to reduce the impacts of this monocultural system. However, despite there being many studies on green infrastructure and the ecosystem services it can provide there is a lack of literature on the enablers and barriers for the implementation of green infrastructure in vineyards. This research project aims to address this gap with four main research questions; What green infrastructure is planted in vineyards and vineyard/wineries and where is it located? What private and public ecosystem services and disservices does the green infrastructure provide? What are the enablers and barriers for planting green infrastructure in vineyards? And finally, how might the amount of green infrastructure, and its associated services be increased in wine grape vineyards and vineyard/wineries? These questions are asked with the aim to meet the following objectives; To describe the theory surrounding the implementation of green infrastructure in vineyards both internationally and, in particular, New Zealand. To describe the status of green infrastructure within vineyards. To determine the realised private and public ecosystem services of green infrastructure among vineyards. To identify and evaluate the enablers and barriers for the implementation of green infrastructure within vineyards and vineyard wineries. And finally, to identify and discuss the implications of this research for improving the performance and implementation of green infrastructure in the vineyard. To meet these objectives 20 vineyard owners and vineyard managers will be interviewed from the Waipara Valley wine region located in New Zealand. These interviews will use a semi-structured interviewing technique along with field observations of the existing green infrastructure in each vineyard and will be analysed repeatedly for themes that are emerging until no new themes emerge, this will be called the point of saturation. In achieving these objectives this research project hopes that the findings will assist in the use green infrastructure in vineyards to become standard practice within the industry.

*This research is currently underway and if chosen for this conference we look forward to sharing the results from this research project.

Acknowledgements: I would like to acknowledge the help of my supervisors Wendy McWilliam and Olaf Schelezki without their advice and guidance I would have been lost. I would also like to thank the participants in this study their willingness to help and to answer our *many* questions in as much detail as they did has proven invaluable to this study. It is our hope that this research will not only benefit the participants but the industry as a whole especially in this changing climate.

O22 - N mineralisation of soil incorporated clover-grass mobile green manure and the influence on N content and biomass yield of sweet corn and kohlrabi

The future use of natural resources

Maria Skovgaard Andersen¹

Ida Astrid Larsen¹

¹ University of Copenhagen

Abstract: The overall objective of this MSc. thesis experimental study is to examine the mineralisation of N from "mobile" green manure that has been incorporated into soil in order to supply nutrients for vegetable crops. The aim is to improve the efficiency with which mobile green manure is used in cropping systems. As opposed to traditional green manure, which grows on the soil into which it is subsequently incorporated, the term mobile (also termed "cut and carry") green manure refers to the situation where a manure crop is grown and harvested in another field than where it is used as an organic fertiliser. Such a system allows for multiple applications of green manure with varying rates, and can thus ensure a continuous supply of N to crops throughout the growing season. However, optimal timing of the applications is crucial for the efficiency of the system. To secure high yields of good quality vegetable crops and to reduce the risk of N losses through leaching, the N mineralisation of the plant material incorporated into the soil must be well synchronized with the N needs of the crops. In a field trial conducted in collaboration with the Danish organic vegetable company Aarstiderne A/S, this synchronisation is currently being assessed. The N mineralisation from a continuously growing clover-grass, harvested and applied as a green manure and the consequent biomass yield and N uptake of sweet corn (*Zea mays*) and kohlrabi (*Brassica oleracea* var. *gongylodes*) will be determined by collecting and analysing soil, plant and manure samples throughout the growing season. This information will allow an estimation of the amount of N from the green manure that is assimilated in the crops, and hence the amount of remaining N that may potentially be accumulated as soil organic N or leached as nitrate N from the system. To support the field trial, a laboratory incubation trial will furthermore be conducted. The obtained results will be useful for organic farmers who are in need of other N sources than animal derived organic fertilisers and can inspire and help these farmers to use mobile green manure systems in the most optimal way for their crop. This will benefit both the farmers productivity, economy and the environment.

Justification of subtheme

Crop production is heavily dependent on synthetic and animal derived fertilisers. The production of both types of fertilisers are significant contributors of GHG emissions in the agricultural sector. To ensure a sustainable development of crop production in the future, alternative nutrient sources must be developed and introduced. Our research on plant based fertilisers supports the development of a less fossil fuel reliant and less GHG emitting crop production.

Keywords

organic crop production, nitrogen mineralisation, mobile green manure, plant based fertilisers

Acknowledgements: Professor Lars Stoumann Jensen (Department of Plant and Environmental Sciences, University of Copenhagen), Svend Daverkosen (Head of Agriculture and Environment at Aarstiderne A/S), Chris Russel (gartner at Aarstiderne A/S).

O23 - Rethinking the satisfaction of human needs for a sustainable use of energy resources

The future use of natural resources

Ariane Weifner¹

Thomas Schinko²

¹ University of Natural Resources and Life Science, Vienna

² International Institute for Systems Analysis, Laxenburg

Abstract: One major global challenge is to break the link between human needs satisfaction, greenhouse gas emissions and climate change. Many services which satisfy human needs and improve human well-being, such as air conditioning, refrigeration or cooking, are highly energy consuming and thus reinforce climate change. We argue that the link between human well-being and greenhouse gas emissions is not primary energy or final energy, but energy service. This broader view allows us to connect the use of natural resources in a more direct way to human well-being and the satisfaction of our daily needs. The aim of our research was to shed light on this intersection, taking into account the impacts of new technologies like renewable energies, communication technologies or new mobility systems. Another goal was to identify indicators for measuring the decoupling of need satisfaction from greenhouse gas emissions. Based on semi-structured expert interviews with stakeholders from politics, science, private sector and institutions, we identified indicators like level of self-supply, the nearby environment and at a national level the independence of energy imports. Furthermore, the amount of saved money was mentioned as suitable indicator several times. This study also highlighted that the impact of technological innovations on energy consumption and related greenhouse gas emissions can be rather complex. If the dynamic feedback of the implementation of new technologies to improve human well-being on climate change is not considered, this may end up generating new and additional energy consumption, which lead to higher greenhouse gas emissions. The climate crisis threatens human well-being around the world, not only in the present, but especially in the near future. This new approach allows a broader view on the use of resources, which could finally help us in decoupling human well-being from greenhouse gas emissions.

O24 - The caudal vertebrae fusion and dysmorphology in White Swiss Shepherd Dog

The future use of natural resources

Paulina Janowska¹

¹ SGGW - Warsaw University of Life Sciences

Abstract: During the German shepherd's breeding in Germany, white individuals were selectively separated. In contrast to Germany, only in the United States, shepherd dogs with white ointment were entered into breeding books. Finally in 1991 the Swiss Kennel Club accepted a White Shepherd and developed a temporary breed standard. In 2002 it was officially published and the name of breed was given: "Berger Blanc Suisse" (White Swiss Shepherd Dog).

The T-box gene belongs to a large family of genes, which encodes transcription factors controlling the embryogenesis process. It plays a major role in the formation of the mesoderm - the layer from which develop the axial structures of the organism. Mutations in the T-box gene result in drastic defects in organism development. In dogs, the mutation of this gene causes the appearance of a short tail in heterozygote, often with the kink, whereas in the homozygous recessive system it is lethal.

The correct shape of the body axis in the developing embryo is crucial for the proper organ system. A spontaneous mutation named "kinked tail" has been identified in mice. In the case of heterozygous it causes a kinked tail due to caudal vertebrae fusion and dysmorphology. In homozygous is lethal. In the domestic dog breeds, it was found that mutations in *DVL2* gene, that segregates with the breed, defining phenotype of screw tail and vertebral malformations.

To check if the T-box gene is responsible for the occurrence of the kinked tail in the White Swiss Shepherd Dogs, samples of hair, blood and epithelium from the inside of the cheek were taken from 24 individuals. DNA was isolated, amplified by polymerase chain reaction (PCR) and subjected to electrophoresis separation in an agarose gel. The obtained product was digested with a restriction enzyme (BstEII) to visualize the polyacrylamide gel assays.

Keywords: T-box, kinked tail, White Swiss Shepherd Dog

Abstract fits the chosen sub-theme : The future use of natural resources, because widely understood use of natural resources includes also efforts to take all possible steps not to reproduce dogs with developmental defects, including those that are revealed in future generations like the "kinked tail" mutation. Knowing exactly the genes responsible for this mutation we can diagnose it easily and avoid carriers in mating programs. Thanks to this we can reduce the spread of developmental defects in dogs.

Acknowledgements: Joanna Gruszczyńska, Beata Grzegorzówka and breeders of White Swiss Shepherd Dogs

O34 - Future pathways of the European bioeconomy – scenario creation based on Delphi and cross-impact analysis

The future use of natural resources

Sebastian Hinderer¹

¹ University of Hohenheim

Abstract: The transformation of currently mainly fossil-based economies into sustainable and circular biobased economies calls for different events that need to take place and a diverse set of measures that need to be applied by various actors. Many of these measures and events have been intensively investigated by research. Others have already been established by politics and industry.

To shed light on the question of how these events and measures will jointly build up to concrete pathways of a full transformation towards bioeconomy, we conduct an expert survey among more than 50 bioeconomy experts. Our expert panel includes researchers, policy makers, representatives of corporates and entrepreneurs from the biobased sector. Applying a four step Delphi study combined with cross-impact analysis (CIA), we uncover necessary events for a transformation towards the bioeconomy and how these events interdepend on each other. The results of the CIA contribute to build a model which maps the relationships among elements of complex situations, i.e. in our case transformation pathways. This model allows for the creation of possible scenarios describing concrete pathways of the bioeconomy transformation. To further validate the model, in the final step of the Delphi, the expert panel are asked to what extent they agree with the model and its underlying implications.

This study provides an evidence-based prospect on the bioeconomy transformation allowing industry as well as politics to anticipate its future development and thereby, enables them to engage actively. Furthermore, the unique expert panel involved in the study – including entrepreneurs, corporates, researchers and policy makers – reveals so far blind spots of the academic and public bioeconomy discourses and hereby, provides starting points for new research projects.

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O35 - Assessment of lead sources in forest soils of the Czech Republic using isotopic ratios

The future use of natural resources

Hana Hurychová¹

¹ Czech University of Life Sciences

Abstract: Lead is an element with no known purpose in living organisms and may pose a significant threat to the environment. Lead can come from both natural and anthropogenic sources and distinguishing between them is often an arduous task. Lead isotope analyses can serve as a solid base for recognizing the leading sources of pollution in an area and aid in future conservation efforts.

The purpose of this work is to evaluate sources of lead in forest soils of the Czech Republic which are not directly affected by industrial activities or urban areas. The focus was on finding differences in isotope ratios across several regions, vegetation compositions, and altitudes. 120 sites were sampled across the forests of the Czech Republic and digested using aqua regia. Four horizons were sampled - F+H horizon, A horizon (0-2 cm) and subsoil horizons in depths of 2-10 cm and 10-20 cm. All samples from the A horizons and selected full soil profiles were then analyzed for lead isotope ratios using ICP MS.

Floodplain forests displayed an increased $^{206}\text{Pb}/^{207}\text{Pb}$ ratio, which could be connected to chemical processes in soils and a larger scale of possible pollution sources such as surface runoff and agricultural pollution in the rivers. In full soil profiles, the $^{206}\text{Pb}/^{207}\text{Pb}$ ratio increased with increasing depth due to greater effect of the bedrock. All observed sites showed a generally uniform pollution signature most likely stemming from a mixture of atmospheric pollution affected by coal and leaded gasoline and local industrial sources. This finding can help with assessing threats in future protection of sensitive areas and in creating better legislation connected with conservation ecology.

Acknowledgements: RNDr. Václav Tejnecký, Ph.D.
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O36 - The water footprint of Denmark for different diets

The future use of natural resources

Rayan kassem¹

¹ University of Copenhagen

Abstract: The dietary choices consumers make determine which crops are to be planted which in turn determine how much freshwater use will be needed. Tackling consumer dietary choices will indirectly lead to the control of the total volume of freshwater needed to produce the foods we eat. The water footprint is an indicator of the volume of freshwater required to yield a certain amount of a crop usually expressed in m³/ton. The Danish diet is characterized by a high consumption of animal-based foods which have a high water footprint. A statistical assessment has been made to compare the water footprint of the Danish consumption pattern between 2009 and 2013 noted as the “reference diet” with three other diets. The first diet is the EAT-Lancet Commission’s dietary intake recommendations, and the two other are diets in which all the meat in the Danish diet is replaced by insects as proteins and all meat in the EAT diet is replaced by insects as well. The results show that on average, every Danish citizen consumes 968 m³ of water per year. If the EAT diet was adopted instead, the water footprint accounted to 702.3 m³/cap/yr, a 27.3% drop in the water footprint from the reference diet. However, if the reference diet was kept the same and only meat was replaced by insects, only 4.22% drop was realized with a total water footprint of 926.8 m³/cap/yr. Finally, if the EAT diet was kept the same and meat was replaced by insects, the water footprint accounted to 715.8 m³/cap/yr (-26% with respect to reference diet and +1.8% with respect to EAT diet). Therefore, adoption of the EAT diet by the Danish population would result in highest drop in water footprint of consumption out of all diets assessed. It is also concluded that the accuracy of data concerning the water footprint of different food products is a key determinant of the total water footprint of a diet.

O42 - Natural resources as a spirit and physical treatment for human beings in modernity life

The future use of natural resources

Aviva Cui¹

¹ Lincoln university

Abstract: As the sociological process of urbanization and modernization developing, individuals start raising more desires of approaching back to natural resources. The future nature resources could potentially link more with human beings instead of separate from human beings. Nature likes a treatment for human being, which can bring calm and relaxation. More individuals prefer to go back nature area for escaping the day to day life from busy city life. This phenomenon reflects in everyday life and new emerged tourism. Examples are as below. New types of outdoor adventure sports emerged in last 20 years, such as downhill biking, downhill ski, and trail running and hiking. Outdoor parks and public playgrounds have played an important role for daily life. More destinations named themselves as a pure nature land to attract tourists, for example, New Zealand. Hotel and accommodation in destinations appeared new types, such as treehouse and bubble house in the forest. All of above examples showing people desire to stay in the quiet place for escaping away from busy noisy everyday life. On the other hand, as more new technologies have coming up, young generation focus on the electronical devices rather than playing in outside. Lack of physical activities, and stay-at-home habit create series social problems including obesity and disease in young age. Nature resources could be motivation to bring young generation out of home doing physical activities,

In recent years, many national parks start to include more activities that individuals can participant in. we can see this is a good starting point, future national park should include functions like education, recreation, a space for friends and families, and physical activities. This can provide a good mental healthy and physical healthy condition. In terms of sustainable developing national park, more educational programs need to be provided to human. National park should also provide more connection ways with nature. For example, mediation room in national park.

O43 - How to achieve the GHG reduction targets of the EU? – A comparative analysis of different tax scenarios in the agricultural sector

The future use of natural resources

Simon Ehjeij¹

¹ University of Hohenheim

Abstract: To meet the goal of the Paris Agreement on climate change, the EU set the goal to cut its greenhouse gas (GHG) emissions in sectors outside the EU emission trading scheme (ETS) by 30% in 2030 compared to 2005 (European Commission, 2014). Accounting for 50% of non-CO₂ GHG emissions and approximately 10% of total GHG emissions in the EU (European Commission, 2018), agriculture is one of the largest emitting sectors outside the ETS and thus outside a European-wide policy framework of GHG emissions reduction. Many authors argue that a dietary change away from GHG intensive foods, like ruminant meat or milk products, accompanied by a decrease in GHG intensive food production is needed to yield significant GHG emission reductions in daily consumption. Thus, policy instruments that increase prices of GHG intensive products can be necessary tools for EU climate policy. This study applies an extended version of the Global Trade Analysis Project (GTAP) model to analyze the impact of two different GHG tax scenarios on the contribution of the agricultural and food sector to meet the EU emission reduction goals for 2030. The first scenario consists of a tax levied on GHG emissions from agricultural producers in the EU, while the second scenario is an EU-wide GHG-tax on food products. By means of the GTAP-model, this study assesses the impact of the two tax scenarios not only on GHG emissions but also in terms of price changes, welfare and trade effects. Special focus is put on emission leakage as a result of emission reductions within the EU. The outcome of this study is a thorough impact assessment of alternative GHG-taxes imposed in the agri-food sector that provides an objective and reliable base for policy recommendations regarding the contribution of policy instruments to achieving the global GHG emission reduction targets.

References:

European Commission. (2014). *Impact assessment accompanying the document “A policy framework for climate and energy in the period from 2020 up to 2030”*. SWD (2014) 16 final. (2013), 1–8. Retrieved from <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014SC0015&from=EN>

European Commission. (2018). *In-depth analysis in support of the commission communication COM (2018) 773: A Clean Planet for all - A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy*.

Justification for the chosen sub-theme:

The applied CGE model is an appropriate and widely used tool for policy impact assessments. It is well suited to quantify the effects of different policies on the change of factor use, such as agricultural and forest land. With policies inducing a dietary shift towards a reduced consumption of resource intensive animal products, less crop and pasture land will be needed for food production and thus can be preserved.

Keywords: agricultural GHG emissions, GHG mitigation, GHG tax, scenario modelling

Acknowledgements: Dr. Kirsten Boysen-Urban, Dr. Dorothee Flaig

O44 - #GreenYourself! Do knowledge about biodiversity affects human well-being?

The future use of natural resources

Magdalena Przymusińska¹

Barbara Salaburska², Agata Równy²

¹ University of Warsaw

² Warsaw University of Life Sciences WULS-SGGW

Abstract: “Looking around the world with the knowledge that other creatures are on it makes me feel better. I am not so lonely anymore, because I know that somewhere nearby there is a bison, wolf, beetle, polar bear or a tardigrade. The world is more interesting. And although the extinction of a species does not affect me, my life - I feel sadness” – Adam Wajrak.

There’s a plenty of evidence that the exposure to nature may positively impact human health, both physical and mental. Exposure to green spaces had been linked to lesser risk of obesity, allergies and even the Lyme disease. Researches also show that psychological benefits of greenspace increase with biodiversity.

Inspired by the citation opening the abstract by a polish naturalist Adam Wajrak we decided to check if the knowledge of biodiversity and the fact that there are other non-human animals roaming the earth with us does in fact affect our mental health and well-being. We strongly believe that it is crucial to analyze it, especially when facing the 6th mass extinction, with more than 26,500 of the world's animal species facing the threat of dying out.

In this study, responses from over 500 questioned people are being analyzed. Respondents have answered closed-ended as well as open-ended questions regarding the knowledge of biodiversity topic, nature relatedness and their psychological well-being. The conclusions are being based on the results of the questionnaire and the scientific literature on the topic.

Green entrepreneurship

O4 - Investigating the effects of green public food procurement on regional food hubs using System Dynamics

Green entrepreneurship

Johannes Felder¹

¹ University of Natural Resources and Life Sciences, Vienna

Abstract: The transition to more sustainable, local and regional food systems has become a policy objective at all administrative levels. Reasons for concern are the exploitative way of how the globalized agri-food system is operating and its negative environmental impacts. Regional food hubs and green public food procurement (GFPF) present two strategies to promote alternative, regional food systems. To gain a better understanding of the interactions between actors involved in GFPF, food hubs working with public institutions in Vienna were investigated. With a combined deductive (literature) and inductive (case study) research approach it was looked into how a GFPF policy is affecting the reliability of the food hubs' suppliers. In order to do so, a draft qualitative System Dynamics Model – visualized in a Causal Loop Diagram (CLD) – was developed based on literature on the topic. This CLD illustrates a hypothetical regional food hub working with public institutions in Vienna, where a quota for organic produce, i.e. a GFPF policy with minimum sourcing requirements for organic food, is in place. CLD development was then supported by four semi-structured interviews with key informants in spring, during which expert knowledge on causal relations in the CLD was elicited and used to amend the CLD. The final model indicates that the reliability of the food hubs' suppliers is only indirectly affected by the Viennese organic quota. First, via the demand for regional, organic foods it creates and second, via collaboration and long-term sales guarantees between food hub and municipality. The latter allow the food hub to also guarantee purchases to its supplying farms, which in turn makes long-term farm-investments and the development of farm resources possible. Future research on these topics requires a much broader and more detailed data basis, especially regarding GFPF practices. Finally, two hypotheses were formulated which can be investigated further.

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Dipl.-Ing. **Magdalena Leithner**

O5 - The vertical farm industry: Exploratory research of a wicked situation

Green entrepreneurship

Simon Allegaert¹

¹ Wageningen University & Research

Abstract: Increasing population, global warming, shortage of agricultural land, food security, water shortage, and others challenges are heavily weighing on the current conventional agricultural system. A disrupting new sustainable system is needed to be able to feed 9.5 billion people in 2050. A possible solution for this is vertical farming (VFing), which is growing enormously, parallel with the rise of technological innovation and business opportunities. New VFs are incipient worldwide, with an increasing amount of capital investment, but what drives this industry? What are the coming opportunities and obstacles and how can they be managed for different VF business models? This paper develops a VF management framework to better understand the industry on a managerial and business-like perspective. The three main aspects of the framework are the organization (e.g. technological innovation), governance cooperation (e.g. partnerships), and enabling environment (e.g. community involvement). For this exploratory research, 40+ participants, who are active in the VF industry (e.g. farmers, executives), mainly from Europe and North-America, are interviewed to discuss and validate the various managerial aspects of the framework. The outcome of this study indicates that despite continued energy and labor struggles, the VF industry carries high business potential, which is why larger corporations are investing. Additionally, the industry needs more vocationally trained employees to support the optimization of the industry. VFing is a decentralized method of agriculture, that is disruptive compared to conventional farming, causing changes in the agriculture value chain. Partnership were identified as key to the success, due to the newness of this emerging innovative industry. Discussing the enabling environment resulted in the use of community involvement as a way of marketing and educating the consumers. The developed framework in this research encounters the major managerial aspects and supports a better understanding of the VF industry.

Acknowledgements: dr Emiel F.M. Wubben, Wageningen University and Research

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O6 - Recognition of *Micrurus mipartitus* Snake Venom and Mamba/Cobra Type I alpha-neurotoxins by Serum from Rabbits Immunized with Recombinant Immunogens.

Green entrepreneurship

Albert Fuglsang-Madsen¹

¹ University of Copenhagen / Technical University of Denmark / University of Costa Rica

Abstract: Every year, 81,000-131,000 people die from venomous snakebites. These bites occur predominantly in poor countries and people living in rural areas are at an especially high risk. In Southeast Asian- and African countries, Elapid snakes such as cobras and mambas are responsible for severe, neurotoxic envenomings, while Central- and Southern American countries are plagued by notoriously neurotoxic coral snakes.

The only cure for envenoming caused by these snakes is antivenoms based on antibodies from animals immunised with the venoms. However, these venoms can be difficult to obtain, as is the case for the venom of American coral snakes, which cannot be kept in captivity and have poor venom yields upon extraction. Another issue is that immunisation generates antibodies against the most immunogenic toxins in a venom, rather than the most potent toxins. Therefore, some antivenoms lack antibodies against important/deadly neurotoxins.

To circumvent these challenges and fortify existing antivenoms, we investigated the possibility of using recombinantly expressed toxins to raise antibodies against neurotoxic venom components which are difficult to target with current therapeutics. To this end, a consensus type I alpha-neurotoxin (T1an) sequence based on mamba and cobra toxin sequences was generated by bioinformatic approaches and expressed recombinantly in an *E. coli* strain optimized for production of disulphide-rich proteins. Additionally, a dominant T1an toxin from the coral snake *Micrurus mipartitus*, mipartoxin-1, was recombinantly expressed. These recombinant toxins were used to immunize rabbits.

Both resulting sera were tested for reactivity against a variety of toxins. The serum raised against the consensus toxin proved capable of recognising *Naja melanoleuca* (forest cobra), *Dendroaspis polylepis* (black mamba) and *Naja kaouthia* (monocled cobra) whole-venom and T1an-containing fractions of their venoms. When testing sera from immunised vs. non-immunised rabbits, a significantly higher response (by ELISA) was measured against a T1an from the black mamba (fraction 4, containing uniprot ID P01416), despite only having 67.80% identity to the immunogen. Conversely, the serum raised against recombinant mipartoxin-1 was shown to recognize the recombinant toxin and *M. mipartitus* significantly stronger for immunized, rather than non-immunized rabbit sera. Neutralisation of the toxins *in vivo* was attempted in mice models, but the IgG titres (from immunised vs. nonimmunized rabbits) were not sufficient for significantly improved neutralisation. Together, these results indicate the successful generation of antibodies with reactivity to native snake toxins, through immunisations with recombinant immunogens and underline the possibility of obtaining cross-reactive antibodies by use of a rationally designed, artificial consensus toxin. By producing recombinant toxins, we can ensure a higher specific IgG titre against only medically relevant toxins. This may potentially lower the necessary dose of antivenom administered to snakebite victims, resulting in fewer adverse effects as the patients are exposed to fewer heterologous molecules. **Acknowledgements:** Main supervisor: Professor Andreas H. Laustsen, Technical University of Denmark, With help from Professor Lars Elgaard, University of Copenhagen and Professors Bruno Lomonte & José Maria Gutiérrez Gutiérrez, University of Costa Rica

O17 - Hiring services to mechanize Conservation Agriculture in Zambia. A multiperiod mathematical programming approach.

Green entrepreneurship

Diana Jaime¹

¹ University of Hohenheim

Abstract: Several programs have been implemented in Zambia to promote sustainable crop intensification through the adoption of Conservation Agriculture (CA). However, the scaling up has been constrained by the high requirement of extension efforts and the unavailability of CA equipment for smallholders who represent 90% of Zambian farmers' population. As farm machinery represents an important capital investment, hiring services from farmers who are tractor owners to non-owners promises to achieve sustainable mechanization.

The aim of this study is to identify factors that contribute to or limit the financial viability of farmer-to-farmer Mechanization Hire Services (MHS) in order to promote the adoption of CA. To achieve this goal, a multiperiod single-agent mathematical programming model was developed to simulate a typical farm of a Tractor Service Provider (TSP) in Zambia using the agent-based software package MPMAS. The agent's objective function was defined to maximize the discounted cash surplus generated by the TSP's investments along a 15-year planning horizon that corresponds to a tractor's estimated lifetime. The agent decision problem included 70 activities and 35 constraints related to land use, crop production, consumption, off-farm income, labor, and machinery renting dynamics. Results showed that MHS provision increases the average discounted cash surplus of the TSP by 47% suggesting that it is a profitable activity with high potential to promote CA mechanization. However, the supply chain has to overcome some deficiencies such as demand with low purchasing power, high transaction costs and expensive breakdown repairs that discourage further expansion. Mechanical training, mechanisms that reduce logistic costs and education on business management can contribute to reducing bottlenecks in the provision of MHS. The public sector should focus on improving the agribusiness environment and access to credit for smallholders to provide demand with enough liquidity that guarantees the viability of the business and further adoption of sustainable intensification practices.

Keywords: Mathematical programming, Conservation Agriculture, mechanization enterprises

Subtheme: The future use of natural resources

In Zambia, as in many other countries of SSA, a big share of the population depends on agriculture. However, productivity is stubbornly low and some of the causes are lack of mechanization and degraded soils. To promote CA adoption through mechanization not only contributes to a more sustainable use of agricultural land but also attracts youth to farming in a context where aging rural population is becoming a growing concern.

Acknowledgements: Johannes Mössinger. University of Hohenheim, Institute of Agricultural Sciences in the Tropics (Hans Ruthenberg Institute), Germany.

Thomas Berger. University of Hohenheim, Institute of Agricultural Sciences in the Tropics (Hans Ruthenberg Institute), Germany.

O18 - Breeding for disease resistant chickens by selecting on natural antibodies: Direct and maternal genetics effects of TLR1A SNP.

Green entrepreneurship

Maud De Kinderen¹

¹ Wageningen University

Abstract:

Justification:

In modern poultry production in developed countries, multiple factors increase the risk of disease among farmed chickens. A potential way to decrease this risk in a sustainable manner, without unnecessary use of antibiotics, is breeding for more robust and disease resistant chickens by selecting them on presence of natural antibodies.

Keywords: *Natural antibodies, chickens, selective breeding, maternal effects.*

Abstract:

Natural Antibodies (NAb) are antibodies present in an individual without having previous exposure to the antigen which binds this antibody. Natural antibodies play an essential role in the immune defence and contribute to disease resistance. Different NAb isotypes are found: IgM, IgA and IgG. Natural antibodies that bind to keyhole limpet hemocyanin (KLH) have been used as a model. In chickens, levels of Nab binding KLH have been shown to be heritable and high levels of KLH-NAb have been associated with survival. Moreover, a maternal environmental effect was revealed for IgM NAb in a purebred white leghorn chicken population. A genome wide association study (GWAS) in that same population showed that a single nucleotide polymorphism (SNP) in the toll-like receptor 1 family member A (*TLR1A*) gene on chromosome 4 was associated with IgM and total immunoglobulin (IgT) NAb levels. Offspring of the white leghorn population has been mated and selected for 7 generations into two lines having either low or high levels of KLH-binding NAb. The aims of the current study were to estimate: 1) the allele frequencies of the TLR1A polymorphism in generation 6 and 7 of the high and low selection line, 2) the effect of the TLR1A polymorphism on NAb levels in the generation 6 and 7 of the selection lines and 3) the effect of the TLR1A polymorphism of the mother on the NAb levels in the offspring. Data on KLH-binding NAb and the TLR1A SNP were available for 681 chickens of generation 6 and 978 chickens of generation 7. The frequency of the C allele (positive effect on NAB) in generation 6 and 7 respectively were 0.64 and 0.66 in high line chickens and 0.07 and 0.04 in Low line chickens. Phenotypic selection on NAb levels changed TLR1A allele frequencies. The NAb levels of the CC/CG genotypes were significantly higher than the NAb levels of the GG genotype. Estimated effects of the TLR1A genotypes confirm a dominant mode of action of the C allele. Analysis of the contribution of the maternal TLR1A genotype on NAb levels of the offspring indicated that these were not present. This can be due to high maternal immunoglobulin levels causing the chick to produce less themselves or a shift in direct and maternal genetic effects over time.

Guidelines used for writing this abstract are obtained from: <https://student.slu.se/en/studies/degree-projects/ells-scientific-student-conference-20192/ells-scientific-student-conference-2019/>

Acknowledgements: Marleen Visker, Henk Bovenhuis and Tom Berghof.

O28 - Testing the ability of different plants to access potassium from Greenlandic glacial rock flour

Green entrepreneurship

Malte Winther Nymand¹

Kasper Tolborg²

¹ University of Copenhagen

² University of Copenhagen

Abstract: The areas with the highest agricultural productivity in the World are found along the margins of the ice cap during the last glaciation. The continuous mechanical movement of the Greenlandic glaciers, will through high-energy abrasion on the bedrock, create a fine-grained powder called Greenlandic Rock Flour (GRF). GRF contains a wide range of essential nutrients for potential use in plant cultivation, including potassium (K). Plant species differ in their K uptake efficiency of immobile K from the soil, but the mechanisms are not clearly understood. Therefore, a project which investigate GRF as a source of K to different plant species was set up as a seven-week greenhouse pot experiment.

This project has investigated, tested and analysed five different plants: common wheat (*Triticum aestivum*), corn (*Zea mays* L.), turnip (*Brassica oleracea* var. *Gongyloids*), lettuce (*Lactuca sativa*) and lupine (*Lupinus*) utilization of potassium from GRF, with the purpose of assessing GRF ability to replace parts of added potassium fertilizer and furthermore to introduce GRF to nutrient poor soils for enhanced fertility. First, to answer this purpose, the theoretical background which reasons the use of crushed glacial stone as a source of plant nutrient where carried out. Secondly, a pot experiment with three different K levels and two sources of GRF, 'Maalutu' and 'Illulialik', where set up during seven weeks in a greenhouse in Frederiksberg, Copenhagen, Denmark. In the project we wish to discuss whether Greenlandic rock flour should be considered a reliable source of K or not. The educational purpose of the project is to learn how to scientifically set up a pot experiment, to work with different scientific methods and to analyse, in a laboratory as well as in a greenhouse, to in the end process and communicate our own data.

The hypotheses of the project were, that:

- Greenlandic rock flour can add potassium to plants, which will increase biomass and improve root morphology.
- The five different plant species will respond differently to the supply of Greenlandic rock flour. Species with root exudation in the rhizosphere will have better conditions for utilizing Greenlandic rock flour as a potassium resource.

The experimental experiment showed very varying data and that the biomass did not distinctively point to K-effects of Greenlandic rock flour for the five different plant species.

The second hypothesis of the project could not be finally followed up. The data produced suggests that the hypothesis that species that acidify the rhizosphere have better conditions for utilizing GRF as a source to K, but the data has been too limited to conclude on this.

As the experiment progressed, however, it became clear that, due to the limited data it would more likely function as a preliminary study. The experiment did show interesting properties in GRF which opens for further investigations which will be followed up in "*The Glacial Rock Flour Project (2015-2020)* *" at UCPH.

*Knudsen, R. (2016): Glacial Rock Flour, University of Copenhagen, available at:
https://greenlandperspective.ku.dk/theme_packages/green_land/glacial-rock-dust/

Acknowledgements: We would like to thank and acknowledge Klara Cecilia Gunnarsen and Lars Stoumann Jensen, FacultyOfScience.UCPH.

O29 - Fish community responses to water colour - Results along a large gradient from clear to brown lakes in Sweden

Green entrepreneurship

Stephanie Koch¹

¹ Swedish University of Agricultural Sciences; University of Natural Resources and Life Sciences, Vienna

Abstract: An increase of dissolved organic carbon and iron in freshwater bodies across the Northern Hemisphere caused by environmental and land use changes lead to water browning with negative impacts on lake ecosystems. Effects of browning on aquatic ecosystems are complex and include reduced light penetration, thermal stratification, lower macrophyte cover, lower primary productivity, and potential shifts in species composition. However, little is known about impacts of browning on lake fish communities. In this study I analysed data from 146 lakes in Sweden along a large water colour gradient (measured as absorbance at 420 nm) to find out how fish community biomass is influenced by water colour. Furthermore, I studied if variations in species composition or mean body size contribute to differences in community fish biomass between clear and brown lakes. Therefore, I tested the relationship between absorbance and community biomass, species biomass, total abundance of fish individuals, mean fish body length, size diversity and species richness and the relationship between community composition and absorbance. The main result of my study was a negative relationship between fish community biomass and water colour, meaning a lower fish biomass in brown lakes than in clear lakes. The lower community biomass is likely explained by a lower biomass of several of the most common fish species, a lower total abundance of fish in dark lakes, and a lower number of species and differences in fish community composition. In contrast, I found no relationship between absorbance and fish body length, demonstrating that a lower biomass in brown lakes was not due to smaller fish. I also found that the variation in total fish abundance and biomass was high for clear lakes, but low for dark lakes. Also, values for highest biomass, highest number of individuals and number of species were much lower in darker lakes than in clear ones, explaining the lower community biomass with increased absorbance. Based on my results and considering that resource use and production are lower in dark lakes, I suggest a limitation of fish community biomass in brown lakes due to low resource availability. My study provides novel insights into fish community responses to absorbance, but also identifies further research needed in face of ongoing climate change and anticipated further water browning.

Justification:

Fish are a valuable natural resource not only economically but also in cultural and recreational terms and for ensuring ecosystem functions and food security. So far, research on the impact of browning on lake fish communities has been limited, but as browner water changes physical and biological water characteristics, the topic is very relevant for generating knowledge that might influence future management actions for freshwater fish.

Acknowledgements: Magnus Huss, Renee van Dorst, Stefan Schmutz

O30 - Exploration of an alkaliphilic microbial system for the conversion of syngas to chain-elongated products

Green entrepreneurship

Philipp Scherer¹

Martijn Diender¹, Ivette Parera Olm¹, Diana Z. Sousa¹

¹ Laboratory of Microbiology, Wageningen University & Research

Abstract: Context: The transition from a linear, fossil fuel driven economy towards a circular economy demands alternative technologies for the production of fuels and chemicals. A promising sustainable technology is the gasification of (recalcitrant) wastes, with the production of syngas (mixture of CO, CO₂ and H₂), and subsequent syngas fermentation to added-value products. Most syngas fermenting microorganisms produce ethanol and acetate, which are difficult to recover from the fermentation broth and relatively cheap. Therefore, efforts have been done to broaden the product spectrum from syngas fermentation. In our group, we have been developing co-cultivation approaches to produce C4 and C6 compounds from syngas^[1]. The established co-culture consisted of an acetogen (*Clostridium autoethanogenum*) and a chain-elongator (*Clostridium kluyveri*). This co-culture was stable and able to produce the desired products, difference in optimal pH between the two microorganisms is a bottleneck in process optimization. In the present work, we selected a recently isolated *Acetobacterium* sp. (strain JM, unpublished) and *C. kluyveri* to optimize the production of C4 and C6 compounds at elevated pH.

Method: In a first phase, co-cultivation of *Acetobacterium* sp. strain JM and *C. kluyveri* was conducted in batch bottles (proof-of-concept). Further on, the co-culture was inoculated in a gas transfer-limited continuous stirred tank reactor (CSTR) to study the microbial physiology, metabolism and interaction of the microorganisms and to optimize the production of C4 and C6 acids/alcohols from syngas.

Results: Synthetic co-cultures of *Acetobacterium* sp. strain JM and *C. kluyveri* could be successfully established in both batch bottles and CSTR. In batch conditions, 2 mM of butyrate and 0.2 mM of caproate were produced from a headspace composed of 90% CO and 10% CO₂ (total pressure 1.5 bar). In the CSTR, concentrations of 0.6 mM butyrate and 0.1 mM caproate were achieved at steady. Traces of the intermediate metabolite ethanol (≤ 0.1 mM) as well 0.1 mM butanol were detected, which supports the co-existence of both bacterial strains.

Conclusion: *Acetobacterium* sp. strain JM and *C. kluyveri* could be successfully co-cultured and the desired products butyrate and caproate were produced. However, the achieved product., which achieved butyrate and caproate concentrations of up to 10 mM and 2.5 mM, respectively. The comparably low ethanol production of *Acetobacterium* appears to be a bottleneck in the co-culture. Consequently, fine-tuning of parameters to reach similar or even higher production rates of C4 and C6 fatty acids remains to be explored .

Acknowledgements: I would like to thank the whole MicFys group of the Microbiology Department (WUR) for giving me the chance to perform my thesis in their group as well as all the support they provided gave me throughout the whole research process.

O37 - Potential of India's large-scale organic business model: a case study on development of PGS-based value chains in Jharkhand

Green entrepreneurship

Daniela Schaezel¹

¹ University of Hohenheim

Abstract: Justification:

Participatory Guarantee Systems (PGS) have been used as small-scale business models in several countries within the last decades. Recently the Indian government started to establish a large-scale PGS program. Thousands of farmers are already registered officially. This case study shows how a local NGO is trying to promote smallholder organic farming with PGS through innovative business and marketing models to broaden smallholders' market access and generate income sustainably.

Keywords: Participatory Guarantee Systems, smallholder farmer, organic farming, smallholder business model

Abstract:

Participatory Guarantee Systems (PGS) are an alternative to third-party organic certification adapted to the circumstances and needs of local stakeholders. PGS can have several advantages for smallholder farmers like generation of market access, joint marketing and a low level of bureaucracy. In India the government program PGS-India is implementing a nation-wide operational structure to promote smallholder organic PGS-farming. Yet, studies on development processes and success factors of PGS-based value chains offering sustainable marketing and business models for smallholder farmers are lacking.

Within this case study the innovative social network analysis tool "Influence Net-Mapping" was used to obtain a comprehensive insight into the development and structure of PGS-based value chains in Jharkhand, one of the pilot regions. Key-Informant interviews increased the understanding of the value chains' functioning as they reflect the actors' perspectives. The study aimed to identify key actors and important interlinkages, success factors as well as problems and challenges of establishing PGS-based value chains. Among other key actors, local NGOs were identified to be the most important ones. Most responsibility of setting up PGS-based value chains lays upon them, however their resources and capacity can hardly cope with the required governance measures. The PGS-India requirements and regulations are challenging for smallholder farmers because of their high level of bureaucracy, making participation hardly suitable for them without the support of NGOs. Marketing smallholder farmers' PGS produce beyond local farmers' markets needs a lot of effort too, because of the smallholders' lacking business experiences. Further, the inclusion of retailers into the value chains is difficult and potential consumers are often not aware of PGS products.

However, if the challenges can be overcome PGS seem to be an important opportunity to promote organic farming-based business models among the vulnerable groups of smallholder farmers in rural areas.

Acknowledgements: Dr. Athena Birkenberg

Solutions for an urban ecosystem

O1 - From grey to green cities: nitrogen chain and water-heat fluxes in constructed wetroofs

Solutions for an urban ecosystem

Ioannis Aristotelis Papagrighoriou¹

¹ University of Natural Resources and Life Sciences, Vienna & University of Copenhagen

Abstract: While cities have historically been drivers of economic growth and poverty reduction, the unplanned urbanization leads to rapid sprawl, environmental pollution, and unsustainable resource consumption. The progressive sealing of surfaces decreases the infiltration and evapotranspiration capacity of urban catchments, and increases surface runoff leading to frequent flooding events. At the same time, impervious surfaces promote the urban heat island effect increasing the residential cooling energy demand. Together with the hydrological and energetic issues, water pollution is among the key environmental problems of urban areas. In this perspective, a sustainable management of the water-energy nexus in urban areas cannot be longer procrastinated. The development of decentralised systems at the building scale hold high potential for two reasons. First and foremost, rooftops represent up to 50% of impervious surfaces in urban areas, meanwhile residential buildings account for 26% of energy consumption in EU and secondly, domestic wastewater is among the most important sources of water pollution. In this view, a novel technology is represented by Constructed Wetroofs (CWRs), which consists of a combination of Green Roofs and Constructed Wetlands. So far, only a few studies have investigated the performance of CWRs, although with promising results. The main aim of this study is to investigate the water quality, hydrological and energetic benefits of CWRs in controlled laboratory conditions. In particular, we focus on the coupled water-solute-heat transport processes in extensive CWRs under different setup and synthetic conditions, with particular regard to the reactive transport of nitrogen. A comprehensive monitoring campaign, supported by specific laboratory measurements, is used to better understand the mutual effect of unsaturated water flow, heat, and solute transport and how this affect the CWRs behavior. Three plots are employed for this experiment, which are placed in a climatic chamber that simulates typical Mediterranean conditions in the spring-summer season. The different model setups are used to enhance the information of the experiment. The first plot consists of a vegetated CWR, irrigated with clean water, and it is used as control plot (CP). The second is a CWR (CWR1), irrigated with wastewater and the latter a non-vegetated CWR (CWR2), irrigated with wastewater. The differences in the test plots give information on the role of the plants on the water-heat-nitrogen balance, as well as the changes in the soil hydraulic properties induced by the near-surface bioclogging. After 45 days of wastewater injection, in situ and laboratory monitoring data is gathered and analysed. The experimental results are discussed with regards to the optimisation of CWRs, as an alternative method for decentralised wastewater treatment.

Acknowledgements: I would like to express my sincere gratitude to my advisors Prof. Christinne Stumpp, Dr. Giuseppe Brunetti and Prof. Efstathios Diamantopoulos for the continuous support of my MSc thesis project.

O2 - Conceptualizing circular economy principles in the context of European agri-food supply chains

Solutions for an urban ecosystem

Jeroen Kerssies¹

¹ Wageningen University

Abstract: Subtheme – “Solutions for an urban ecosystem”

I deconstructed the contemporary understanding of circular economy principles, including drivers and barriers, to identify alignment and ambiguity in its theory & design. I developed a comprehensive framework aimed at disambiguating the circular economy concept. I tested this framework against food waste management frameworks to identify applicability, possible routes for development and for operationalization of the framework, as well as further research directions for circular economy and (food) waste management.

Keywords – circular economy framework, food waste management, agri-food supply chain, valorisation, grounded theory

Abstract

Background – Stakeholders throughout agri-food supply chains are urged to feed the growing world population without further exceeding planetary boundaries. Meanwhile, thirty percent of food produced globally is wasted each year. Supposedly, ‘the circular economy’ provides a sustainable alternative through reducing waste generation, redistributing available resources, and providing cross-sectoral policies. Up to now, conceptualizations of the concept that provide solutions to these ends are ambiguous or incomplete.

RQ – How can the circular economy concept be applied to identify drivers and barriers for food waste valorisation in the agri-food supply chain?

Approach – This question is answered through a qualitative analysis of documents and theories, dissecting conceptualizations into characterizing components and influencing factors.

Findings - Results show that circular economy is: (1) a subset means of sustainable development, (2) both a future prospect and strategy towards this prospect, (3) only reached through systemic change at all societal levels, meeting diverse societal, environmental and economic interests, and (4) providing options for redesigning waste as resources. The proposed framework depicts 22 factors influencing the CE transition across five categories: cultural, market, technological, regulatory and planetary. A test against food waste management frameworks validated 16 of these factors, and identified that: (1) a more sustainable system of production and consumption begins with cultural change, and; (2) businesses should focus on value chain collaboration, distributing more equally the economic, environmental and social burdens of their operations.

Conclusion – Circular economy principles can contribute to the development of a more sustainable

food production and consumption system. Specifically, stakeholders throughout agri-food supply chains should focus more on higher-order retention options such as ‘refuse’, ‘reduce’ and ‘reuse’ activities. After all, systemic change of the complex food system, especially in light of excessive food waste generation, will not be accomplished through expanding the available economic or technological means for food waste management.

Acknowledgements: Dr. Renzo Akkerman - MSc Thesis supervisor

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O3 - Characterization of biogas digestate and corncob developed carbon electrodes used in microbial fuel cells

Solutions for an urban ecosystem

Musa Bishir¹

Catalina Rodriguez Correa¹, Andrea Kruse¹

¹ Universität Hohenheim

Abstract: Department of Conversion Technologies of Biobased Resources, University of Hohenheim, Garbenstraße 9, 70599 Stuttgart, Germany

*Corresponding Author: Musa Bishir (musa.bishir@uni-hohenheim.de)

A new approach known as Microbial Fuel Cell (MFC) technology presents a multiple sharp edge advantage of sustainable electrical energy supply, clean water generation and environmental protection. The aim of this research was to develop and characterize carbon-based materials that are not only affordable, but also sustainable and electrically functional to replace the existing cost prohibitive electrodes used in MFCs as well as characterizing the digestate used as source of the electrogenic bacteria and source of their nutrients. Pyrolysis of weighed quantities of corncobs was carried out at temperatures of 400°C, 600°C and 800°C under a constant nitrogen flow of 3 L/min for a reaction time of 30 mins. The physical and chemical properties of the pyrochars produced and digestate obtained from biogas plant were then determined according to standard procedures. The highest pyrochar yield of 3.93g (29.37%) was recorded at 400°C and the lowest 3.57g (24.72%) at 800°C. The elemental analyses revealed the highest C content (87.57±0.24 wt%) but lowest H/C (0.10 mol/mol) and O/C (0.06 mol/mol) at 800°C. On the contrary, the lowest C content (77.45±0.28 wt%) but highest H/C (0.55 mol/mol) and O/C (0.14 mol/mol) were recorded at 400°C. The cyclic voltammetry (CV) revealed the highest current of 25.19mA with pyrochar produced at 800°C (MCPYR800) using 1.0M NaNO₃ and the lowest current of 0.828nA with pyrochar produced at 400°C (MCPYR400) using 1.0M KOH. Best red-ox behavior (reversibility) of the electrodes was however observed with MCPYR800 using 0.25M H₂SO₄ as electrolyte, but with a maximum current of 7.82mA. While MCPYR600 had the highest surface area (SA) of 88.48±1.69m²/g and MCPYR800 had 0.00 m²/g (due to graphitization), MCPYR400 and MCPYR600 had an average pore size of 18.47±0.00Å each. The physico-chemical analyses of the digestate revealed an average pH of 8.97±0.08, electrical conductivity (EC) of 12.35±16.34 μS/cm and total organic carbon of 410.50±48.79 mg/L. Of the three pyrochars produced at different temperatures, MCPYR600 had the highest surface area (for biofilm formation) with reliable stability in structure, high current as well as comparable redox reversibility. Therefore, the best temperature for electrode production from corncobs by pyrolysis is 600°C, especially because of its high surface area for colonization of electrogenic bacteria during biofilm formation and the digestate also contribute to increased voltage output in MFCs due to its high EC.

Keywords: MFC, Energy, Corncob, Electrode, Pyrochar, Current, Digestate, Electrical conductivity

Acknowledgements: A part of this work was carried out in collaboration with Heumesser, F. and Zerrer, E. who were Humboldt Students at the Department of Conversion Technologies of Biobased Resources, Institute for Agricultural Engineering, University of Hohenheim, Stuttgart, Germany.

O13 - The renewal of Blasieholmen, A design proposal and analysis based on theories for sustainable city development.

Solutions for an urban ecosystem

Linnéa Gustafsson¹

¹ Swedish University of Agricultural Sciences

Abstract: Sustainable city development is key in creating a sustainable future for all. To create truly sustainable cities one must study people's usage of cities, because it is how we use the cities that determines if they are attractive, joyful and sustainable. The aim with this thesis is to analyze and make a design proposal for Blasieholmen, in the city center of Stockholm, with focus on sustainable urban planning. The framework for sustainable urban planning used in this thesis is PEBOSCA which is based on 1996s Habitat Agenda. The framework consists of seven equally important resources namely, Physical, Economical, Biological, Organizational, Social, Cultural and Aesthetic. The methodology can be described as a time glass where the selected area first was analyzed using all seven resources. Then a design proposal was made based on two selected resources and finally the result of the design proposal was again analyzed using all seven resources. The two selected resources in the design proposal are social and aesthetic values.

A comprehensive site study including inventory analysis, observations and semi structured interviews were made in order to understand Blasieholmen. Important qualities of Blasieholmen is the location in city center with marvelous views over Stockholm, the close access to water and its historical buildings such as the National Museum. The main problem with the site is that it is organized for cars instead of people. As a result, the design proposal presents a vision for Blasieholmen as a green place for people to use and enjoy. The thesis concludes that the design proposal would have a positive impact on all seven resources in PEBOSCA, even though only two resources were the main focus of the design proposal. The thesis shows that the site study's sustainable approach helped to create a design that would impact the sustainability of the city and people's wellbeing. Since landscape architecture is about designing and planning places it is essential that landscape architects understand how their design can help to create a sustainable future.

Key words: Blasieholmen, Sustainable urban development, PEBOSCA, Jan Gehl, Design proposal.

Justification of sub-theme: In order to work towards a solution for global climate change an urban structure that helps people to make more sustainable choices is necessary. This thesis is about the importance of the city's public places and how they together create a network of sustainable places that affects the whole city. Without a sustainable urban structure with people's wellbeing and behaviors in mind, there will not be a sustainable future.

Acknowledgements: I would like to express my great appreciation to my mentor Per G. Berg for all inspiration, engagement and support in my project. I am particularly grateful that Per G. Berg has inspired me to understand that it is possible to work towards a sustainable future with landscape architecture.

O14 - The value of opportunistic citizen science for monitoring birds: A cross-comparison between five European cities.

Solutions for an urban ecosystem

Damian Veiga Löffel¹

¹ University of Copenhagen (KU) and University of Natural Resources and Life Science of Vienna (BOKU)

Abstract: Citizen science as a tool for ecological monitoring has tremendously developed over the past decade. The growing practice of including amateurs into scientific research is often praised for its ability to gather huge amounts of data, to raise environmental awareness and its relative inexpensiveness. My study aims to compare the opportunistic bird monitoring schemes of five different European cities: Copenhagen, Geneva, Stuttgart, Uppsala and Vienna. For the year 2018, social and ecological patterns were investigated and compared. Interviews with concerned project managers were carried out afterwards in order to facilitate the final interpretation. As a result, it is observed that most of the data are actually produced by a minority of “serious” birdwatchers (~10% of the people contribute to 80% of the data). In those schemes, birdwatchers tend to be male (~80%), but no significant gender differences are observed in terms of observation intensity. An economic valuation based on the number of hours of volunteered work shows that the scheme in Copenhagen is virtually the most valuable one (~250'000 € for 2018). In terms of spatial and temporal trends, observation hot-spots are usually located close to parks and water bodies, with some notable exceptions explained by anthropogenic factors. Observation rates are significantly higher during week-ends and holidays in four cities, with the surprising exception of the city of Vienna. The differences between the communities of bird observed were compared with a Principal Component Analysis. Diversity indices were calculated and put in multi-regression models with parameters such as: city area, number of observations, number of participants, etc. The results are here still being processed. Knowing the structure and biases within citizen science schemes, as well enabling comparison between projects, will lead to fruitful adjustments in the way those initiatives can be designed, can interact with volunteers and eventually produce knowledge.

Acknowledgements: My supervisors: Ander Tøttrup (KU), Florian Heigl (BOKU).

As well as the different project managers and the thousands of volunteers collecting the data.

O15 - Transport of nanoplastics in soil by percolation and bioturbation

Solutions for an urban ecosystem

Wiebke Mareile Heinze¹

Geert Cornelis²

¹ Swedish University of Agricultural Sciences & University of Copenhagen

² Swedish University of Agricultural Sciences

Abstract: Micro- and nanoplastics are increasingly perceived as an emerging threat to ecosystems. While environmental research on microplastics has focused on marine systems, behaviour and fate of small plastics in terrestrial ecosystems have only scarcely been investigated. Soils are subject to plastic pollution via different pathways, with sewage sludge application as a primary input to agricultural soils, and tire abrasion or degradation of mismanaged waste causing mass flows to urban soils. Meanwhile, global plastic consumption is steadily increasing, challenging waste management capacities of urban centres. A better understanding of microplastic fate is necessary to reliably estimate time-dependent exposure levels of soils and arising risks for terrestrial ecosystems and human health. This study aimed to develop and compare different modes of transport of plastics in soils, in particular transport by percolation and by bioturbation. Palladium-doped polystyrene nanoplastics of 256 nm diameter size were utilized in these process studies to overcome major challenges in detection of plastics in environmental samples. Transport of nanoplastics with percolating water was investigated in leaching tests with soil columns under saturated conditions. Leachate and soil were then analysed with regards to their Palladium content. Results were used in an inverse modelling approach with HYDRUS-1D to obtain kinetic parameters based on breakthrough curves and depth profiles. Attachment efficiencies and detachment rates could be established for the used polystyrene particles, demonstrating relatively high mobilities. Migration of nanoplastics in soil via bioturbation was investigated in columns via single-species tests using deep burrowing earthworms, *Lumbricus terrestris*. Changes in the depth profiles were analysed over a period of four weeks to calculate mixing rates. In addition, accumulation in earthworm tissues were analysed. The two modes of transport were then compared with regards to their relative importance, and potential implications of plastic pollution for terrestrial ecosystems in urban and agricultural areas discussed.

keywords: nanoplastics, soil, transport, bioturbation, modelling

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O16 - Multi-Stakeholder Partnership in Smallholding Dairy Farming: A Case Study from Bangladesh

Solutions for an urban ecosystem

FARJANA BILKIS¹

¹ Swedish University of Agricultural Science

Abstract: In the era of Sustainable Development Goal 2030 agenda, development of agribusiness and poverty eradication is quite significant challenges, particularly in developing countries like Bangladesh. Smallholding dairy farming is a crucial part of agribusiness and poverty reduction in Bangladesh, though there are many economic and social challenges for smallholding farmers. Therefore, the smallholding dairy farming industry needs combined, coordinated, and comprehensive support from the government, private sector, and civil society in Bangladesh to form a formal market which may eradicate the social and economic challenges of smallholding farmers. This study reveals how the multi-stakeholder partnership (MSP) approach creates value for smallholding dairy farming business in Bangladesh and what are the consequences of adopting creating shared value (CSV) approach on smallholding dairy farmers. This study also reveals why MSP and CSV approach can be considered as crucial business strategy tools to form a structured dairy value chain for the economic and social development of the smallholding farmers. In this qualitative in-depth case study of smallholding dairy farming in Bangladesh, the researcher identified the economic and social problems of the small-scale dairy business and followed previous literature to find out the experts' evidence-based opinion as empirical research background. Afterward, the researcher investigated the case from Bangladesh, which adopted the MSP and CSV approach to finding out the features, importance, and evaluation of MSP and CSV. From the literature review, conceptual framework and empirical data from semi-structured interviews of multiple stakeholders, the researcher have found that MSP and CSV execute crucial roles in addressing social and economic challenges of smallholding dairy business. These approaches enable the stakeholders of smallholding dairy business to work together for mutual benefits, to form a formal value chain and to increase profit for all stakeholders. The findings contribute to the literature of business strategy and agribusiness marketing in a developing country. The study is concluded by outlining these findings and suggesting potential avenues for further research.

O25 - Application of pulsed electric field in the technology of obtaining plant-based yoghurt

Solutions for an urban ecosystem

Kinga Drożdżał¹

Weronika Marczak¹

¹ Warsaw University of Life Sciences

Abstract: Worldwide sales of non-dairy alternatives for milk products are on the rise. Nowadays people more often choose plant-based substitutes due to some different reasons such as lactose intolerance, allergy, vegan diet or other health and environment related issues. In response to growing demand, producers are in search of new formulations as well as methods to improve process efficiency and quality of the product.

Oat is one of the promising raw materials for functional food. It is considered to be rich in protein, soluble fiber, β -glucans, fat and antioxidants. Buckwheat is a pseudograin considered as a very good source of nutrients, antioxidants, amino acids and vitamins, especially vitamin B. Oat and buckwheat are traditionally cultivated in Poland and they grow with less water in compare to major crops.

In this study fermented yoghurts based on oat and buckwheat were formulated. In order to meet consumer preferences various ratios of oat and buckwheat were used: 1:1, 1:3, 3:1. Pulsed electric field was applicated in order to promote fermentation, minimize using of high temperature in technological process and prolong shelf-life. Moreover, the color in CIE L*a*b* system and viscosity were measured and the organoleptic assessment was carried out. The results of this research seem to be very promising.

Keywords: oat, buckwheat, pulsed electric field, plant-based yoghurt

O26 - Effect of variant ovarian fluid on sperm performance and egg fertilization rates of Arctic charr (*Salvelinus alpinus* L.)

Solutions for an urban ecosystem

Lwabanya Mabo¹

¹ Swedish University of Agricultural Sciences (SLU), Umeå, Sweden

Abstract: Successful *in vitro* fertilization in aquaculture is highly dependent on the method used to handle or treat the eggs and milt. As such it is of paramount importance that timely evaluation of the methods is conducted to enhance hatchery productivity and reduce the cost of production. In this study, three methods of handling eggs of Arctic charr in Sweden were evaluated, with the objective of ascertaining the importance of retaining the ovarian fluid in the egg batch. Further, activation of fish sperms with a commercial activator, ActiFishTM, was tested to compare the fertilization rates, in a bid to overcome the current low egg fertilization and hatching rates among farmed Arctic charr. Variation of the volumetric amount of the ovarian fluid did not yield dissimilar fertilization rates. As such, tempering with the volume of the ovarian fluid under the current study did not affect the performance of the sperms and consequent fertilization rates. Further, no differential fertilization rates were recorded for the sperm extender and freshwater. However, positive relationships were recorded for fertilization rate and sperm velocity (VCL). The study contends that high and successful fertilization rates are likely to be obtained with or without the ovarian fluids under *in-vitro* fertilization of Arctic charr eggs.

Key words: *Arctic charr, Ovarian fluid, Sperm motility, fertilization rate, VCL*

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O27 - Assessing the governance capacity to implement resource-oriented waste management in Chia (Colombia)

Solutions for an urban ecosystem

Mónica García¹

¹ Swedish University of Agricultural Sciences & University of Copenhagen

Abstract: Integrated approaches to urban waste management, like resource recovery from organic waste, can contribute to food and energy security while connecting sanitation and waste management to a circular and bio-based economy. A first step towards successful management is to know what resources are available in the city's waste streams, how they could be reused in a safe manner, and how much revenue can be obtained from reusing those products. However, in addition, it is crucial to understand what are the governance drivers that can boost the implementation of these integrated approaches, and what are the governance challenges that can emerge as barriers to its successful application.

This study aims to obtain a deeper understanding of the key conditions determining urban sanitation and waste governance; identifying the main obstacles and opportunities to put resource recovery systems of organic urban waste streams in practice. For that, a governance analysis is carried out based on an empirical case in Chia, a semi-urban city located 10 kilometers north of Bogotá, Colombia. The Water Governance Capacity Framework (GCF), an integrated empirical based approach that provides insights into the most effective improvements to increase the governance capacity to address water urban challenges; is adapted and applied to the local environmental, social and economic context in Chia. Thereby, a focus is put on issues of waste, sanitation and resource recovery rather than water management. The GCF consists of 3 dimensions, 9 governance conditions, and 27 indicators; all of them identified as good factors to achieve good governance. A triangular method is applied to range each indicator with a score, from very encouraging to very limiting to succeed in the urban governance effectiveness. First, a preliminary score for each indicator is given based on a review of scientific research, policy documents, and grey literature. Afterwards, 21 semi-structured interviews are conducted with relevant stakeholders linked with sanitation and waste management in the city. The goal of the interviews is that at least 3-4 interviewees can illustrate their views on each of the indicators. Finally, with the information collected and by adding all the arguments of the stakeholders interviewed, final scores for each indicator are obtained. Final scores are used to show the main barriers and opportunities that can enhance governance effectiveness to implement systems for resource recovery systems of organic waste streams in Chia. Supplemented by a deep analysis of the interviews and policy documents, insights into the nine governance factors are presented. Furthermore, based on the results, several ideas are proposed to stimulate integrated waste management and resource recovery policy-making and action by urban stakeholders. Apart from that, the suitability of the GCF approach for a sanitation and waste management case is assessed.

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Innovations in the food chain

O7 - Prevention of Geosmin and 2-Methylisoborneol accumulation in Nile Tilapia (*Oreochromis niloticus*)

Innovations in the food chain

Peter Horstmann¹

¹ Wageningen University and Research

Abstract: Currently, the most reliable method for removing off-flavor from a fish fillet is to purify the fish in odor-free water. However, the depuration method comes along with economical costs and welfare issues. Therefore, this study is focussed on the prevention of Geosmin (GSM) and 2-Methylisoborneol (MIB) accumulation in Nile Tilapia (*Oreochromis niloticus*) by adding a test product (TP; 30 mg/L; INVE aquaculture, Dendermonde, Belgium). The experiment consisted of an adaptation period (five weeks) and a treatment period (three weeks). During the treatment period, three identical lab-scale recirculating aquaculture systems (RAS; V = 460L) were randomly assigned to the control group (CTRL) and three RAS to the test product treatment group (TPTG). The purpose of this experiment was to evaluate: (1) if the TP reduces GSM and MIB accumulation to below the human sensory threshold (HST) in water and (2) in fish fillet; (3) if the TP affects fish performance and (4) if the biofilter performance is affected by the TP. The results showed that the TP was unable to reduce the MIB concentration in the water and fish flesh to below the HST. An treatment effect on GSM concentration in fish flesh could not be detected as the concentration in the CTRL as well as in the TPTG was to below the HST. Previous studies with the TP showed a positive prevention of off-flavor in water. A difference with previous studies might be the amount of COD present, and lower degradation of the TP. Therefore, factors affecting the TP and the mode of action of the TP has to be investigated in more detail in future experiments. There was only a tendency for a lower feed intake in the TPTG during the morning feeding after the TP application observed. It is assumed that this effect was due to the increase in turbidity, caused by the TP application, as it coloured the water and probably led to a diminished view. To be sure the TP does not affect feed intake by turbidity, feed intake has to be investigated in a similar experiment with feeding levels set at satiation feeding. In this study, it was shown that the biofilter performance was not affected by the TP. However, it is not clear if the TP showed its full effect on ammonia oxidizing bacteria (AOB) and nitrite oxidizing bacteria (NOB) as it was not tested under conditions where the TP prevented the accumulation of GSM and MIB. Therefore, the results of the biofilter experiment should be interpreted with care and follow up studies should investigate the effect of the TP under conditions, where it prevents GSM and MIB accumulation. Overall, knowledge of the TP composition, the mode of action (prokaryotic application range) of the TP and factors (e.g. COD) affecting the effectivity of the TP in an aquaculture setting has to be gained.

Acknowledgements: Ep Eding (Thesis supervisor), Barbara Hostins (Supervisor from INVE aquaculture), Bavo De Witte (Analyst for GSM and MIB water samples), Edward Schram (Analyst for GSM and MIB fish samples).

O8 - Detection of bovine mastitis biomarkers in milk by porous silicon optical biosensors

Innovations in the food chain

Nofar Pinker¹

Giorgi Shtenberg²

¹ the Hebrew University

² The Volcani Center

Abstract: The proposed research specifically addresses the most prevalent health problem in dairy cows, which is a major problem for dairy industry worldwide, by developing a generic integrated biosensing platform for on-site monitoring applications. Bovine mastitis (BM) is one of the most frequent diseases in dairy cattle, having a large effect on farm economics, including increased treatment costs, decreased milk yield and even death. Traditional diagnostic methods check the quality of milk through the detection of mammary gland inflammation, diagnosis of infection and its causative microorganisms. However, all those techniques lack the ability to detect analyses in real-time or outside the laboratory boundaries. Even, the "on-site" California Mastitis Test has low sensitivity and difficulties in results interpretation. Therefore, there is an urgent need for a rapid, non-destructive, accurate, cost effective, simple and portable method to evaluate in real-time new cases of BM, that will be followed by corrective and/or prevention actions, leading to a positive effect on animal health and overall economy of the dairy farms. Herein, we have designed and fabricated an optical biosensing platform, based on porous Silicon (PSi) nanostructures, a Fabry-Pérot thin film, for the detection and quantification of BM predicting biomarkers - Haptoglobin (Hp) and N-acetyl- β -D-glucosaminidase (NAGase). We show specific detection assay by immobilizing Hemoglobin for the detection of Hp and horseradish peroxidase for indirect detection of NAGase, within the PSi nanostructure. The BM predicting biomarkers are monitored in real-time by reflective interferometric Fourier transform spectroscopy. Our studies reveal that the optical nanostructure capable of multitasking i.e., immobilization, size-exclusion separation, rapid and sensitive detection of specific biological targets in "real" milk samples, offering simultaneous real-time detection based on physical characteristics. Thus, the main advantage of the presented biosensing concept is the ability to detect BM predicting biomarkers in milk, using a simple and portable experimental setup.

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O9 - Effect of Selected Stilbenoids on Human Fecal Microbiota

Innovations in the food chain

José Diógenes Jaimes¹

Veronika Jarošová¹, Ondřej Veselý¹, Chahrazed Mekadim¹

¹ Czech University of Life Sciences Prague

Abstract: Dietary phenolics or polyphenols are mostly metabolized by the human gut microbiota. These metabolites appear to confer the beneficial health effects attributed to phenolics. Microbial composition affects the type of metabolites produced. Reciprocally, phenolics modulate microbial composition. Understanding this relationship could be used to positively impact health by phenolic supplementation and thus create favorable colonic conditions. This study explored the effect of six stilbenoids (batatasin III, oxyresveratrol, piceatannol, pinostilbene, resveratrol, thunalbene) on the gut microbiota composition. Stilbenoids were anaerobically fermented with fecal bacteria from four donors, samples were collected at 0 and 24 h, and effects on the microbiota were assessed by 16S rRNA gene sequencing. Statistical tests identified affected microbes at three taxonomic levels. Observed microbial composition modulation by stilbenoids included a decrease in the Firmicutes to Bacteroidetes ratio, a decrease in the relative abundance of strains from the genus *Clostridium*, and effects on the family *Lachnospiraceae*. A frequently observed effect was a further decrease of the relative abundance when compared to the control. An opposite effect to the control was observed for *Faecalibacterium prausnitzii*, whose relative abundance increased. Observed effects were more frequently attributed to resveratrol and piceatannol, followed by thunalbene and batatasin III.

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O19 - The influence of some phenolic acids on bacterial biofilm formation by *Salmonella*

Innovations in the food chain

Marta Szumiata¹

Alicja Synowiec¹

¹ WULS-SGGW - Warsaw University of Life Sciences

Abstract: There is compulsory requirement to use different additives in food production not only to improve flavor, appearance or increase the efficiency in manufacturing but mainly to prevent products from spoilage and provide safety in food chain. Preservatives as sulphates, sorbates or benzoates protect food from bacteria, fungus and viruses and prolong its shelf-life. What is more, there are some research which informs about their harmfulness for human health. Therefore, they are not perceived as desired and rather avoided in food composition by consumers. Hence, there is a need to find another solution for that problem. There is opportunity to obtain the antimicrobial effect by using naturally occurred phenolic acids.

In the following study, some of phenolic acids (gentisic, vanillic, *trans*-cinnamic and *p*-cumaric) and their two-component mixtures were examined for their ability of forming biofilm by the bacteria *Salmonella* Enteritidis ATCC 13076. Firstly, the matrix was prepared (single phenolic acids and their two-component mixtures with bacteria). Then, they were incubated for 72 hours in 37°C. After specific procedure, the absorbance (wavelength $\lambda=600$ nm) was measured with Bioscreen C. The results enabled to access if the forming of biofilm was weak or strong.

All examined phenolic acids showed inhibitory effects. The best one was gentisic acid. Moreover, mixing different acids enabled to use a smaller amount of them providing the same or even better effect. The most effective one was the mixture of vanillic and *p*-cumaric acids. Furthermore, there was a synergy between phenolic acids in the two-component mixtures.

O20 - The application of dietary fibre in the microencapsulation of sea buckthorn oil.

Innovations in the food chain

Ewelina Drozińska¹

¹ Warsaw University of Life Sciences

Abstract: Justification: Sea buckthorn oil is rich in polyunsaturated fatty acids, carotenoids, polyphenols and tocopherols. All of them are crucial for the proper functioning of human body. Unfortunately, they are also very sensitive to the external environmental factors. Microencapsulation can be used to protect the sensitive compounds against light, oxygen or microorganisms. Adding beta-glucan to the coating material of microcapsules may increase its nutritional value.

Keywords: microencapsulation, beta-glucan, sea buckthorn oil, spray drying.

Abstract text: Due to large amounts of polyunsaturated fatty acids, carotenoids, polyphenols and tocopherols, sea buckthorn oil is enjoying growing popularity among consumers. To meet their expectations food producers are more willing to add it to products such as yogurts, juices and bread. Unfortunately, the oil addition is limited, because of high content of compounds sensitive to the process to which food products are subjected. The solution may be adding oil in the form of capsules. Microencapsulation is a developing technology which depends on enclosing active material in special wall material. Therefore, the aim of our study was to examine the possibility of using beta-glucan as a coating material in microencapsulation of sea buckthorn oil, depending on the concentration of fibre in the initial solution. We have used 0.5, 1, 3% of beta-glucan as wall material in complex with starch to microencapsulate sea buckthorn oil. The control group consisted of microcapsules in coating from the complex of maltodextrin and gum Arabic, due to their widespread use in scientific works. The microencapsulation efficiency for the sample with 0,5% of beta-glucan concentration in the coating material was 72,22% and it was higher than for the control group (67,96%). As research has shown microencapsulated oil did not significantly degraded in capsules with 3% of beta-glucan in coating material. The α -linolenic (0,338%) and linoleic (62,394%) acid content was similar to the acid profile in analysed oil (respectively 0,360% and 62,560%). Lipid oxidation after one-week storage in microcapsules with 3% beta-glucan in the coating material was 5.50mEq/kg fat. The oxidation was about five times lower than during conventional storage oil in the fridge (31.78mEq/kg fat). In addition, the process makes it possible to increase the intake of soluble dietary fibre fraction thanks to the possibility of using beta-glucan as a wall material for the microcapsules prepared.

Acknowledgements: This work was supported by The National Centre for Research and Development project “Microencapsulation as the technique for increasing the application of beta-glucan in the food industry [LIDER/ 25/0022/L7/15/NCBR/2016].”

and dr hab. Marcin Andrzej Kurek

O21 - Creating a Nutritionally Adequate Oat-based Alternative to Bovine Milk

Innovations in the food chain

Petrine Stokkebye¹

¹ University of Copenhagen

Abstract: The popularity of plant-based milk is rising significantly, whilst traditional cow's milk is consumed at decreasing rates. It is thus a growing concern that plant-based alternatives cannot nutritionally compete with cow's milk. This review focuses on oat-based milk and aimed at finding out where oat milk is inferior to cow's milk and exploring novel technologies to make it a nutritionally adequate milk substitute. These technological propositions centre around; improving protein quality by increasing lysine content, lowering the glycogenic index by implementation of Isomaltooligosaccharides (IMOs), effectivization of cobalamin and riboflavin production, and increasing bioavailability of Ca^{2+} , Fe^{3+} , Mn^{2+} , K^+ and Zn^{2+} with phytases. Further, an analysis of how these technologies align with the branding ethos of 20 current oat-milk companies was conducted, to explore the extent to which implementation of these is realistic.

We confirm that oat-based milk does not have the same high nutritional value as cow's milk and demonstrate that a broad spectrum of technologies for potential nutritional optimisation of oat milk do exist. The developmental stage of these technologies is evidently a factor to be considered for potential future implementation. However, we show that the commercial significance of these technologies is also dependent on a company's willingness to implement them. While some companies show interest in supplementation with fortifiers, phytases and IMOs, hesitance prevails if these involve genetic engineering or contain supplements sourced from organisms of non-vegan origin. A reluctance that may stem from a branding ethos founded upon a general misconception about GMO and an uncompromising wish to be identified as a vegan product.

Acknowledgements: I would like to give a special thanks to my supervisor Associate Professor Andreas Blennow for patiently listening to my ideas, guiding me in the right direction and supporting me throughout the process of writing this thesis. I would also like to thank the oat-milk companies *Alpro*, *Califia farms*, *Earths Own*, *Innocent*, *Oatly*, *Silk Oat yeah* and especially *Naturli* for their kind cooperation, knowledge sharing and interest in the project.

O31 - Ecosystem Vulnerability Analysis and Population Dynamics Modelling of Gene Drive Releases for the case of *Drosophila suzukii*

Innovations in the food chain

Carina Roberta Lalyer¹

¹ BOKU

Abstract: Gene drive techniques are being developed in order to suppress populations or alter the organisms' properties. They are able to bypass the natural Mendelian law of heredity by increasing the chances of an allele to be inherited. Gene drives are supposed to be applied on wild populations and therefore represent a new stage in the release of genetically modified organisms.

To prospectively explore the impact of releasing gene drive organisms in wild populations, this study aims to identify the most important consequences at the ecosystem and species level. To assess this impact, the state of the science is reviewed and collated to develop a framework for an ecosystem vulnerability analysis. This analysis contains three main criteria: exposure, sensitivity and adaptive capacity. To prepare the basis for an event-based analysis of vulnerability, a hazard impact map for a suppression gene drive in *Drosophila suzukii*, an invasive fruit fly native to Southeast Asia, was created to visualize the spectrum of potential initial effects in an ecosystem. Finally, to further explore the case of *D. suzukii*, a stable population was modelled depending on temperature data of a native habitat of the fly in Japan. Moreover, a *Medea* gene drive was simulated in order to explore the invasiveness of the gene drive in the *D. suzukii*-population.

The work represents an early stage ecosystem vulnerability analysis for gene drives. It is concluded that there is a trend for high exposure potential at the different analyzed levels. Many knowledge gaps were already identified concerning the biology, ecology, and interactions of species but also uncertainties at the ecosystem level have been recognized that should be addressed in further investigations. According to the hazard impact map there is evidence for many potential cascading effects that have to be explored more in detail. According to the model results, the gene drive is efficient at spreading and the wild-type genotype is suppressed.

Acknowledgements: Dr. Bernd Giese, Dr. Johannes Friess

O32 - Optimizing Genomics Assisted Plant Breeding – Digibreed

Innovations in the food chain

Magdalena Ehn¹

¹ University of Natural Resources and Life Sciences Vienna

Abstract: Common bunt, a seed-borne disease caused by the fungi *Tilletia tritici* and *T. laevis*, seriously affects grain yield and quality in wheat (Cherewick, 1953; Gaudet & Puchalski, 1989). Heavily bunted wheat is neither suitable for further food processing nor for use as animal feed (Bailey et al., 2003). Systemic fungicides, which have become available during the last century, are very effective against common bunt, but are not allowed in organic agriculture. Genetic resistance against the disease is the most environmentally friendly, sustainable and, for organic farming, also the most efficient way of protection against common bunt (Matanguihan et al., 2010). Bunt resistant lines and cultivars exist, but the majority of highly resistant germplasm is not adapted for cultivation in Austria. Therefore, there is an urgent need to incorporate bunt resistance into regionally adapted cultivars. Since phenotypic selection for bunt resistance is in many cases difficult and always time consuming and laborious, other selection methods have been suggested (Singh et al., 2016). Marker-assisted selection has successfully been applied to introgress resistance alleles from relatives or landraces into elite breeding lines (Cobb et al., 2018). Unfortunately, unfavourable agronomic traits are often unintendedly incorporated into such newly generated resistant lines due to linkage drag. Therefore, genomic background selection for quantitative traits, particularly adaptation, productivity and quality, can be applied to enhance line performance (Bernardo, 2016). In this project, a breeding strategy will be explored and developed which combines genomics assisted selection and marker selection to rapidly introgress resistance alleles into a genetic background with superior performance in terms of yield and quality.

For this purpose, a large backcross-population has been established with lines harbouring common bunt resistance QTL (quantitative trait loci) derived from three exotic donor lines that were crossed to regionally well adapted cultivars or elite breeding lines. Starting with over 600 plants descending from 45 crosses, repeated rounds of selection and back-crossing or selfing will be applied. Plants which carry at least two bunt resistance genes detected using tightly linked SNP (single-nucleotide polymorphism) markers (foreground selection) and at the same time show superior genetic performance using genome-wide background markers in combination with established genomic estimated breeding values for performance and quality (background selection) will be selected. A dataset with phenotypic data from several thousand winter wheat breeding lines will serve as a training population for the statistical prediction model in order to identify the most promising genotypes with respect to yield and quality, and rapidly reach the performance of the most recent elite breeding lines. The set-up genomic-assisted backcross scheme will be optimized by an *in silico* simulation study, and the developed genotypes will be tested for common bunt resistance, yield and quality traits in replicated field trials at the end of the project.

Acknowledgements: Hermann Bürstmayr (supervisor)

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O33 - Microencapsulation of Camelina Sativa oil, using selected soluble fractions of dietary fiber as the wall material

Innovations in the food chain

Aleksandra Kanclerz¹

¹ Warsaw University of Life Sciences

Abstract: Justification: Study describes innovative method that is used in food production – microencapsulation of oil. This process allows to protect the oil from damaging factors that can occur during processing and storage. Thus, it helps to achieve effect strongly needed by contemporary food industry – to extend shelf life of a product without losing its health-promoting properties.

Keywords: microencapsulation, Camelina sativa oil, spray drying, dietary fiber, microcapsules.

Abstract:

The aim of the study was to prove usefulness of microencapsulation of *Camelina sativa* oil regarding to its vulnerability to oxidation caused by oxygen, temperature and other factors. Different kinds of polysaccharides were used as wall materials: pectin, inulin, gum Arabic and β -glucan, each of them mixed with maltodextrin. Their usefulness to reduce oxidation and to keep core material protected by external factors were examined. As a method to prepare microcapsules spray drying was chosen, which is most commonly used method, because of its high effectiveness and appropriate properties of final microcapsules. Results known from literature were confirmed by the research, that inulin and gum arabic are most proper wall materials, because they provide high efficiency of process and also ensure small oxidation increase during storage. Microcapsules with gum Arabic as wall material had peroxidase value 0.26 on day 1 and 4.52 on day 7 (values are given in oxidase equivalent/kg), while those with inulin had value 2.32 on day 1 and 5.92 on day 7. Due to the lack of available research in this field, β -glucan needs to be more investigated regarding to conditions of its usage to increase its effectivity. It is highly recommended to use β -glucan in microcapsules because of its high pro-health properties. Pectin turned out to be the least appropriate polysaccharide to be used as a wall material, because it is not able to assure sufficient protection for core material, in this case *Camelina sativa* oil. Peroxidase value of microcapsules prepared with pectin was 2.83 on day 1 and 16.11 on day 7, which is very significant growth. Use of polysaccharides in microencapsulation, except of performing role of wall material, has advantage of increasing amount of dietary fiber in human diet.

Acknowledgements: This work was supported by The National Centre for Research and Development project "Microencapsulation as the technique for increasing the application of beta-glucan in the food industry [LIDER/25/0022/L7/15/NCBR/2016]."

O38 - Suitable food for people with non-celiac gluten sensitivity

Innovations in the food chain

Ladislav Žatečka¹

¹ Czech University of Life Sciences Prague

Abstract: Non-celiac gluten sensitivity has recently become a frequently discussed topic among the scientist, and despite a number of studies, it is still unclear what is the exact cause and mechanism of its origin.

The aim of the study was to investigate the effect of consumption of gluten and easily fermentable carbohydrates on the intensity of negative symptoms, anthropometric parameters and blood pressure. This was investigated using an observational clinical study involving 9 volunteers. The study lasted 14 weeks and consisting of two phases. The first phase included a gluten-containing diet and a gluten-free diet, as well as double-blind exposure weeks and the second phase included a diet with a reduced amount of easily fermentable carbohydrates followed by an exposure test. The intensity of negative symptoms using a visual analogue scale, anthropometric parameters and blood pressure of all volunteers were regularly measured.

The results of this study showed that neither gluten nor easily fermentable carbohydrates had a significant effect on the intensity of negative symptoms in our volunteers. Although a positive effect on symptom intensity has been shown in the case of a gluten-free diet, this effect was not confirmed in a double-blind placebo challenge test. The results of the study also showed that there was no significant change in anthropometric parameters and blood pressure due to the consumption of a gluten-free diet and a diet with a low content of easily fermentable carbohydrates. According to our study, it appears that role of gluten and easily fermentable carbohydrates in non-celiac gluten sensitivity is overemphasized, however further studies are needed.

Keywords: Gluten, gluten-free diet, easily fermentable carbohydrates, visual analogue scale, anthropometric parameters

Subtheme: Innovation in the food chain

Justification:

The prevalence of celiac disease has been estimated to approximate 1 % of the world population and it is assumed that the prevalence of non-celiac gluten sensitivity is higher. Focus on the appropriate diet and consequently to develop innovative products for this population which can improve the nutritional value of their diet is therefore very important.

Acknowledgements: I would like to thank all the volunteers that participated in this study. My thanks also belong to my supervisor doctor Monika Sabolová and advisors doc. Ing. Lenka Kouřimská, Ph.D. and doctor Hoffman.

O39 - Microspore culture, embryogenesis and doubled haploid induction in *Brassica carinata* and *B. juncea*

Innovations in the food chain

Pavla Bryxová¹

Miroslav Klíma², Eloys Fernández Cusimamani¹

¹ Czech University of Agriculture, Kamycka 129, 165 21 Prague 6-Suchbát, Czech Republic

² Crop Research Institute (CRI), Drnovská 507, 161 00 Prague 6 – Ruzyně, Czech Republic

Abstract: Species from the family Brassicaceae are important sources of vegetables as well as edible or industrial oils, condiments and forage. Recently, most cultivated species and some of their wild relatives are highly valuable because of their anti-carcinogenic effect. They contain glucosinolates, which are the source of flavour, aroma and have anti-microbial, fungicidal and anti-bacterial effect, or could serve as natural bio-fumigants. Microspore culture technique is a tool for obtaining doubled haploid (DH) lines. Doubled haploids can be used in various studies as well as in breeding programmes. Microspore culture technique enables to obtain high frequency of microspore embryos in a wide spectrum of genotypes. As microspore regenerants are formed from haploid cells, artificial or spontaneous chromosome doubling is required. However, the frequency of spontaneous chromosome doubling is usually insufficient. Thus, the application of antimetabolic agent is required for most genotypes. In this study, microtubule depolymerising herbicide was used, because it proved to be efficient for *in vitro* chromosome doubling and the rate of its toxicity is lower than for the common antimetabolic agent – colchicine. The aims of this study were to evaluate the efficiency of the antimetabolic agent and to obtain doubled haploids in two tropical crops – *Brassica carinata* and *Brassica juncea*. Immature pollen grains were isolated from fertile plants and cultures were enriched with the herbicide amiprofos-methyl. Regenerants were cultivated in the greenhouse and its growth was observed. The ploidy level was assessed via flow cytometry. The effect of amiprofos-methyl on embryogenesis, regeneration ability and fertility of plants was evaluated. Optimized protocol of microspore culture technique was established and will be used in subsequent breeding programmes.

Key words: *microspore culture, Brassicaceae, antimetabolic agent, glucosinolates*

Acknowledgements: The research was financially supported by Internal Grant Agency of Faculty of Tropical AgriSciences and by projects of the Ministry of Agriculture of the Czech Republic – NAZV QK1910225 – „Implementation and use of complex biotechnological methods to characterize and create genetic resources and other materials for mustard food and forage purposes“ (2019-2023) and by institutional project MZE-RO0418 (2018-2022) of the CRI.

O40 - The effect of reformulation of bakery products on their quality

Innovations in the food chain

Lucie Svadbíková¹

¹ Czech University of Life Sciences Prague

Abstract: Salt is an integral part of our diets. It enhances flavour and has a positive effect on other sensory properties of food. However, according to WHO, we consume more salt than we ought to. High doses of sodium chloride have been linked to increased risks of developing cardiovascular illnesses. Therefore, food reformulation is an effective option of positively influencing the health-affecting properties of the food while conserving its sensory qualities. Focusing on baked goods could help improve a major part of our diet.

The aim of this study is to assess the differences in sensory quality of baked products containing different quantities of salt. In the experimental samples, the amount of sodium chloride was either reduced or partially substituted with potassium or calcium chlorides in varying amounts. Rheological characteristics of the dough were measured, as well as the size of the final products. Both the results showed alterations correlating with the composition of the products. Sensory analysis was conducted with both hedonic and intensity methods. The results showed that the sensory perception varies with sex, age and salt contents respectively.

Keywords: food reformulation, sensory quality, baked products, sodium intake

Acknowledgements: Many thanks to my supervisors Lenka Kouřimská, Božena Riljáková and Oldřich Faměra who contributed valuable insights regarding the analyses, and to Backaldrin for cooperation and provision of facilities.

O41 - Obesity induced fertility problems in human males: an overview of the effects on semen parameters, sperm DNA-integrity and reproductive hormones

Innovations in the food chain

Charlotte Born¹

¹ Wageningen University and Research

Abstract: BACKGROUND: Besides the well-known direct effects of obesity on health, obesity might also be associated with fertility problems in human males. While it is generally accepted that obesity affects fertility in females, this association is less certain for males. Nevertheless, the adverse effect of obesity on male fertility is gradually recognized. This review summarizes recent data on the impact of overweight/obesity on semen parameters, sperm DNA integrity and reproductive hormones.

METHODS: A systematic literature research was performed by searching the following search engines and online university libraries: Pubmed, Google Scholar, Web of Science, Wageningen University & Research's library and the University of Bergen's library in September and October 2018. The impact on semen parameters and reproductive hormones was analyzed with focus on male human evidence, whereas evidence from animal models for obesity was used to study leptin signaling onto kisspeptin and neuroptide-Y neurons.

RESULTS: In short, overweight and obesity may be contributing factors to poor semen quality, partly due to their effects on sperm DNA integrity. Epigenetic modifications may also explain the link between obesity and fertility problems. Furthermore, an increase in body weight is associated with a decrease in testosterone and sex hormone binding globulin levels and an increase in leptin and estradiol levels.

CONCLUSION: Obesity-related factors such as hyperleptinemia, changes in hormonal status and chronic inflammation may directly dysregulate male reproduction by deregulating the hypothalamic-pituitary-gonadal axis, ultimately affecting spermatogenesis, but may also indirectly induce epigenetic changes of specific genes involved in reproductive pathways. Future studies should include multiple adiposity markers, since studies showed stronger relations between body fat percentage and waist-to-height ratio with semen parameters, compared to BMI. More evidence is emerging confirming the negative impact of obesity on male reproductive function; however, more studies are still needed, especially on the impact of overweight/obesity on sperm parameters, since results between studies remain contradictory.

Keywords: obesity, infertility, semen parameters, leptin, kisspeptin

Justification for subtheme (Innovations in the food chain):

The rapid increase in the obesity incidence has made it one of the largest public health challenges of today. Besides undernutrition, overnutrition now also forms a threat to food security, since obese individuals often don't have access to nutritious foods. Innovations in the food chain could help by introducing more affordable nutritious foods and healthier alternatives. Ultimately, this could help prevent the severe health effects, including fertility problems, of obesity.

Acknowledgements: Katja Teerds poster

The future use of natural resources

P3 - The impact of the garbage dump and compost facility in Radiowo on animal populations in the Bemowo Forest

The future use of natural resources

Katarzyna Bagińska¹

Anna Karlak¹, Julia Kaźmierska¹, Katarzyna Wielgórska¹, Magdalena Rogoza¹

¹ SGGW - Warsaw University of Life Sciences

Abstract: The Bemowo Forest (BF) is located on the outskirts of Warsaw and partially sited in the buffer zone of Kampinos National Park (KNP). At the border with BF there are the large garbage dump and the compost facility – Radiowo. Various protected areas in BF, including two nature reserves and habitats of rare plant, mammal and birds species are located nearby. For species such as moose, the BF is too small as an area for the functioning of an independent population. Meadows and plantings near the garbage dump constitute an ecological corridor between BF and KNP, ensuring continuity of habitats. The aim of this study was to investigate the impact of the compost facility on animals in the BF area, especially the distribution and migration of mammals. Monitoring was carried out using methods, such as the use of camera traps on the animal migration paths, regular field inspections alongside marked transects, faeces collections and heavy metals concentration analysis. All traces of the animals presence were marked using GPS devices to create a map of their deployment. The faeces samples after drying were powdered and subjected to chemical analysis using atomic emission spectrometry (ICP-AES Thermo iCAP 6500 DUO) for the presence of heavy metals (Cd and Pb). The study results allow to undertake activities aimed at improving the BF protection and contributing to the minimization of damage caused by the neighbourhood garbage dump and compost facility, and thus improving the comfort of life not only of animals, but also of people. The possibility of heavy metals accumulating in organisms may be caused by pollution of the Bemowski Forest.

Justification:

Our project raises a problem that affects both humans and animals. Objects such as garbage dumps and composting facilities are a problem that practically all contemporary societies must face, regardless of socio-economic conditions. The location of this type of facility within the limits of the Bemowo Forest, which is part of the National Park's buffer zone, affects populations of wild animals and the state of the environment, thus reducing the natural and tourist values of the region. In addition, it adversely affects the health and comfort of life of both humans and animals.

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P20 - Bird communities at an offshore island of Abu Dhabi, Sir Bani Yas, UAE

The future use of natural resources

Bilal Kabeer¹

Sadaf Bilal¹, Sadia Abid¹, Abid Mehmood¹

¹ Czech University of Life Sciences, Prague

Abstract: Birds are recognized as one of the most important indicators of the state of the environment. Because they are sensitive to habitat change and they are easy to the census, changes in bird populations are often the first indication of environmental problems. Sir Bani Yas Island in the UAE (8700 ha; IBA criteria 2i & 4) is the important bird area and bird sanctuary as well as a wildlife reserve. There is now ample evidence of the ecological impacts of recent climate change, Infrastructure development; the responses of both flora and fauna span an array of ecosystems and organizational hierarchies, from the species to the community levels. Phenological responses are different across trophic levels, which may lead to birds failing to breed at the time of maximal food abundance. Bird community structure provides information about the interaction of avifauna with the environment, which includes health of the ecosystem, specific groups of birds are at high risk from climate change: migratory, mountain, island, wetland, Arctic, Antarctic, and seabirds. The current study is designed to monitor the bird diversity on an island, including, habitat utilization, breeding, migratory patterns, and time budgeting. Moreover, the effects of infrastructure development on the above-mentioned parameters will also be studied. The data will be collected through visual observations through binoculars and spotting scopes. Birds will be identified through standard field guides.

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P21 - Impact of conservation agriculture on soil fertility and cowpea's dinitrogen fixation in semi-arid Kenya

The future use of natural resources

Ferdinando Binacchi¹

¹ Hohenheim University

Abstract: Providing farmers with access to improved technologies and know how's, is an important component of conservation agriculture (CA) in Kenya. A lack of research on grain legume atmospheric dinitrogen fixation response to no-till practices was identified and investigated upon. The study was performed at the Kiboko research station, located in semi-arid eastern Kenya on research field trails which had been running for 7 seasons by the time the sampling took place during the long rains of 2017. The experimental set up was a randomized complete block design with a split-split-split design, main plots being tillage system (no till with maize stover applied at 5 Mg ha (CA) and conventional tillage (CT) to 15 cm depth without mulch), sub plot being cropping system (maize-cowpea intercrop, maize monocrop and cowpea monocrop) and sub-sub plot maize variety. The natural abundance method was used to assess ¹⁵N and ¹³C partitioning among above and below ground maize and cowpea plant parts, at flowering and harvest stages. Soil mineral nitrogen was more abundant in the top soil decreasing to subsoil (0-5 cm depth > 5-15 > 15-30 > 30-50) although only significant when comparing NH₄⁺ content in CA intercrop to CT monocrop cowpea in the top 15 cm. Total soil C and N was not significant among CA and CT treatments across depths which could be attributed to the limited capacity of sandy soils to accumulate OM. Number of nodules per plant was higher in CA treatments rather than CT (p<0.05). At flowering stage, ¹⁵N abundance varied between plant parts, with roots and nodules found to be enriched compared to shoots although litterfall also reported higher than shoot values. At harvest ¹⁵N values were consistently lower than at flowering as well as the reference plant reporting lower ¹⁵N at the second harvest compared to the first. No significant differences were found among whole plant weighted means (between 1.5 and 2.4 at flowering stage and between 0.9 and 2.1 at harvest stage). When comparing cowpea's ¹⁵N values to the reference maize, percentage of N derived from fixation (%Nd_{fa}) resulted in being between 56.5 % and 68.8 % at flowering stage and between 44.8 % and 63.6 % at harvest stage. Cowpea in intercrops yielded between 472 and 590 kg ha of grain while in monocrops the seed yield was between 1464 and 1618 kg ha. This meant that intercrops derived between 17.8 and 22.8 kg ha of their total N from atmospheric dinitrogen fixation while monocrops between 54.9 and 55.2 kg ha. Between 200 and 400 kg ha of litterfall were recorded in intercrops while between 1000 and 1200 kg ha⁻¹ in monocrops. Belowground dry weight accumulation was between 7 and 9% of total plant's biomass. ¹³C data revealed no differences in water stress between CA and CT but the effect was clear (p<0.001) between monocrop and intercrop cowpea suggesting δ¹³C higher cowpea water stress in intercropped plots. δ¹⁵N ha⁻¹.

P22 - Building resilient livelihoods towards biotic and abiotic disturbance factors in Bhutan: a community-based adaptation to global change

The future use of natural resources

Gargi Tariyal¹

Gargi Tariyal¹, George Gratzer¹, Andras Darabant¹

¹ University of Natural Resources and Life Sciences, Vienna

Abstract: Climate change has threatened agricultural production and food security, which is one of the biggest challenges of the 21st century. A shift from subsistence to cash crops farming is an ongoing trend in Bhutan, which exposes it to higher climate change prone risks. The rapid expansion along with intensive cultivation raises concerns about low resilience of agricultural landscapes against vulnerabilities to climate change in southern Bhutan. The aim of this study is to analyse agricultural decisions and choices made by farmers to adopt resilient practices. The study site is situated in the remote village of Pungshi in south-central Bhutan. The field work included a variety of qualitative place-based research methods, such as semi-structured questionnaire, group discussions with user-groups and transect walks with extension officers. Thus, perspectives on choice of crops and agricultural decision made by the farmers were recorded. The potentials for increasing individual farm resilience was explored through the use of participatory research methods. The data will be analysed to better understand the awareness among farmers. The results will help the farmers to adopt resilient measures to become economically independent in case of an ecological risk outbreaks, which appear in terms of pests and diseases, that might affect the farmlands and result in crop failures in Bhutan, like it has happened only a decade ago.

Keywords: Climate Change, Bhutan, Agroforestry, Resilience

P23 - Assessment of soil pollutants (pesticides and microplastics) in agricultural soils of Groningen, the Netherlands

The future use of natural resources

Zhaoqi Bin¹

¹ Wageningen University

Abstract: In this study, the distribution of 36 pesticide residues and the amount of microplastics were evaluated in 39 agricultural topsoil samples from 12 farms in Groningen, the Netherlands. Liquid Chromatography-Mass Spectrometry (LC-MS) and Gas Chromatography-Mass Spectrometry (GC-MS) method were used to qualify and quantify pesticide residues in soil samples. A flotation method was used in the determination of microplastics. The samples were collected in April 2018 just before the new pesticide application season. In the results, microplastics were found in 8 soil samples in 6 farms. All soil samples were detected pesticide. Many unapplied pesticides had been detected in soil samples. Prosulfocarb with mean value $4.029 \pm 0.477 \mu\text{g kg}^{-1}$, glyphosate with mean value $183.964 \pm 366.327 \mu\text{g kg}^{-1}$, its metabolite aminomethylphosphonic acid (AMPA) with mean value $89.742 \pm 136.021 \mu\text{g kg}^{-1}$, and DDTs (DDT and its metabolites) with mean value $7.660 \pm 11.890 \mu\text{g kg}^{-1}$, were the compounds most frequently found in soil samples. The maximum total pesticide concentration assessed in a soil sample was $1702.92 \mu\text{g kg}^{-1}$ with dominant pesticides in glyphosate (67%) and AMPA (25%). In this sample, other pesticide compounds (bixafen, boscalid, chloridazon, DDTs, fluopicolide, metamitron, pendimethalin, prosulfocarb, prothioconazole, and tebuconazole) only occupy 8% of the total pesticide concentration. Such a large amount of pesticide residue in the soil, with predominance in glyphosate and AMPA, would have negative effects on human health. The total pesticide content in biological farms is significantly lower than those in conventional farms ($p < 0.05$). The total pesticides concentration was weakly correlated with soil properties, while strong negative correlations were found with the percentage of coarse sand and the number of pesticides detected per sample ($r_2 = -0.459$, $p < 0.01$). The amount of microplastics has a positive correlation with the amount of bixafen residue ($r_2 = 0.640$, $p < 0.01$). The amount of microplastics has a weak correlation with the total pesticide concentration per soil sample. Further studies are required as a monitoring plan for understanding the state of pesticide residue concentration and microplastics in the agricultural soils of Groningen.

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P24 - The effect of deacetylation on chitin nanocrystals for the production of chitin-PLA nanocomposites

The future use of natural resources

Kieke De Boer¹

¹ Wageningen University & Research

Abstract: Currently, most food packages are made of petrochemical based plastic. The environmental concern results in increasingly more attention for bioplastics, which are produced from natural constituents and are compostable. Among them, polylactic acid (PLA) is one of the most promising biopolymers due to its excellent environmental footprint, and similar optical properties and process ability compared to currently used plastics. Unfortunately, the commercial applications are limited as PLA is very brittle, and has moderate barrier properties.

These properties can be improved by creating a nanocomposite, consisting of PLA and chitin nanocrystals. Chitin is a biodegradable, non-toxic, and abundant polymer. Since chitin has antimicrobial and antifungal functionalities, it could be of special interest to the food packaging industry. Despite chitins attractive properties, relatively little is known about the reinforcing effect of chitin nanocrystals in a chitin-PLA nanocomposite. This project focused on the effect of deacetylation on the properties of chitin nanocrystals.

Chitin nanocrystals were produced through acid hydrolysis of shrimp chitin powder. Deacetylation of the nanocrystals was performed under varying conditions: time, temperature, alkali concentration, heating method (heating plate or sonication bath), and crystal state (wet or dried). In addition, a cheap and user friendly UV absorbance method was improved to determine the degree of acetylation. This method was corrected for the formation of by-product and showed to be accurate for chitin and chitin nanocrystals. Deacetylation of the chitin nanoparticles was confirmed with this newly developed UV method and with an increased zeta potential. During deacetylation, the shape of the nanoparticles remained intact, indicating it was possible to modify the chitin nanocrystals without destroying them.

Incorporation of chitin nanocrystals, with various degrees of acetylation, in a chitin-PLA nanocomposite will provide insight in the compatibility between chitin nanocrystals and PLA, and in the effect of deacetylation on nanocomposite properties.

Keywords: Chitin; Nanocrystals; Deacetylation; UV method; Nanocomposites.

Justification subtheme

The future use of natural resources, replacements for fossil fuel based products.

Nanocomposites are multiphase materials that consists of a polymer matrix reinforced with nano-sized (in)organic fillers. The suggested nanocomposite is produced with chitin nanocrystals, obtained from crustacean waste, and a polylactic acid (PLA) matrix, produced by fermenting agricultural materials. Due to the mechanical properties, barrier properties, but foremost the biodegradability of this nanocomposite, it will be able to replace the currently used nonrenewable plastics in the food packaging industry. **Acknowledgements:** Ivanna Colijn (Msc)

Karin Schroën (Prof.)

P25 - Antimicrobial activity of essential oil-bearing plants against microorganisms causing spoilage of agricultural products in vapor phase

The future use of natural resources

Ingrid Faltová¹

¹ Czech University of Life Sciences

Abstract: Diseases caused by plant pathogens lead to significant postharvest losses to most perishable food crops. Plant diseases are currently controlled with fungicides, however, reliance on this single control strategy leads to problems such as environmental pollution and resistance to fungicides. Therefore there is an increasing pressure to find more natural methods of disease control. One of the prospective methods could be the use of essential oil (EO) vapors by fumigation [1]. EOs from aromatic plants have previously demonstrated antimicrobial and antifungal activity against the number of plant pathogens. Despite the great antimicrobial potential EOs, the growth-inhibitory effects of their vapors have poorly been investigated against microorganisms causing spoilage of agriculture products [1].

In this study, we determined the antimicrobial activity of EOs in liquid and vapor phase against significant plant pathogens (*Pseudomonas* spp., and *Pectobacterium* spp.) using broth microdilution volatilization method [2, 3]. EOs of five plants namely *Thymus vulgaris*, *Cinnamomum zeylanicum*, *Syzygium aromaticum*, *Allium sativum*, and *Citrus sinensis* were obtained from dried plant material using hydrodistillation. Subsequently, minimum inhibitory concentrations (MICs) were determined [3]. The result showed that the *T. vulgaris* EO produced the highest antimicrobial activity against *Pseudomonas fluorescens*, *Pectobacterium atrosepticum*, and *Pectobacterium carotovorum* with MICs ranging from 256 µg/mL to 512 µg/mL in liquid phase and 256 µg/mL to 1024 µg/mL in vapor phase. In conclusion, the above-mentioned EOs could be used for the development of new products for control of pathogenic microorganisms causing spoilage of agricultural products e.g. in form of controlled atmosphere or fumigation.

keywords: essential oils, antimicrobial activity, broth microdilution method, fumigation

Acknowledgements: prof. Ing. Ladislav Kokoška, Ph.D. (supervisor)

Ing. Markéta Houdková, Ph.D. (consultant)

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P26 - Influence of APAP on physiological characteristics of lettuce.

The future use of natural resources

Jiří Kudrna¹

František Hnilička¹, Jan Kubeš¹, Pavla Vachová¹, Helena Hniličková¹

¹ Czech University of Life Sciences Prague

Abstract: Many pharmaceuticals such as paracetamol (N-acetyl-p-aminophenol) (APAP) enters wastewater, landfills and sewage sludge. Sewage sludge can be used as agricultural fertilizer. Facing the real contamination of the environment, the objective of the work on how APAP affects the cultivated plants was determined. Plants in contact with xenobiotics (in this case APAP) must involve a system of defense mechanisms leading to detoxification. The stress response in plants has a number of mechanisms of action and many physiological characteristics can be affected. Parameters of photosynthesis and fluorescence were monitored. These parameters were chosen as a direct indicator of the effect of stress on the plant homeostasis. The model plant was lettuce (*Lactuca sativa* L.). The experiment was performed in a greenhouse with controlled temperature (25 ° / 19 ° C) and light mode (16/8). APAP was supplied in pure form by irrigation at concentrations of 5µM, 50µM, 500µM, 5mM, in the acute (1x application) and chronic (regular application) variants. Photosynthesis values were measured through gasometric methods using infrared radiation by LCpro + SD gas analyzer (µmol CO₂ .cm⁻².s⁻¹) and fluorescence by OSPi FL (Fv / Fm) via pulse fluorescence emission. It was found that with a higher concentration of APAP, the Fv/Fm ratio of the observed plants decreased. After 336 hours after APAP application, the fluorescence values in the control plants (chronic / acute) were 0.822 / 0.822, at the concentration of 5µM 0.745 / 0.755 and at 5mM 0.674 / 0.714. Acute contamination photosynthesis rates were 6.64 for control plants, 6.61 for 5µM, and photosynthesis was 4.54 for 5mM. For chronic contamination 6.64 (control), 4.9 (5µM) and 4.67 (5mM). The results show that with increasing concentration of APAP there is a higher influence on monitored physiological parameters of experimental plants.

P37 - Utilizing heathland topsoil: Logistic implications for the Dutch province Gelderland

The future use of natural resources

Charlotte Conradie¹

¹ Wageningen University and Research

Abstract: Heathlands are habitats of high cultural and natural value with the Netherlands playing an important role in heathlands conservation. The management of heathlands, however, is cost intensive. Valorizing by-products bears the potential to partly outbalance those costs. One by-product is topsoil, that is produced during the removal of the top-layer. Heathland topsoil is rich in carbon but low in nitrogen making it an interesting fertilizer for areas suffering from nitrogen surplus. The province of Gelderland has the largest heathland territory in the Netherlands. If all heathland areas in Gelderland would be managed by sod-cutting, a maximum quantity of 26,000 tons of heathlands topsoil could become available in one year. In this thesis the utilization of heathlands topsoil in a circular agriculture is approached from an operational research perspective. A model was developed to get insight in important cost drivers during the disposal of the topsoil. Furthermore, several scenarios were developed how the utilization could be improved. Important performance indicators are disposal costs and transport distance but also the quality of the usage was considered.

It was concluded that applying the topsoil on local farmland should be the preferred option, thereby contributing to the food production in the Netherlands. Currently, topsoil not accepted by farmers within a one kilometer radius needs to be disposed at composting facilities, which are often widely distant from the heathlands. Increasing the legally permitted distance to apply heathland topsoil on farmland from one to five kilometers could decrease the costs of disposal by €375,000 and the total transport distance by more than 4,000 kilometers. Tree nurseries are a promising potential second choice if they were willing to pay a threshold price of €2.50 to cover additional costs for sieving the material. Only when no other option is available should the by-product be disposed at composting facilities.

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P46 - Carbon ecosystem - atmosphere exchange in arctic tundra in response to environmental changes

The future use of natural resources

Joseph Gaudard¹

Emily Pickering Pedersen¹

¹ University of Copenhagen

Abstract: The arctic is one of the regions of the world that is most impacted by climate change. One of the expected effects is a shift in the precipitation regime, which might affect the carbon cycle. If the summer precipitation increases, the tundra could emit more methane (CH₄) and carbon dioxide (CO₂), and therefore lead to a positive climate feedback. In the same way, higher temperatures could increase the availability of phosphorus (P) in the soil (arctic ecosystems are generally P limited), possibly enhancing plant growth or changing plant species composition.

The aim of this study was to find out how the carbon cycle in the arctic tundra is affected by a higher precipitation regime and increased phosphorus availability. A set of 24 homogeneous plots were selected in the tundra near the Arctic Station, Disko Island (Greenland). The experiment was designed with 6 blocks of 4 plots each. Treatments included P addition (2.5g/sqm, 4 times), water addition (equivalent of 8mm of rain per week), the combination of P and water addition, and control in a full factorial design. Carbon fluxes (CO₂ and CH₄) were measured weekly using a closed loop chamber system with a Picarro-62201-i Analyser. Net ecosystem exchange was measured using a transparent chamber and ecosystem respiration was measured by covering the chamber with a black cloth. Measurements were conducted during the whole growing season (from end of June till beginning of September).

After one season of treatment and measurement, it was found that the phosphorus treatment increased both CH₄ and C turnover. Due to a very rainy season the effects of the water treatment were not clear, but it generally seems that this ecosystem is a carbon source. This experiment is meant to be continued, as one year of treatment is not enough for the long term effects to be seen.

Acknowledgements: This work was supervised by Prof Anders Michelsen

P47 - Effect of Pyrolysis on the Fluctuation of Element Contents in Sewage Sludge

The future use of natural resources

Marcela Ulloa Murillo¹

¹ Czech University of Life Sciences Prague

Abstract: In this study, there were tested the combined effects of three pyrolytic temperatures (600°C, 700°C, and 800°C) and two temperature increment rates (Fast and Slow) on the pyrolysis of sewage sludge coming from two Wastewater treatment plants of Czech Republic. The sewage sludge derived biochar (SDBC) was analyzed in terms of the total and available content of selected elements.

This investigation demonstrates that the pyrolytic temperature and the temperature increment rate can greatly affect both the total and available concentration of all three groups of elements analyzed: Toxic elements (As, Cd, Cr, Pb), Macronutrients (Ca, K, Mg, P, S), and Micronutrients (Cu, Fe, Mn, Mo, Ni, Zn). The total concentration of toxic elements showed mostly low variation relating to the temperatures and temperature increment rate for both sludges. An exception was Pb that showed greater variation among the treatments from its original raw sludge value, related to pyrolytic temperature. Cadmium was observed for fast pyrolysis at 600 °C only, after 700 °C, the values were below detection limit - BDL (<0,17 mg/kg),. This result was expected because Cd can volatilize at 700 °C. Total content of macronutrients in SDBC increased with the rising temperature compared with the content in the feedstock, availability for macronutrients in SDBC from sludge 1 registered the highest availability portions for Ca, K and Mg; Sludge 2 presented a different behaviour, Ca and Mg availability decreased with the increasing temperature, K remained approximately constant. At both temperature increment rates, macronutrients were enriched in the SDBC. Total and available content of micronutrients in both sludges showed different behaviour depending on the rate. The use of a fast rate in SDBC from sludge 1 caused an increase of concentration with temperature when slow rate was used no general trend could be associated with it. Pyrolysis substantially increased the stability of sludge and its applicability.

Acknowledgements: Ing. Pavel Tlustoš, CSc and Ing. Filip Mercl

P48 - Developing Interventions to Prevent Land Degradation Issue with Soil and Water Conservation Measures in Hadocha Catchment of Fincha'a Watershed

The future use of natural resources

Shassy Endah Cahyani¹

Johan de Groot¹

¹ Wageningen University and Research

Abstract: Despite its benefit for water and energy security in Ethiopia, the hydropower reservoir in Fincha'a watershed has caused significant land degradation. The reservoir inundated several areas surrounding Fincha'a in which caused major land use changes, especially in agriculture. Croplands were relocated in steep slopes area. As a result, soil erosion occurs along with depletion of nutrients from arable land. Hence, suitable soil and water conservation (SWC) measures should be implemented to reduce the future adverse impact of unsustainable farming practice. Hadocha sub-catchment of Fincha'a watershed has been selected as a geographical boundary in this study. The study has the purpose of analysing the possibilities to reduce erosion rates by 50% in Hadocha with scenarios of SWC measures. Several SWC scenarios were developed as a prediction for erosion from the hydrologic model includes surface runoff, detachment rate and transport capacity. Scenarios were based on a variety of vegetation and SWC measures. The variation cause changes in rainfall interception, effective hydrological depth, crop cover factor, and evapotranspiration ratio as input for Morgan, Morgan, and Finney model (MMF). The model was used to process different input of every scenario in a raster map. Model outputs were analysed using multicriteria analysis to choose the best SWC method in terms of investment cost, fodder production, food production, and erosion reduction. The study demonstrates that trade-off between agricultural production and erosion is inevitable. The best scenario based on different farmer interest and priority. Nevertheless, being focus on adoption rate is the best option to develop regardless of the scenario that will be implemented.

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P50 - Utilization of activators of organic matter biological transformation in terms of their impact on soil physical properties and related crop growth

The future use of natural resources

Václav Novák¹

Kateřina Křížová¹

¹ Czech University of Life Sciences Prague

Abstract: In recent decades, many significant changes in Czech agricultural practice may be observed. One of the staple ones is the decline in a livestock production that finally results in a decreasing amount of manure produced. Since manure is one of the staple natural substances that supply the soil with organic matter, this phenomenon has become a serious issue in terms of soil properties. Soil erosion, compaction, the loss of organic carbon seriously impact the soil environment. Therefore, this study deals with the issue of organic fertilizers and activators of biological transformation respectively. PRP SOL (PRP Technologies, France), as a soil activator, is investigated independently or in a combination with the manure treated by Z'Fix (PRP Technologies, France). The effect on physical soil properties has been investigated. Experimental plots have been established in 2017. Penetration resistance has been measured using the penetrometer PEN 70 (CULS, Prague). Kopecky cylinders have been used for undisturbed soil samples. Implement draft has been measured using the tensometric dynamometer with a strain gauge S-38/200 kN / (LUKAS, Czech Republic). Since the effects of these activators have not been sufficiently investigated yet, the main aim of this study is to bring complex information about the nature of activators' impact on soil properties and a related crop growth. Vegetation properties, such as biomass content or water status, are about to be assessed using selected spectral indices derived from free Sentinel-2 satellite imagery.

Acknowledgements: Authors would like to thank Petr Šařec and Oldřich Látal for their helpful advice.

P51 - Carbon sequestration with woodchip mulch in organic farming

The future use of natural resources

Jeffrey Thimm¹

¹ University of Hohenheim

Abstract: Keywords: hedgerows, SOC

Modern agricultural trends have seen increasing field sizes decrease the prevalence of hedgerows despite the numerous ecosystem services they provide. Hedgerows are therefore promoted through EU environmental legislation, but resultant woody biomass from pruning is often considered waste despite benefits associated with its use in both urban and rural contexts as mulch. With added pressure on the agricultural sector to reduce greenhouse gas (GHG) emissions and contribute to climate change mitigation, the opportunity to sequester carbon through biomass growth is gaining popularity. If leveraged, agriculture could even be carbon negative, with soils serving as long-term carbon sinks. To be adequately supported, such efforts require accurate accounting of soil organic carbon (SOC), a primary indicator for soil health, and the sequestration potential of techniques like hedgerow woodchip mulching needs to be properly assessed.

This research builds upon a 16 year field trial testing the efficacy of hedgerow derived woodchip mulch at rates of zero, 80 and 160 m³ ha⁻¹ for weed control, with consideration for yield, in a grain-based organic farming rotation in Southwest Germany. By measuring the total organic carbon and nitrogen, as well as bulk density, in both topsoil and subsoil (in 5 gradients from 0-90cm), SOC can be monitored and the carbon sequestration ability of woodchip mulch can be determined. It is expected that analysis of soil samples from the field trial will show increased SOC content in plots with greater amounts of woodchip mulch applications. While the majority of SOC should be found in the topsoil, it is also hypothesized that SOC will increase in the subsoil below tillage depths due to biological incorporation. Based on these findings, hedgerows and woodchip mulch could be incorporated into climate smart agriculture strategies and contribute to reducing the carbon footprint of food systems.

Acknowledgements: Dr. Sabine Zikeli

P52 - Efficacy of XenTari® (*Bacillus thuringiensis* var. *aizawai*) against larvae of the gypsy moth, *Lymantria dispar* L.

The future use of natural resources

Bernhard Traxler¹

Christa Schafellner¹

¹ Institute of Forest Entomology, Forest Pathology and Forest Protection, Department of Forest and Soil Sciences, University of Natural Resources and Life Sciences, Vienna.

Abstract: Justification: Mass outbreaks of the gypsy moth cause significant defoliation in oak forests and adjacent areas such as vineyards or fruit tree plantations. In Austria, pesticide use in forest land is tightly regulated and aerial spraying is totally prohibited. Therefore, the effectiveness of the soil-borne, entomopathogenic bacterium *Bacillus thuringiensis* (Bt) subspecies *aizawai* was tested as a reasonable alternative to chemical insecticides with low impact on non-target organisms in order to preserve the biodiversity of forest ecosystems.

Keywords: insect biocontrol, XenTari®, *Bacillus thuringiensis*, *Lymantria dispar*

XenTari® is a selective biological insecticide used against free feeding butterfly and moth larvae for the protection of crop, vegetable, fruit and ornamental plants. The product is based on spores and toxins of the bacterium *Bacillus thuringiensis* subsp. *aizawai*. Upon feeding leaves treated with the product, the Bt toxins perforate the caterpillar's gut, enabling the bacteria to multiply throughout the entire body, leading to the death of the insect within approximately two days.

In this study, we tested different dosages of XenTari® on third (L3) and fourth instar (L4) larvae of the gypsy moth, *Lymantria dispar*, a serious pest insect of deciduous trees. The larvae were kept individually in Petri dishes at constant 24°C under long-day conditions in a climate chamber and fed wheat germ diet *ad libitum*. We recorded mortality/survival at least for 8 days post Bt ingestion. Furthermore, we investigated effects of Bt infection on the insect's immune response by determining the activity of two enzymes in the hemolymph which are part of the humoral immune defenses and show strong anti-microbial activity upon pathogen infection.

Ingesting 2.5 µg or more of the Bt product caused 100% mortality within 1-3 days in all larvae. When the larvae had survived day 4 post Bt ingestion, we did not observe any further mortality; the surviving larvae developed into perfect pupae and adult moths. In L3 larvae, 50% and 90% mortality occurred when the larvae consumed 0.500 µg and 0.875 µg, respectively. In L4 larvae, 50% and 95% mortality was observed when the larvae consumed 0.375 µg and 0.875 µg. These results indicate that dosages causing either 50% or 95% mortality are rather close for both instars.

P53 - Climate Change Adaptation and Adequate Mitigation Policies for Smallholder Farmers in Bangladesh

The future use of natural resources

Rasha Binte Mohiuddin¹

¹ University of Hohenheim

Abstract:

After decades of suffering, a huge number of fatalities, losses of crops and live stocks, climate change adaptation, and mitigation policies in the agriculture sector are back on the development agenda in Bangladesh. According to Climate change Index (2019), Bangladesh ranked 7 among disaster-affected countries and 13 million people are expected to be displaced by 2050. A huge number of smallholder farmers already gave up their profession and migrated to another city which creating a huge labor crisis in the agriculture sector. This paper analyses the climate change adaptation efforts in smallholder-based farming system and the governance challenges involved in Bangladesh. This research is based on both primary and secondary data using qualitative research method; expert-interviews. Interviews were conducted with the experts of different stakeholders' group e.g. ministries, government, and non-governmental organizations. A local subset stakeholder was also interviewed with the smallholder farmers group from a low-lying coastal belt area of Barisal in Bangladesh. The result shows that climate change adaptation and mitigation policies for the poor and marginal farmers are still coming from top-down. There is not any climate insurance; seed bank or shelter houses for their live stocks, agricultural mechanizations are urgently needed. Finding reveals that the effectiveness and success of agricultural adaptation due to climate change also depends on the early weather forecasting and a sustainable water management system. The need for strengthening the capacity of ministries identified as a priority. Networking, communication and coordination gap between different implementing organizations are leading delay and repetition of knowledge generation. Research suggests that strengthening the capacity of institutions by experienced and expert leaders will be more efficient to speed up the processes. Research needed to explore more adaptation options to reduce the climatic migration of poor smallholder farmers to generate income in the offseason.

Keywords: Climate change adaptation · agriculture · smallholder farmers · policy · Bangladesh

Thesis work in partial fulfillment of the requirement for the degree of Master of Science in Environmental Protection and Agricultural Food Production at the University of Hohenheim

¹ Production Theory and Resource Economics, Institute of Farm Management, University of Hohenheim, 70599 Stuttgart, Germany.

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Finally, I would like to express my appreciation to everybody else who has contributed directly or indirectly to this Master Thesis.

P59 - Sustainable reliance on community forests after the earthquake of Nepal in 2015

The future use of natural resources

Cecilia Fraccaroli¹

¹ University of Copenhagen

Abstract: Natural disasters and their unpredictability present a risk for humans, especially to the ones living in a rural context. In such contexts, the lack of technical experience implies less preparation and higher damages to the territory and to the people. Where people rely on the forest to get livelihoods and find a way out of poverty, it is relevant to study the role of the forest as safety net after natural disasters. This can contribute to reducing the exposure to certain threats and losses. Considering the earthquake that hit Nepal in 2015, this study aims to examine the changes in wood products use by rural people while responding to the shock. Five community managed forests located close to the epicentre, at Barpak, have been studied. A forest inventory of 48 permanent sample plots was carried out on the basis of the previous measurement done in 2015/16 by the Department of Food and Resource Economics (IFRO) of Copenhagen University and Institute of Forestry (IOF) of Tribhuvan University in Nepal. The data from 2019 have been compared with the ones collected just after the earthquake in order to examine the forest growth, wood product extraction, and its sustainability. Moreover, household survey (n=58) were conducted to understand household-level income and adaptation strategies. The changes in assets owned by the people during the recovery process analysed using the sustainable livelihoods framework of F. Ellis. In the study was found that timber consumption differs community by community according to the management strategies implemented after the EQ. However, the extraction of wood did not exceed the growth of the forest determining sustainable forest management. Moreover, on a household level, the families have applied different strategies, diversifying their activities.

Acknowledgements: Prof. Henrik Meilby

P62 - Which diet has the least environmental impact on our planet? A systematic Review on comparison of a vegan, vegetarian and omnivorous diets

The future use of natural resources

Johannes Reidar van der Voort¹

Kristina Grofelnik¹, Bingli Clark Chai¹, Helga Gudny Eliasdottir¹, Ines Klöss¹

¹ University of Copenhagen

Abstract: Justification: This systematic review associates data about use of natural resources with most common diets in the world today. This knowledge is essential for future regulations of food systems and dietary guidelines, and therefore sustainability of both. It represents a necessary step forward in science by incorporating and interpreting collected systematic data in an understandable and simple way.

The food that we consume has a large impact on our environment. The impact varies a lot between different diets. The aim of this systematic review is to compare three mainstream diets: the vegan, vegetarian and omnivorous diet, and figure out which one has the least environmental impact on our planet. This article addresses the question: *Which diet has the least environmental impact on our planet? A comparison of a vegan, vegetarian and omnivorous diet.* This systematic review is based on 22 studies and 19 reviews. The durations of the studies ranged from 7 days to 27 years. Most of the studies were carried out in the US or Europe. The included studies were selected by focusing directly on environmental impacts of human diets. Four electronic bibliographic databases, PubMed, Medline, Scopus and Web of Science were used to conduct a systematic literature search based on fixed inclusion and exclusion criteria. The result suggests that the vegan diet is the optimal diet for the environment because it results in the least GHG emissions out of all the other diets compared. Additionally, there is a possibility of achieving the same environmental impact as vegan diet has, but without excluding meat and dairy as food groups.

Keywords: Sustainable; diet; GHG; LCA; systematic review

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P72 - The Interactions between Oat Bran and Blackcurrant/Blueberry: Effects on Glycaemic Properties and Antioxidant Activities

The future use of natural resources

Xiaodan Hui¹

¹ Lincoln University

Abstract: Background: A diet with high glycaemic index can lead to increased risk for type 2 diabetes. Researches have demonstrated that bioactive compounds such as polyphenols have strong antioxidant and certain hypoglycaemic properties. Increasing the intake of bioactive components may be an effective way to stabilize the blood glucose. Blackcurrant and blueberry are rich sources of polyphenols. Previous studies have been performed on pure components but may not reflect a realistic situation since functionality of foods is highly influenced by the interactions between food components.

Methods: In this study, a simple oat paste product was developed and used to investigate the effect of the interactions between oat bran and phenolic compounds on the viscosity and physico-chemical characteristics as well as their antioxidant activities. We also compared how the additional and replacement levels (10, 15 and 25%) of berry phenolic compounds affected the predictive glycaemic values of such products *in vitro* digestion and in cell cultures.

Results: Increasing the replacement 10 and 15% proportion of blackcurrant and blueberry in oat pastes resulted in a ($P < 0.05$) decrease in glucose release after *in vitro* digestion, while the additional proportion and replacement of 25% of berries increased the glucose release compared to the control. In addition, incorporation of blackcurrant and blueberry in oat pastes increased the antioxidant capacity significantly ($P < 0.01$). Oat pastes with a specific proportion have the potential nutritional value and can reduce the glycaemic index of such pastes.

Acknowledgements: Charles Brennan¹, Margaret Brennan¹, Shuze Tang², Xiyang Wu², Jinbo Wei³

1 Department of Wine, Food & Molecular Bioscience, Lincoln University, New Zealand

2 Institute of Food Safety and Nutrition, Jinan University, Guangzhou, Guangdong, China

3Guangdong Zhongke Enhealth Science and Technology Co., Ltd, Foshan, Guangdong, China

P73 - Evaluating the potential ecotoxicity of different nitrification inhibitors using terrestrial and aquatic test organisms

The future use of natural resources

Julia Kössler¹

Olga Calvo¹, Jürgen Franzaring¹, Andreas Fangmeier¹

¹ Hohenheim

Abstract: The increasing demand for food and animal fodder worldwide has led to an intensified agriculture with an increasing use of nitrogen fertilizers. More recently, nitrate leaching and gaseous nitrogen emissions have become the focus of environmental issues and climate politics. One approach to reduce such negative impacts is the use of nitrification inhibitors (NIs) that have shown to effectively reduce nitrogen losses to the groundwater and the air. However, ecotoxic effects of NIs have been studied to a limited extent only. Therefore, two commercial NIs (Piadin and Vizura) and the active ingredient dicyandiamide (DCD) were subjected to various ecotoxicological tests: the *Lemna* Growth Inhibition Test (*Lemna gibba*), the Seed Germination/Root Elongation Toxicity Test (*Agrostemma githago*, *Fagopyrum esculentum*, *Glycine max*, *Hordeum vulgare*, *Lunaria annua*, *Zea mays*), the Seedling Emergence and Seedling Growth Test (*A. githago*, *F. esculentum*, *Z. mays*) and the Luminescent Bacteria Test (*Aliivibrio fischeri*).

DCD did not show ecotoxic effects in any test conducted. Piadin and Vizura showed ecotoxic effects throughout all experiments. Frond number and frond area of *L. gibba* were inhibited with increasing concentrations of both substances with Piadin leading to an earlier inhibition and therefore lower EC₅₀ values. In the Seed Germination Test, Vizura generally inhibited seed germination and root development more effectively than Piadin. Regarding both substances, the endpoint root length was much more sensitive than the endpoint germination. In the Seedling Emergence Test, *Z. mays* was the least sensitive and the rare weed species *A. githago* the most sensitive species with regard to the tested endpoints and both substances. *A. fischeri* was strongly inhibited by Vizura, whereas Piadin did barely affect the bacteria.

All findings indicate ecotoxic effects of Piadin and Vizura, especially on the aquatic species *L. gibba* and on the root development of several terrestrial plant species. However, the origins of the ecotoxic properties remain unclear as both substances contain a mixture of –to some extent unknown – chemical compounds.

P74 - Hemp as a multifunctional alternative for sustainable use of landscapes: the case of Quilombola communities in the Brazilian Sertão

The future use of natural resources

Danilo Crispim Massuela¹

Cinzia Piatti¹

¹ Institute of Societal Transition and Agriculture, University of Hohenheim, Stuttgart, Germany

Abstract: Justification:

Quilombola communities are marginalized rural ethnic groups historically food insecure, example of resistance as a rural minority that fights for constitutional rights (land, water and food). When empowered by governmental programs, they promote the sustainable use of the landscapes in the Brazilian Sertão, preserving the Caatinga biome and agriculture lands. The multi-functionality of hemp is discussed as an alternative in their quest for sovereignty over natural resources use.

Abstract:

The present investigation was based on a participatory observatory qualitative research with seven Quilombola communities in the Brazilian Sertão - an area subject to droughts, famine and social inequalities. Inside the region, the São Francisco river valley is the main agricultural landscape but also one of the biggest producers of narcotic cannabis in Brazil. The river lands have been the stage of violent and unequal forms of settlement, marginalizing traditional communities such as indigenous groups and the Quilombolas - a rural minority descending from slaves, historically subjected to food insecurity, racism and land confiscation. Such communities often join the traffic networking and crop narcotic cannabis for subsistence matters, facing violence and police persecution. In addition, the predatory effects of agribusiness in the region made smallholder farmers living in Quilombola communities suffer threats to their productive resources, therefore hindering their alternatives. The data collected exposed how the social organization and political engagement of the communities have brought achievements on their fight for constitutional rights (land, water and food) although object to hindrance caused by hidden interests of the agribusiness and political patronal in the local governments. The data further shows that while having the empowerment of governmental programs and public policies such as the “Zero Hunger” and “Bolsa Família”; such smallholder farmers could promote the sustainable management of the natural ecosystems and agricultural landscapes, reducing their engagement and dependence to narcotic networks, countering environmental degradation and social marginalization. With the current political and economic crisis in Brazil, previous policies aiming at rural development have been drastically reduced, adding to prosecution of traditional communities. This work discusses whether industrial hemp could be a viable alternative to the narcotic illegal plantations, aiming the community’s pacification, income alternatives and sustainable development based on a current social problem.

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P75 - How to cheer a deer

The future use of natural resources

AGATA RÓWNY¹

Hasan Tekin²

¹ Warsaw University of Life Sciences

² Czech University of Life Sciences

Abstract: Nowadays more attention is paid to emotional state of captive animals. A number of enclosures in ZOO's have been equipped with tools that increase the range of behavioral choices to a variety of animal species and draws out their appropriate behaviors and abilities, thus enhancing animal welfare. So far there is hardly any data on behavioral enrichment for cervids. The time they would have to spend in "survival mode" in the wild has been eliminated by living in a human-arranged enclosure and not replaced with other activities. It negatively affects their mental state as well as decreases their attractiveness for visitors which is crucial to meet the educational and conservation goals of the zoos.

This study is a review of environmental enrichment methods in search of strategies suitable for improving deer welfare in captivity as well as a summary of experimental data collected in Prague Zoo where the environmental enrichment methods were applied in deer's enclosures. Three deer's enclosures with the highest number of deer were studied, it included 15 Eld's deer (*Panolia eldi thamin*), 8 Javan rusa (*Rusa timorensis*) and 6 White lipped deer (*Cervus albirostris*). The data were collected during July, August, and September and included behavioral observations - assessing the landscape of comfort, time budget, and behavioral diversity. The observation period was divided into three main blocks before, during, and after environmental enrichment application and the difference between them analyzed.

The result shows that environmental enrichment has great potential to encourage deer to explore their enclosures and stimuli higher diversity of behavior. We concluded that environmental enrichment is a tool which by increasing welfare of individual helps managing healthy and viable populations for conservation reasons, as well as conveying reliable conservation-education messages to the visiting public. It also brings great opportunity to grasp visitors' attention and involve them in the educational programs.

Category justification:

As we are facing the 6th mass extinction, with over 26,500 of the world's animal species endangered, their conservation should be a top priority. The main roles of the modern zoological gardens are education, research, and conservation. In order to reach those goals and contribute to sustaining high species' biodiversity zoos should focus on improving animal welfare. Environmental enrichment is one of the most powerful and easy to apply tools to positively influence captive animals well being.

Acknowledgements: Dr Francisco Ceacero Herrador
Dr Krzysztof Klimaszewski

P76 - Green Protein - Aroma Interactions

The future use of natural resources

Gérault-Landry Eggermont¹

Remko Boom¹, Igor Bodnár², Mirela Pascu², Shane Avison²

¹ Wageningen University

² Firmenich SA

Abstract: Currently there is a high interest in using plant proteins as meat replacers. Therefore, one needs to understand how plant proteins interact with flavor compounds. Previous research has shown that the interactions are class dependent. Accordingly, it was decided to focus on esters as flavor compounds, with further including chemical variation (linear, branched and unsaturated) into one specific chemical class. Regarding the examined proteins, both pea and soy were selected for the green proteins and whey as dairy protein. The purpose of this study was to determine if the dairy protein aroma interactions, studied previously in Firmenich, could be extrapolated to plant-based proteins.

Based on headspace measurements, the direct relation between hydrophobicity and partitioning got confirmed. Further, increasing both protein concentration and the chain length of the flavor resulted in more flavor retention. Subsequently, the effect of steric hindrance was perceived within the examined branched compounds, with the exception of 2-methylpropyl acetate. Additionally, incorporating a double bond resulted in less retention for the examined esters, likely caused by bulkiness, which is against earlier findings for aldehydes. Consequently, changing the batch of whey resulted in a major shift on flavor-protein interactions, likely because of a different processing history.

The effect of processing, namely UHT-treatment, for pea protein was examined. Overall, no influence of UHT was found for the examined esters. Hence, in case of small differences, there were found to be irrelevant for the food industry.

A model was established for the protein-flavor interaction. It was found that the used relation for protein-aroma interactions for dairy systems can be extrapolated to plant systems. However, the assumption that the flavor-protein interaction is dominated by hydrophobicity seems valid, but yet to simplified. For more hydrophilic compounds, complex interactions which are not proportional to the water-octanol partition coefficient seem to be relevant as well.

The proportionality coefficient (*aP*) made clear that whey binds 1.38 times more than soy and 1.18 times more than pea. Within the plant proteins, pea retains 1.16 times more flavor than soy.

Nevertheless, as the proportionality coefficients have the same order of magnitude, one should remember that there are no major differences for flavor-protein interactions. With these findings, Firmenich can work more efficiently on how much flavor is needed in a plant-based system and thus solidify existing relationships with clients.

Acknowledgements: European Master in Food Studies

P77 - Genetic diversity within *Saxifraga oppositifolia* L. (Saxifragaceae) on Svalbard

The future use of natural resources

Angeline Bruls¹

¹ Wageningen UR

Abstract: The purple saxifrage (*Saxifraga oppositifolia*) is often used as a model species in Arctic ecosystems. This plant, which has a circumpolar distribution and also occurs in alpine areas, has a great intra-species diversity in for example growth form (cushion or trailing), flower colour (from white to purple), and habitat preference (from moist snow beds to dry rocky ridges). A lot of research has been done on this species, for example on its phenology and on how it will be affected by climate change. However, there is another dimension of variety within the purple saxifrage which has been neglected in most studies: *S. oppositifolia* is an autopolyploid, meaning that it can have multiple options for the number of copies of its genes. So far, diploids (2n) seem most common, but triploids (3n) and tetraploids (4n) also occur quite often. However, it is still unclear how important the differences in ploidy levels are, and if ploidy level plays a role in, for example, habitat preference. It has been found that tetraploid individuals of *S. oppositifolia* always have a trailing growth form, while diploids can have any growth form. Earlier, growth form has been related to habitat. So, could ploidy level have a direct effect on habitat selection? On Svalbard, there is an additional knowledge gap in the sampling locations for *S. oppositifolia*: so far, only coastal populations have been sampled and inland populations have been ignored, mainly due to logistical reasons. In this study, however, we sampled *S. oppositifolia* from inland populations for the very first time. The aim of the study is to shed a light on the diversity within *S. oppositifolia* on Svalbard, using samples from locations all over the archipelago. For fresh samples, ploidy level will be determined using flow cytometry. The total pool of dried and fresh samples will be analysed using chloroplast DNA markers. We also tested ten microsatellite markers which were developed specifically for the purple saxifrage, and report on the testing process for these markers.

Note: Since my thesis is not finished yet, I don't have any results or conclusions right now. However, by November the project will be finished so I can share my results at the student conference.

Acknowledgements: Pernille Bronken Eidesen, UNIS supervisor

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Tina Dahl, Anna Grimsby, Charlotte Sandmo for help during fieldwork

P78 - Genetic Diversity and Selection Signatures in horse breeds in the Netherlands

The future use of natural resources

Louise Bonnier¹

¹ Wageningen University and Research

Abstract: *Background* Through the ages horses have been used for several purposes which led to human-driven selection. The emerging of studbooks in the nineteenth century caused less exchange between breeds which led to much genetic diversity between breeds and little genetic diversity within breeds. Where analysis of genetic diversity could first only be done with pedigree analyses, it is now possible to use genomic information with which variation between and selection within breeds can be calculated. To make sure variation can be preserved, it is important to find selection signatures and unique variation. Therefore, in this study, the focus is on investigating the genetic diversity in nine breeds, analysing their contribution in comparison to the total diversity, relative to the within-breed variation, and to analyse signatures of selection.

Results In this study it is found that, in these nine breeds, Friesians have most homozygosity, have the greatest genetic distance from the other breeds and have the most unique variation. 75 out of 180 horses throughout all the breeds have a homozygous region on ECA11. 16 out of 20 Shetland ponies have a homozygous region on ECA1, with an F_{st} value of 0.9 in this region.

Conclusion We have looked at unique variation contributions and selection signatures in nine horse breeds in the Netherlands. Most breeds show unique variation, but there are big differences amongst the breeds. Specific selection signatures have been found throughout the nine horse breeds, between and within breeds. One option for further research would be to include more breeds with known relations to the breeds used in this study. Another option for further research would be to study the here found selection signatures in depth through haplotype analyses.

Keywords Selection signatures, Genetic diversity, runs of homozygosity, horse, genome, SNP, conservation.

Acknowledgements: B.J. Ducro,
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P79 - Potential of historic polyculture & ridge farming

The future use of natural resources

Patrick Hohenegger¹

Anna Hollerer¹, **Bernhard Mayer**¹, Johannes Waltner¹, Simon Nussbaumer¹

¹ Boku Wien

Abstract: Due to climate change and an alarming rate of biodiversity loss, actors in agriculture are facing new challenges. While on one hand farmers are suffering the consequences of these challenges, on the other hand intensive monoculture production intensifies the challenges leading to soil degradation, enhanced susceptibility for pests and diseases and a loss of worldwide biodiversity. The aim of this paper is to examine the mixed cropping systems planted on ridges in order to show alternative farming methods and niches for small sized farmers based on sustainable principles. We applied a mixed methods approach conducting an extensive literature review, qualitative expert interviews and designed an on-farm experiment to test the developed concept. Three crop combinations, which have beneficial effects on each other, were selected. Those symbioses should fit regional criteria to promote and strengthen natural processes. Through the new insights a concept for small sized farmers was created: spring barley and caraway, camelina and pea as well as safflower and lupine.

The results of this study are: (1) multiple cropping reduces the risk of susceptibility to pests and diseases, (2) suitable crops like legumes help to maintain soil fertility, (3) cultivation on ridges support the water balance of the soil and protect the plants from drought.

At the hands of our led expert interviews results suggest that there is a huge potential in mixed cropping system planted on ridges which is fueled by the interest of farmers and fostered by agricultural science facilities.

The tight relationship between farmers and science inspired by the knowledge of old national and international cultivation techniques bares the potential to enhance production in agriculture and increase plant health, soil quality and appreciate the fundamental connections between human and environment. Further research on the profitability as well as the practicability in different regions is needed.

P80 - Pro-environmental behavior of Nigerian youths: Barriers to plastic recycling

The future use of natural resources

Loveth Aikowe¹

Jana Mazancova¹, Miroslava Bavorova¹

¹ Czech University of Life Sciences, Prague

Abstract: A lot of studies focusing on pro-environmental behavior (PEB) more recently have been directed towards adolescents and youths in more advanced countries, thus there is a huge research gap in developing countries on PEB. Therefore, this study sets itself apart by including perspectives from Nigeria on PEB towards plastic recycling in the country and can be replicated in other developing countries to bridge the research gap in this field and region. Like many other countries today, Nigeria is showing an increasing concern for the environment and have also announced plans to introduce a national policy regarding plastic waste management. Considering this, the study focuses on plastic recycling as the PEB under investigation. Furthermore, the study also utilizes the theory of planned behavior (TBP) in explaining the attitudes and barriers of plastic recycling among Nigerian elite youths since they are unarguably vital stakeholders, presumably expected to hold key decision-making positions in the labor force. This study adopts mixed method approach targeting university students from agriculture (N=200) and Technology (N=200) and multivariate statistical analysis. Firstly, 6 focus group discussions are setup with 5 students from each study field under investigation (i.e. agriculture, social science, and engineering), in order to determine outcome evaluations needed to develop paper and online questionnaires. Data is then coded and imputed for analysis using SPSS and Stata. For independent samples, comparisons between two groups of students (looking at gender and discipline) are carried out, and structured equation modelling is used to examine the main determinants of PEB. Based on preliminary studies, Nigerian university students from agricultural studies show higher PEB in plastic recycling than engineering.

Keywords: Developing countries, Pro-environmental behavior, TBP, climate change, plastic recycling

Acknowledgements: The paper has been supported by project No. 20195004 of the Internal Grant Agency, Faculty of Tropical AgriSciences, Czech University of Life Sciences Prague.

P81 - Quantification of the understorey contribution to carbon storage in a peri-urban temperate food forest

The future use of natural resources

Lisa Lehmann¹

¹ University of Copenhagen

Abstract: The continued rise in population and increasing instability of the climate requires a strong need for a more sustainable food production on rural, peri-urban and urban land. To create a fully sustainable food production system a more holistic view is necessary. The field of agroecology has been developed based on such a view, focussing on the environmental interactions derived from ecology and applying the ecological principles to agricultural practises. Temperate food forests are a type of agroecology being described as complex polycultural and multifunctional systems, designed to mimic young natural forests, aimed at being low maintenance, biologically sustainable, resilient to climate change and highly efficient. They are designed to minimise the input of fertiliser, pesticides and irrigation, while providing a yield of food, fibre, fodder, fertiliser and pharmaceuticals. This study has estimated the carbon (C) stock of the understorey in a well-established, 0.64 ha peri-urban food forest in Devon, UK. Through various field measurements and the use of 23 allometric equations, above-ground biomass (AGB) was calculated, and below-ground biomass (BGB) was estimated based on a root-to-shoot ratio of 0.26. The corresponding carbon stock was calculated based on carbon content analysis of shrub samples of 31 species. The understorey was estimated to store 3.69 Mg C ha⁻¹, corresponding to 8.54 % of the total living carbon stock of 43.22 Mg C ha⁻¹ stored within the food forest of the Agroforestry Research Trust. This study demonstrates that the often-overlooked understorey constitutes a notable addition to the living biomass carbon stock especially in temperate food forests with dense understoreys. Peri-urban food forests are by this means reckoned to potentially sequester similar amounts of C relative to rural forests.

Acknowledgements: The author wish to thank MSc supervisor Christian Bugge Henriksen, as well as Marin Lysák and Luke Schafer for their aid in drafting this abstract.

P82 - Quantification of vegetation's productivity during the 2018 drought through satellite data in comparison with in-situ soil moisture measurements

The future use of natural resources

Anne Swank¹

¹ Wageningen University & Research

Abstract: The western part of Europe was hit by a drought in the summer of 2018, temperatures increased and soil moisture decreased as well as the photosynthetic activity of the vegetation. Soil moisture is the controlling factor in reduced GPP and key in the land-atmosphere dynamics (including VPD and ET) and can reverse the global carbon cycle from sink to source. Despite the importance, models face limitations regarding ecosystem response to water stress. Many authors suggest to incorporate the root available soil water and dynamics into models.

In this study, a comparison of root-zone soil moisture and satellite-retrieved SIF and NIRv data is made to examine the possibility to use satellite data as an indicator for future drought scenarios on a large spatial scale. The satellite products are different indicators for GPP on a spatial resolution of 0.5 and 0.05 degree accordingly. Soil moisture is obtained from two measurement networks installed two years prior to the drought in the Netherlands. Root water uptake from different depths are correlated with both satellite products. The meteorological variable VPD is calculated based on meteorological observations and correlated to soil moisture as well. ET is calculated based on the in situ measurements assuming no vertical flow and compared to currently used Makkink calculations. Results show that VPD increases where soil moisture decreases. A change in direction of the correlation slope of soil moisture and NIRv indicates the offset of vegetation water stress. This study starts to explore the possibility to use satellite data to incorporate root water uptake dynamics in models.

Acknowledgements: Ryan Teuling, Martine van der Ploeg, Naomi Smith, Coleen Carranza, Gerbrand Koren

P83 - Strategic Landscapes - conversion of an agricultural land to a ecosystem connecting the natural values, residential and agricultural requirements

The future use of natural resources

Johana Šimčíková¹

Vendulka Nesvadbová¹

¹ CULS

Abstract: The study aims to connect three pillars of the landscape and neighbouring urban area - natural values, residential and agricultural requirements. With the landscape planning for the agricultural area comes an opportunity to convert the land into a functional ecosystem. The aim of the study was to support the biodiversity in the area, landscape structuring and layering which then could have become beneficial for the residents.

Today the situation in the area is rather disturbing and landscape architects are concerned that with the high level of homogenous fields could have a negative impact on the future of the area. Not only that the land is not as fertile as before but also the area is getting drier each year. This situation could change with better landscape planning for agricultural lands. The project is based on the idea of recreating the Land cover into functional structures which benefit the landscape and life in the ecosystems. To support the diversity in the area several tools were used to design the landscape strategy that supports the antierosion measure, connects ecosystems, suggests places for rainwater infiltration and supports the biodiversity and fertility of the agricultural land. This was achieved by rescaling the oversized fields, multiplying the landscape features such as buffer zones and bio corridors which then created new connections between the biocentres. Also, based on the water drainage data and contour lines each of the features was placed to support water infiltration and antierosion. The project implements all three layers – the trees, shrub, and plant structure and native species. The project suggests a new landscape plan that is part of the landscape strategy for today and tomorrows.

Keywords: Land cover, Land use strategy, Agriculture land, Cropland sustainability

Acknowledgements: Recreating the functional landscape structure is managed by rescaling the oversized fields, implementing the antierosion features, features for better water infiltration and also by supporting biodiversity by creating new connecting landscape elements that supports the ecosystems. Also, the diversity of the land cover brings new values to the area – not only for the nature but also for the neighbouring urban area. The agricultural land becomes habitable.

P84 - Pyrolysis conditions and long-term storage potential of forest fire charcoal

The future use of natural resources

Emil Brezovsky¹

¹ University of Natural Resources and Life Sciences, Vienna

Abstract: This work is a pre-project for a charcoal dating model using infrared spectroscopy, which could help to analyse implications between climate change and fire regimes cost-effectively. Further considering climate change, recalcitrant carbon pools like pyrogenic carbon produced by wildfires or biochar engineered anthropogenically gain importance. Inexpensive charcoal dating could help attain more information about the durability of charcoal as a carbon sink and long-term charcoal-soil interactions in general. Main targets were to examine the effects of pyrolysis conditions and ageing on charcoal chemistry. Charcoals of a high-intensity crown fire (106 samples) and a low-intensity surface fire (87 samples) were characterized using FT-IR spectroscopy. Fire events happened 1994 and 2003, respectively. Pyrolysis temperature, carbon, hydrogen, and oxygen contents were determined using already existing prediction tools. Spectral information revealed a clear difference between the chemical composition of charcoal pieces from low-intensity and high-intensity fires. Based on the elemental ratios O:C and H:C long-term stability was evaluated. Low-intensity fires did not produce any material recalcitrant for more than a few hundred years in maximum. Even at high-intensity fires a majority of remaining charcoal pieces did not feature a highly recalcitrant chemical composition. The diversity of forest-fire pyrolysis conditions becomes apparent, with temperatures between 140-330 °C for the low-intensity and 170-630 °C for the high-intensity fire. The concept of using infrared spectroscopy for a charcoal dating model is further confirmed by first signs of ageing in lower pyrolyzed charcoal (<400-500 °C).

Acknowledgements: Johannes Tintner, Ena Smidt

P88 - Molecular sex identification in selected bird species

The future use of natural resources

Anna Karlak¹

¹ WULS-SGGW

Abstract: Sex in birds is important to maintain their biodiversity. To control biodiversity in forests and urban agglomerations it is crucial to know the sex of the animal, which can not always be phenotypically determined. Molecular methods allow to determine the sex unambiguously. Thanks to these methods it is possible to better understand/know the ecosystem and the structure of a given populations. The presented below research is based exactly on these methods as well, what enables the correct observation of birds.

Research was conducted on 22 individuals belonging to 14 different bird species from the bird sanctuary in the Municipal Zoological Garden in Warsaw. Birds examined by a veterinarian were considered healthy and their death was caused by a very poor physical condition. The genetic material was isolated from the birds tissue using a commercial set GeneMatrix Tissue&Bacterial DNA Purification Kit (EURx). Electrophoretic DNA separation was performed by using a 1% agarose gel and measurements were made using a NanoDrop spectrophotometer to determine the purity of the isolated DNA. The samples were then purified by using sodium acetate and 96% ethanol. The CHD1 gene (*Chromodomain Helicase DNA Binding Protein 1*) was used for molecular sex identification. The polymerase chain reaction used a pair of primers P2 and P8, and 2550F and 2718R. The electrophoretic separation of the PCR products was performed by using a 3% agarose gel. Subsequently, then some samples in which unambiguous sex identification was impossible were cut with the *Bsu*RI restriction enzyme. Again, an electrophoretic separation was performed by using a 3% agarose gel with high resolution (HR). In eight newly tested species, five was successful amplified using a pair of P2 / P8 primers and the sex was determined using molecular methods. Using the 2550 / 2718R primer pair did not allow sex identification in any of the bird species tested.

Acknowledgements: Joanna Gruszczyńska, Maciej Miąsko, Agnieszka Czujkowska

P95 - Influence of Rural Culture and Water Managers' Personality Trait on Successful Water Management Practices in Nigeria: Evidence from Kogi State

The future use of natural resources

Jocelyn Aikowe¹

Jana Mazancová¹, Miroslava Bavorová¹

¹ Czech University of Life Sciences, Prague

Abstract: Water availability is a challenge in rural Nigeria regardless of the water developmental projects being delivered to the rural areas for several years. Previous studies have identified relationship and importance between culture and natural resource management, however, there appear to be a significant literature gap in the influence of culture on resource management in Nigeria. This research recognizes the rich diversity of Kogi's culture and its importance in natural resource availability. This study additionally seeks to identify how different cultural groups manage available water source within a sustainable framework. Furthermore, this study determines personality traits of water resource managers in Kogi state using the BF-10 method and compare them with the recommended traits for natural resource managers. Using a mixed method, 300 questionnaires are distributed amongst rural households in 6 local government areas in Kogi state, Nigeria. To understand properly the importance of cultural beliefs and ethical values, personal interviews with key informants (village heads and water resource managers) are conducted. SPSS is utilized to analyze the data. Multiple linear regression is used to identify factors influencing the availability of water while Chi-square test was used for comparison amongst the different cultural groups and their perception of water management. Regression results indicate that culture determines women's presence in water resource management.

The study also shows that governing policies for employing water resource managers in Kogi, does not include personality trait assessment as a prior criterion for employment in a managerial position. This research would not only contribute to existing literature gap but also provide recommendations for policymakers in improving rural Nigeria water availability challenges.

Keywords: Water resource, Culture, Ethnicity, Rural development, Developing countries

Acknowledgements: The paper has been supported by project No. 20195004 of the Internal Grant Agency, Faculty of Tropical Agrisciences, Czech University of Life Sciences Prague.

P96 - Knowledge and perception of edible weeds and herbicides among smallholder farmers. A case study from Eastern and Southern Province in Zambia.

The future use of natural resources

Carolin Schweizerhof¹

¹ Universität Hohenheim

Abstract: Since several years, herbicides are increasingly used by farmers in Sub-Saharan Africa. Herbicides may help to increase productivity in agriculture by reducing labor requirements and by limiting pre-harvest losses from weed infestations. However, some weeds are characterized by a high micronutrient content and are widely consumed as a side dish. An increased use of herbicides may cause these edible weeds to disappear from food baskets, which may be problematic given the high rates of under- and malnutrition in Sub-Saharan Africa.

Against this background, the aim of the study is to analyze the knowledge structures of edible weeds and herbicides. Furthermore, the study aims to identify perceptions of edible weeds and herbicides and how the perceptions influence the adoption of herbicides and edible weed consumption. Particular attention is to be paid to possible trade-offs smallholder farmers face when adopting herbicides.

Zambia was chosen as a case study because despite its political stability and more than a decade of economic growth, it still faces challenges of food insecurity, malnutrition and chronic poverty. In cooperation with the Zambian Indaba Agriculture Policy Research Institute two out of the ten Zambian Provinces were selected for the study. In the selected Eastern Province and Southern Province, smallholder agriculture is the main activity of the population and compared to the other provinces lower herbicide adoption rates have been observed in previous studies.

The research design includes a survey of 159 households, 16 focus group discussions with different foci and five expert interviews. The field work of the study was conducted from December 2018 till February 2019.

Preliminary results of the study show that in the households surveyed between one and ten different edible weeds (an average of 3.5 different varieties) are regularly consumed, both fresh and preserved. Edible weeds are particularly important in the rainy season, when the fields are close to harvest and stocks from the previous season are near their end. Women, especially older women, play a central role in the transfer and storage of knowledge about edible weeds. The existing knowledge is passed on orally to the next generation and is hardly recorded in written form. At first glance, the study shows that edible weeds are important for the daily nutrition of the households surveyed and that knowledge about edible weeds is widespread in the research areas. However, some preliminary results from the focus group discussions also suggest that the importance and consumption of weeds is declining. This change can not only be linked to the introduction of herbicides, but also to new dietary patterns, social changes through migration and reduced weed growth through the absence or delay of the rainy season.

Acknowledgements: The study is conducted as a tandem project with Alysha Vehre, who investigates the habitats and different uses of edible weeds, the role of edible weeds for food security and the risks that herbicides could pose to edible weed consumption. The work was financially supported by the Foundation Fiat Panis.

P97 - Local knowledge about the ecological sustainability of wild medicinal plant harvesting in Lemnos island, Greece

The future use of natural resources

Dimitrios Papageorgiou¹

Penelope Bebeli², Maria Panitsa³, Christoph Schunko¹

¹ University of Natural Resources and Life Sciences, Vienna

² Agricultural University of Athens

³ University of Patras

Abstract: Countries surrounding the Mediterranean show rich biocultural diversity and gathering wild medicinal plants is an integral element of a variety of cultures in the region. However, diminishing local knowledge, unsustainable harvesting practices and several forms of commercial development may result in medicinal plants' over-exploitation and degrade their natural habitats. A harvest plan under ecologically sustainable terms has been recognized as a tool to mitigate or eliminate this problem. The natural ecosystems of Lemnos island, Greece, have been greatly degraded. This paper documents local harvesters' knowledge of the gathering and utilizing of wild medicinal plants on the island of Lemnos, with a focus on identifying elements that relate to an ecologically sustainable harvest.

Successive free-lists with subsequent semi-structured interviews were conducted in July and August 2018 with sixteen harvesters knowledgeable about gathering and use of wild medicinal plants. Participant observation with six of the respondents allowed for deeper insights and facilitated the herbarium development.

In total, 145 different plant taxa were listed as useful, whereas 81 were harvested in the prior three years. Medicinal applications were mainly relating to the digestive and respiratory systems. Plant material was most commonly infused and consumed orally. Harvested plant parts mostly included ripe flowers, leaves and upper stems. Despite the gradual loss of local knowledge, harvesters' practices suggested a high potential towards an ecologically sustainable harvest. Though, a decreased availability for certain plant species was reported and mainly attributed to pollution, destructive harvesting and agricultural practices.

Knowledgeable harvesters of Lemnos gather and use a considerable number of wild medicinal plants and possess harvesting knowledge with incorporated elements of ecological sustainability. In addition to destructive harvesting, other anthropogenic factors like intentional pastureland fires, chemicals in agriculture and industrial pollution need to be recognized and encountered to conserve this flora and preserve the relevant local knowledge.

P98 - Meteorological and hydrological extreme events within the Nile and Niger Basins

The future use of natural resources

Viktoria Lindner¹

¹ University of Hohenheim

Abstract:

Justification: Why does the abstract fit the chosen subtheme?

Water on earth is the most important natural resource for direct life as well as for agriculture. Due to anthropogenic climate change, water resources on earth are redistributed as reported by the IPCC. Therefore, predicting possible extreme events such as floods and droughts will be essential in the future, as the population has to deal with their consequences e.g. epidemy or malnutrition.

Keywords

climate change, continental water cycle, extreme events, satellite data

Abstract

A possible consequence of global climate change is an increased risk of natural hazards, such as floods and droughts as reported by the Intergovernmental Panel on Climate Change (IPCC). Studying changes in the continental water cycle is crucial in order to predict future water availability and to identify risks for the Earth's population. During the last decades, various satellite missions gathered data on the redistribution of water masses in the atmosphere, on the continents and over the oceans. For instance, between 2002-2017, the Gravity Recovery And Climate Experiment (GRACE) mission provided measurements of total water storage changes for the entire globe. Since 2018, its follow-on mission GRACE-FO continues the records. NASA's and ESA's dedicated soil moisture missions observe the water changes within the upper centimetres of the soil layer, while altimetry missions measure changes of inland water bodies and rivers. In context with precipitation data, this information can be used to study the impact of meteorological droughts and extreme precipitation events on the continental water resources.

In this thesis, flood and drought events in the Nile and Niger Basins (Africa) will be assessed, their frequency and duration, as well as their possible intensification. In particular, GRACE(-FO), soil moisture and altimetry data will be analysed to identify temporal and spatial patterns of extreme events.

Acknowledgements: Prof. Dr. Maike Schumacher

P99 - Integrating blockchain technology into sustainable palm oil certification of smallholders

The future use of natural resources

Carina Pölzl¹

¹ BOKU Vienna

Abstract: This thesis investigates to what extent blockchain technology (BCT) acts as a panacea to address sustainability challenges associated with problems of palm oil production. Palm oil is currently the most commonly used vegetable oil worldwide. As the global demand rises, palm oil plantations are expanding. The unsustainable practices in palm oil cultivation have led to the establishment of certification schemes, like the Roundtable on Sustainable Palm Oil (RSPO). The RSPO label is currently the most effective private standard-setting body that ensures more sustainable palm oil cultivation. However, for small farmers, it is difficult to participate in the RSPO certification process. As small farmers are contributing to 40 percent of global palm oil production worldwide, their non-participation in the RSPO program decreases the effectiveness of the program. In this regard, the blockchain technology is often discussed to be able to contribute to sustainable developments and to enhance the implementation of the Sustainable Development Goals (SDGs). The blockchain technology is seen as modern marvel based on algorithmic principles empowering anyone with an internet connection to transfer data with unprecedented security and integrity without relying on third-party verification. Therefore, this thesis is guided by the research question: Which challenges for small palm oil farmers are expected to be addressed by the blockchain technology? The thesis is based on a literature review and a comparison of use cases. Firstly, the major limitations of RSPO certification for smallholders are examined, revealing eight limiting factors. Subsequently, three blockchain-based case studies comparable to palm oil production are analysed in terms of their background circumstances, their approaches, and their outcomes. Finally, the limiting factors of the RSPO certification program are compared with the learnings of the use cases. The results show that BCT has the potential to tackle three of the major limitations. Hence, the blockchain technology promises to better involve small palm oil farmers in certification schemes, such as RSPO. However, the thesis also shows that the technology will not be sufficient to tackle all limitations of contemporary labelling schemes.

Acknowledgements: Supervisor: Mag. Dr. Michael Braito

Green entrepreneurship

P7 - Identification of mutation in T-box gene in dogs of Polish Hunting Spaniel breed

Green entrepreneurship

Agata Stasiak¹

Magdalena Rogoza¹

¹ Warsaw University of Life Sciences

Abstract: Justification: Preserving of C295G mutation in exon 1 of T-box gene in polish hunting spaniel breed is not allowed, because short tail is not compatible with pattern of breed. Moreover, this mutation in homozygous system is lethal and homozygous puppies have a lot of spinal defects. We don't want to let this situation happens, because this is unethical and unecological.

Keywords: polish hunting spaniel, T-box gene, anury, brachyury

Polish hunting spaniel is unofficially called the sixth polish breed. This breed belongs to group VIII: retrievers, flushing dogs and water dogs and Section 2: flushing dogs, but this breed is not register in FCI yet. The history of spaniels in Poland began in XIX century, when various breeds of spaniels were introduced with import of hound dogs. Appearance breeds like Springer Spaniel, Cocker Spaniel, Sussex Spaniel and Field Spaniel contributed to create the polish hunting spaniel. Selection of spaniels was started in terms of ability to work, body conformation, temperament and hunting passion. Haworth et al. (2001) wrote about inherited lack of tail (*anury*) and shortened tail (*brachyury*) in cocker spaniel breed. The broader research focused on dogs genetic diseases confirming the C295G mutation in exon 1 of T-box gene, which is inherited in autosomal dominant way. The carriers of this mutation have short tail (from lack of one vertebra in tail to absence of whole tail) but in a homozygous system this is lethal defect (Haworth et al., 2001; Indrebø et al., 2008; Hytönen et al., 2009). Gruszczyńska et al. (2013) developed molecular test which allows to determine the dogs genotype in T locus and ascertain if the tail reduction is a consequence of surgical intervention or it has a genetic basis.

The aim of the study was to identify the carriers of C295G mutation in exon 1 of T-box gene, which correspond to the presence of short tail in polish hunting spaniels. Hair's bulbs collected from 25 unrelated dogs were used to isolate DNA. The obtained genetic material was subjected to digestion with restriction enzyme *BstEII*. Described molecular test is use at the time of picking animals to propagation and rating on dogshows.

Acknowledgements: Joanna Gruszczyńska, Beata Grzegorzółka and breeders of Polish Hunting Spaniel dogs

P8 - The Paris Agreement and its impact on carbon offset markets

Green entrepreneurship

Benja Faecks¹

¹ Wageningen University and Research

Abstract: Whereas the Paris Agreement is regarded as a milestone in international climate action, its operationalization turns out to be a challenge for the international community. Compliance as well as voluntary carbon offset markets currently undergo a transition with fundamental changes respective to the post-Kyoto era. The aim of this study is to analyze the debate that emerged from the implementation of nationally determined contributions (NDCs) in the frame of the Paris Agreement that clashes with the carbon offsetting regime as it used to be. A literature study was conducted based on recent working papers and specialist literature on the debate from 2005 to 2019. Issues regarding double counting and additionality of carbon offsets emerged that are only partially solved yet. Recommendations are made for the avoidance of double counting that require host countries of offset projects to include emission reductions in their NDCs and end buyers to claim mere attribution. Scholars did not reach consensus about how to define, operationalize and test additionality. However, the in- or exclusion of certain sectors in NDCs and additionality testing is debated. Consensus and clear directions on additionality have to be established by the international community in order for offset actors to act in line with the goals of the Paris Agreement.

P9 - Implementing solar milk cooling: A case study in western Kenya

Green entrepreneurship

Aline Mack¹

Sarah Graf¹

¹ University of Hohenheim

Abstract: Small scale milk cooling has the potential to ensure food safety, reduce milk spoilage and increase income for smallholder farmers. Solar based systems further address challenges of remoteness, vulnerability to energy markets and the need for climate-friendly technologies. A great number of technical solutions have emerged recently, that use renewable energy for milk cooling. But while the technological aspects of these systems are well known, there is very limited knowledge about impacts of these interventions on beneficiary level.

We researched implementation and outcomes of three pilot projects in Kenya that introduced small scale solar milk cooling, using a comparative case study approach with mixed methods. The studied technologies include a solar-fridge to store evening-milk and a solar ice-maker providing ice-blocks for milk-cooling during transportation. Out of 7 donated solar coolers only three were used for milk cooling. The study revealed a striking misfit between project assumptions and the actual structures of the local dairy value chains, which mainly resulted from neglecting marketing possibilities in the informal market. Furthermore, unsuited installation sites and insufficient communication contributed to preventing project success.

Based on the findings of the three study cases, we assess under which conditions and to what extend farmers can benefit from the technologies: In the milk-deficient study area value chains are short and most milk is marketed directly to consumers. The scope for spoilage reduction and the benefits of cooling evening-milk are thus limited. As milk is almost exclusively consumed boiled or fermented, consumers neither demand high bacterial milk quality. We found no negative effects on household milk consumption. Instead solar coolers expanded opportunities to market milk directly to rural consumers. Implementers should ensure that rights, responsibilities and benefits are allocated fairly. As wealthier farmers with more cows, experience more milk spoilage, they might disproportionately benefit from milk cooling projects.

Acknowledgements: We want to thank our supervisors Regina Birner and Thomas Daum for their help and guidance. We are very thankful you accompanied us to the field, so we could learn from you and together decide on the direction of the research.

Colleagues from the Agricultural Engineering in the Tropics and Subtropics (440e), we are more than grateful for the materials you provided and all the questions you answered.

We want to thank all our respondents, who agreed to be researched. We shall not forget to thank our dear driver Vincent, who took us wherever we needed to go and most of all we want to thank our dear translators Cynthia, Frederick and Centrine. Without you the research would not have been possible.

P10 - The detection of lack of feed based on alterations in the grazing behavior of dairy cows in a part-time grazing system

Green entrepreneurship

Marie Schnellbacher¹

Leonie Hart²

¹ Institute of Livestock Systems Engineering, University of Hohenheim, Garbenstarsse 9, DE-70599 Stuttgart

² Agroscope, Competitiveness and System Evaluation, Tänikon 1, CH-8356 Ettenhausen

Abstract: Precision livestock farming uses different sensors to detect cows' behavior. Based on these sensors the Cattle-FeedBack Model was developed to detect insufficiency in pasture allocation of grazing cows. However, this Model was developed under Irish conditions, namely full-time grazing and on behavioral data, measured by the RumiWatch system (Itin+Hoch GmbH, Liestal, Switzerland). In a grazing experiment at the research barn in Tänikon (Switzerland), this study evaluates if it is possible to use this model for practical use under Swiss farming conditions while dairy cows graze part-time. The RumiWatch system is not commonly used on farms because of the high costs and limitation in the duration of wearing that halter. Therefore, we examined the possibility of supplementing it by the Smartbow system (Zoetis, Parsippany, NJ, USA), an ear-tag accelerometer which mainly detects rumination behavior. However, this study aims to scrutinize if Smartbow detects enough information about animals' behavior to use the Cattle-FeedBack Model. A first step was to validate Smartbow (SB) during grazing through direct observation (DO) during 40 hours and according to RumiWatch (RW) during 207 hours. Concordance correlation coefficient (CCC) was used to validate associations in rumination time between DO, SB and RW. The combinations were concordant as follows: CCC = 0.86 (SB vs RW), CCC = 0.31 (SB vs DO) and CCC = 0.84 (RW vs DO). In the next step, the Cattle-FeedBack Model will be evaluated. During a grazing experiment, two groups of ten cows each were grazing part-time, in two paddocks over six days. As the allocated paddock supplied 80% of the cows' feed demand the amount of feed got insufficient during this time. The alteration of cows' behavior over this period was observed to develop a future decision support tool for farmers which helps to find the optimal timing of allocating a new paddock. The classification of this study in subtheme 'Green entrepreneurship' bases on three aspects: Animal Welfare is higher classified in a pasture-based dairy system. Decision support systems can help farm managers to implement a grazing system. The usage of external resources is reduced through grazing instead of silage production. In addition, a paddock rotation timing that is based on cows' behavior ensures the animal feed supply and preserve the swards.

Keywords:

precision technologies, grazing management, cattle behavior sensors
animal welfare, sustainable dairy production

Acknowledgements: I would like to thank the technicians and farm staff for helping to conduct this project. Many thanks to Christina Umstätter for planning this project and advising. Thanks to Abu Zar Shafiullah for statistical support.

P12 - “Jack fruit” - A magic fruit that yields money and increases social welfare for Indian tribes

Green entrepreneurship

Christina Peters¹

Aradhana Jayaprakash¹, Nishu Priya¹

¹ Hohenheim University

Abstract: Jackfruit (*Artocarpus heterophyllus* LAM.), is a species of tree in the fig, mulberry and breadfruit family (Moraceae). They are widely cultivated in tropical regions of the world and is found to be the state fruits of the Indian states of Kerala and Tamil Nadu. Both harvesting of jackfruits and removing the pulp and other components from its fruit are challenging due to the lack of technology and fluctuating labour requirements in Kerala. However, jackfruits offer a great biomass potential for increasing both income and welfare in the local community.

Therefore, the two major objectives of the project are (i) to build a feasible business model by considering the various purposes of jack fruit and its bio-waste, and (ii) to strengthen a tribal community in Kerala, India by providing them with fruitful opportunities to increase the social welfare of their community.

Design/ Methodology/ Approach – We aim to adapt to the Triple Layer Business Model Canvas (TLBMC), which is a tool for exploring sustainability-oriented business innovation which considers all three sustainability aspects namely environmental, social and economic aspects.

Significance/Value – Our work identifies that Jackfruit is a very under-rated fruit; not only in India but all over the world. The significance of this project is to provide the tribes with employment and identify the potential uses from its various parts i.e. gum, peel, mucilage, seed and fruit in different industries such as process, food, dye, pharmaceutical etc.

Keywords – Jackfruit, TLBMC (Triple Layer Business Model Canvas), Tribe, biomass potential, sustainability

Justification – Green entrepreneurship is all about addressing an environmental/social issue with entrepreneurial ideas/innovations that are economically feasible and socially beneficial. Our topic aims at uplifting a tribal community in India who are generally outcasted by the general public and identifying the viability of jackfruit and its bio-waste and creating a feasible business model from it.

Acknowledgements: Moritz von Cossel

P34 - How to upgrade current management plans for the invasive species Giant Hogweed in Denmark – a case study from Vordingborg municipality, Zealand

Green entrepreneurship

Yaquan Chang¹

Alfred Figueras Anton¹, Oriol García Antúnez¹, Andreas Davidsen¹, Jens Lindgaard¹

¹ University of Copenhagen, Department of Geosciences and Natural Resource Management

Abstract: Invasive Alien Species (IAS) is a global issue that poses a threat to native biodiversity and human health. Globalization and associated processes of rapid infrastructure development in recent decades have increased the rate of dispersal across the globe, allowing IAS to establish populations in hitherto unseen quantities and varieties across the countries of the global North. In Denmark, municipal authorities are obligated to eradicate invasive species in accordance with current EU-regulation. This work is coordinated through management plans for each species which are drawn up by the municipalities. The process of creating such plans is resource consuming for most municipalities and also for the municipality of Vordingborg which is the subject for the study reported. An action plan for the invasive species **Giant Hogweed** (*Heracleum mantegazzianum*) was created in this municipality in 2014, but a high number of populations are still present and municipal officers have no clear ideas of how to approach the problem of eradicating them. In order to test a new approach to eradication planning, which could potentially be used in municipal contexts across Denmark, we tested two different techniques to produce various types of probability maps for the occurrence of Giant hogweed in Danish landscapes. Based on an array of environmental variables co-predicting the distribution of the species, a statistically-based Species Distribution Model (SDM) and a process-based GIS suitability analysis were created. The two models, both of which are spatially explicit, were tested and evaluated by comparison with in situ observations collected in May and June 2019 in Vordingborg Municipality. On this basis an upgraded action plan for Vordingborg Municipality was drawn up, consisting of a general risk map, a cadastral explicitly risk map, a map of landscape types associated with the occurrence of the species and a guidance document detailing how to manage the threat of this species based on the new datasets and strategic plans made available. In this paper, we discuss the validity, usefulness and further development of the models which were created for the species and the strategic planning instruments derived from the new data, including how our case study results from Vordingborg Municipality may be used in a broader geographical context.

Acknowledgements: Our acknowledgments go to Dr. Andreas Aagaard Christensen for inspiration and guidance throughout the project period. Throughout the project, Andreas inspired the group to follow and test new theories and ideas. As a group, we would also like to send our appreciations to Dr. Andreas Aagaard Christensen and Dr. Peter Stubkjær Andersen for a well-structured and educative field trip to the municipality of Vordingborg. A special thanks go to Rasmus Scharling from the municipality of Vordingborg. Rasmus provided the group with vital information about existing management practices and guidance to calibrate the different risk maps and communication tools. Finally, we would like to express our deep gratitude to Dr. Charles P.-A. Bourque at the University of New Brunswick, and Dr. Nan Zeng at the Nature Conservancy for their patient guidance on developing the SDM model and constructing the action plan.

P35 - Market value chain of indigenous fruit tree species (*Tetracarpidium conophorum*) as option to improve livelihood of local communities in Cameroon

Green entrepreneurship

Choungo Patrick Bustrel¹

Tchoundjeu Zacharie², Jiofack René Bernadin², Tsafack Sygnola³, Temgoua Lucie⁴

¹ Department of Crop Sciences and Agroforestry, Faculty of Tropical AgriSciences, Czech University of Life Sciences Prague, Kamýcká 129, 165 00 Prague-Suchdol, Czech Republic; Czech University of Life Sciences

² Higher Institute of Environmental Sciences (HIES/IBAYSUP), Ydé, Cameroon

³ Independent consultant, Civil Society Organization, Ydé – Cameroon

⁴ University of Dschang, FASA

Abstract: *Tetracarpidium conophorum* is known as a vine from Euphorbiaceae family, producing edible nuts widely distributed across West and Central Africa with a lot of properties for local farmers. The objective of this study was to assess marketing channel and value chain of this local vine and determine its contribution on livelihood improvement. The survey was carried out at Mbam and Inoubou localities in Cameroon, especially in Bafia and Yaounde. Respondents included 48 households and 50 traders. Results showed that marketing intermediaries included collectors, wholesalers and retailers. The production of the conophor nut was dominated by men (67 %) while commercialization was dominated by women (12 %) and children (30 %). The price of 15kg bucket ranged from 15.43 to 27.43 USD depending on the production season and the marginal benefit per bucket was 10.36 to 14.41 for producers, retailers and wholesalers. Processed products as oil are used for medicinal purposes (46 %) to cure rheumatism with hypocholesterolemic and hypotriglyceridemic properties. While flour is used as a food supply (64 %) for children and the rest of family. Positive impact of this income has been observed on the livelihood of local population of the area because they were able to pay children school fees and medicines.

Acknowledgements: Thanks to Ebenezar Asaah for comments. Thanks also for those who help me during field work Irene Mbouwe, Armelle Tchanou, Charlene Djomo and Armel Mouaffo.

P36 - Application apple pomace to make biodegradable packaging and dishes intended for contact with food

Green entrepreneurship

Tomasz Sadowski¹

¹ Szkoła Główna Gospodarstwa Wiejskiego w Warszawie

Abstract: This paper presents the possibility of apple pomace application for the production of disposable biodegradable dishes and packing intended for contact with food. As part of the work, an experiment was carried out to determine the properties and suitability of the material resulting from the extrusion of apple pomace, as well as for comparative purposes with the material created in the process of pressing the same raw material, but without the use of extrusion. The properties and suitability of the application were tested by measuring the water activity of the initial product, colour parameters in the CIELab and CIELCh spaces, mechanical strength of extrudates and stampings, as well as their structure by measuring acoustic emissions during the breaking test. The conducted research allowed to state that apple pomace is a material with high potential for use as a raw material for the production of disposable utensils. In addition, the extrusion process significantly increases the hardness and mechanical strength of the extrudates.

Acknowledgements: *PhD hab. Hanna Kowalska, associate professor*

P38 - Monitoring of functional parameters of boar spermatozoa during proteasomal inhibition during in vitro capacitation

Green entrepreneurship

Lenka Hackerová¹

Markéta Sedmíková¹

¹ Czech University of Life Sciences Prague

Abstract: A series of biochemical and biophysical changes during capacitation initiate a signaling pathway leading to protein phosphorylation. It is the tyrosine phosphorylation that is associated not only with the change in the pattern of sperm movement during the capacitation process, so-called hyperactivation, but it also regulates the activity of the proteasome which is responsible for protein degradation. However, the proteasomal activity can directly or indirectly control the activity of protein kinases that catalyze the phosphorylation process. The proteasome inhibition by proteasome inhibitor MG132 could be reflected in the changes in the main compartment of the sperm flagellum, which could result in a change in their mobility during capacitation. The aim of this thesis was to evaluate the influence of MG132 inhibitor on kinetic parameters of motility of boar sperm via computer aided sperm analysis (CASA). The effect of the MG132 inhibitor was monitored on the sperms incubated for 2 hours in a capacitation medium. The sperms were incubated with DMSO and the inhibitor at 10, 25, 50 and 100 μM concentrations. The sperm motility functional parameters were evaluated by the CASA system at zero, first and second hour of the incubation. In addition, the acrosome integrity, which was labeled with PNA lectin, was monitored after the capacitation and the induction of acrosomal reaction in individual sperm samples. Amplitude of lateral head displacement (ALH) is the only parameter where a major significant difference was observed in all samples with inhibitor in both the first and second hour of capacitation in comparison with the control group. The two highest concentrations of MG132 inhibitor negatively affected all the other monitored sperm kinetic parameters (VAP, VCL, VSL, STR, LIN), which points out the involvement of the proteasome in regulating the motility of male sex cells during the capacitation process.

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P39 - Elucidating the native glycine assimilation module in *Ralstonia eutropha* to capture CO₂

Green entrepreneurship

Natalia Giner Laguarda¹

¹ Wageningen University

Abstract: Background: The extensive use of fossil fuels and its concomitant generation of major greenhouse gases such as CH₄ and CO₂ is largely responsible for climate change and global warming. These have become a humanity's grand challenge which calls for an immediate transition to an economy powered by alternative feed-stocks, possibly made of renewable energy sources and CO₂. To tackle this challenge, the biological conversion of C₁ compounds has been proposed as a promising solution. While electrochemical reduction of inorganic molecules enables a highly efficient reduction of CO₂ into simple molecules, microbial production of chemicals permits the generation of desired complex molecules. To integrate both the physicochemical and biological fields, formate arises as the most suitable mediator. Formate can be efficiently produced from electrochemical reduction of CO₂ and subsequently be consumed by microbes as the sole carbon source for the production of value-added chemicals, thereby addressing major global challenges in chemical production and energy storage. The current formate assimilation pathways employed by natural formatotrophs are inefficient and not highly suitable for industrial applications. Alternatively, engineering an organism with biotechnological potential to formatotrophic growth using synthetic, formate-assimilation routes could become an advantageous strategy. *Ralstonia eutropha* employs its efficient formate dehydrogenase to obtain energy and reducing power from formate to fix CO₂ by the Calvin Cycle. Instead, the RGP could be introduced to assimilate CO₂ in a more efficient manner. A rational integration of native and foreign enzymes enabled the tetrahydrofolate and glycine cleavage/synthase systems to operate in the reductive direction, such that *Ralstonia eutropha* satisfies all of its glycine and serine requirements from the assimilation of formate and CO₂. Glycine is assimilated based on natural enzymes, which have to be elucidated to allow further improvement. To establish a fully active synthetic pathway, an efficient way to assimilate glycine and effectively produce all biomass and metabolites

from formate in *R. eutropha* is crucial and is yet to be established, leaving room for future undertakings.

Results: By rationally deleting the glyoxylate carboligase gene from a *R. eutropha* strain evolved to grow on glycine, we demonstrate that the glycerate route is the native route for glycine assimilation in *R. eutropha*.

Additionally, we elucidate that the DadA6 is required for *R. eutropha* to assimilate glycine and we demonstrate that this enzyme is a glycine oxidase which can use something else than oxygen as an acceptor of electrons.

Conclusion: In this project, a novel glycine assimilation pathway to accomplish a fully active RGP is elucidated in *Ralstonia eutropha*. This native glycine assimilation pathway relies on a DadA6 glycine oxidase which is in charge of the oxidation of glycine into glyoxylate; and the glycerate route which is the pathway followed to assimilate the glyoxylate produced.

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P60 - Production of PHAs from volatile fatty acids. Cultivation of *Bacillus megaterium* in a fed-batch process with a pH-dependent feed regime.

Green entrepreneurship

Lukas Pucher¹

¹ BOKU

Abstract: Abstract:

Polyhydroxyalkanoates (PHAs) are microbial polyesters that are produced as a storage polymer by many bacteria and archaea. Due to their biodegradability and their thermoplastic properties, PHAs represent an alternative to petrol-based plastics and may have the potential to fight plastic pollution and climate change in the near future. High production costs, which are to a large extent due to the substrate supply, could prevent the introduction of PHAs as a competitive alternative to non-biodegradable plastics.

The main emphasis of this work was put onto the applicability of volatile fatty acids (VFAs) as a sustainable carbon source for PHA production in *Bacillus megaterium*. VFAs can be produced in an acidification step during anaerobic digestion of biogenic waste, such as municipal waste or sludge from wastewater treatment plants, and are therefore inexpensive and not competing with food production.

In this work, fed-batch fermentations with a pH-dependent feed regime were conducted. *Bacillus megaterium* was able to produce an ultimate biomass concentration of 10.2 g/L cell dry weight with 56% of PHA on a mineral medium with acetic acid as a carbon source. When a spiked VFA-medium produced from waste resources was used for the carbon feed, a cell dry weight of 4.8 g/l with 17% PHA content was obtained. Additional experiments will be required in order to optimize the nitrogen content and to investigate the potential for adapting the strain to the media and cultivation conditions.

Justification to the Subtheme “The future use of natural resources”

Since the early 1950s large amounts of fossil fuel based and non-biodegradable plastics accumulate in the environment. Besides more social awareness it needs a sustainable, bio based, and biodegradable alternatives to conventional plastics. PHAs can be produced sustainable from waste streams with no need for additional agricultural land.

Keywords:

polyhydroxyalkanoates, sustainability, volatile fatty acid, sustainable bioprocess

Acknowledgements: I would like to express my special appreciation and thanks to my supervisors Markus Neureiter and Milos Kacanski.

P61 - Long-term electricity load forecasting for municipalities in Bavaria and the Czech Republic in high temporal granularity

Green entrepreneurship

Maximilian Roithner¹

¹ University of Natural Resources and Life Sciences, Vienna

Abstract: Climate change is a phenomenon strongly influencing and being influenced by many aspects of modern societies. One area that is impacted strongly is the energy sector. Specifically in the light of reducing greenhouse gas emissions, future electricity production is required to transition to renewable energy sources. Since those tend to be quite flexible in their generation and the electricity grid requires a constant frequency (balancing supply and demand), detailed estimations of future electricity demand are needed.

This thesis establishes a method to integrate existing forecasts of macro-economic drivers, such as population development and land-use change with electricity demand statistics from official sources. The method provides time series of high temporal (hourly) and spatial (municipality level) resolution.

As a reasearch area, Bavaria and the Czech Republic were chosen, to be able to compare regions in neighbouring, yet different countries. To reduce computation power needed, mainly the years 2030 and 2050 are examined.

These time series can be applied to many different use cases. Shown here, is how they can be used to determine the electricity self sufficiency of municipalities, when combined with projections of renewable electricity supply and data on installation costs.

An optimization model is employed to calculate the economically most sensible combinations of wind and solar power generation together with battery storage.

It was found that a sizeable portion of municipalities could self sustain their projected electricity demand.

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P63 - Rethinking XXL-distribution. A case study in North-Brabant

Green entrepreneurship

Gerwen van der Veen¹

¹ Wageningen university

Abstract: The rise of the online shopping markets and international trade, has shaped a new man-made object in the Dutch landscape. The appearance of the XXL-distribution centre is a building, which is larger, higher and above all covers a larger surface, in comparison with the regular distribution centre. Buildings are being placed around the cities, the highways and in the landscape. The lack of policies from the central government regarding the positioning of XXL-distribution is worrying experts and residents. This thesis, addresses the development from a landscape architecture perspective, with the following main design question: *What would be the most optimal integration for XXL-distribution in the Dutch cultural landscape between Rotterdam and Venlo?*

The main purpose of this thesis is to explore the combination of logistics positioning criteria and landscape integration concepts. To find a suitable landscape for the positioning of XXL-distribution on a regional scale, different models were tested, based on logistic criteria and the landscape integration concepts, regarding the openness and appreciation. The outcome of this study showed that sand- and peat landscapes are most suitable for the implementation for XXL-distribution, because of their existing vegetation in the shape of tree lines and forests. Open sea clay landscapes are more vulnerable for horizon pollution and are therefore less suitable, because of their openness. To reduce the footprint of XXL-distribution, a more efficient logistic model is developed based on the high bay warehouse. High bay warehouses have the ability to reduce the footprint of the regular distribution centres with 50 to 60 percent, but are exceeding a height of 45 meters. With a compact way of building, more space can be reserved for the integration of the buildings. This integration is addressed in the final phase of the thesis. By designing a prototype for the sand landscape nearby Tilburg. The companies are stimulated to develop nature areas, to compensate for their settlement in the landscape. In this way it is possible to develop a spectacular landscape with work, leisure and nature.

Acknowledgements: Adriaan Geuze

P64 - Assessment of investment opportunities in hay drying technique by means of Monte Carlo-Simulation, with special consideration of weather risks

Green entrepreneurship

Benedikt Fritz¹

¹ University of natural resources and life sciences Vienna

Abstract: In this thesis, different methods for the production of silage-free, organic milk are compared. For this purpose, the economic consequences are calculated in eight different scenarios with the aid of the *Visualisation of Financial Implications* - method (VOFI). The scenarios differ in their way of hay drying, either by field-drying or by ventilation using cold, warm or dehumidified air. All methods require different investments in buildings and technical equipment. Another difference is the required length of a rainless period for harvesting. For example, the production of field-dried hay requires a longer rainless period than ventilated hay. In processes that require a shorter rainless period the harvest can therefore be performed closer to the optimal point of use of the grassland. The time of harvest has a significant impact on yield- and quality parameters and hence economic outcome, thus representing an important factor. The average time of harvest allows conclusions to be drawn regarding the quality and quantity of staple feed. Based on these parameters, diets are formulated and the milk yield is derived. In the following step, one calculates the economic target indicator of the VOFI (*compound value*, which is the amount of stock cash at the end of the planning period), including costs for investments, harvesting and other. In order to implement weather risks in the model, the VOFI is extended using a Monte-Carlo-Simulation model (MC-Simulation). Factors, which have a significant economic influence are identified through a sensitivity analysis. These are then represented by probability distributions. The results of the MC-Simulation are probability distributions for the economic target indicator (compound value), which allows conclusions regarding the profitability and the risk of the scenarios. Applying the concept of stochastic dominance shows the scenarios involving field - drying and ventilation with warm air to be the most economic. Furthermore, field-drying represents a higher risk than warm air ventilation. Therefore a risk-averse decision maker may choose the latter, whereas as risk-affine one the former.

The model developed in this thesis could also be used for other farmers as a decision support system for planning investments in hay-drying technique.

Acknowledgements: Supervisors:

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P65 - Social and Solidarity Economy organizations as Bio-economic Systems? Insights from the case-study of the ‘Association Sahel Vert’.

Green entrepreneurship

Pietro Beltramello¹

¹ University of Hohenheim

Abstract: Abstract: Voluntary organizations, such as those belonging to the Third sector or the more radical Social and Solidarity Economy (SSE), rely basically on self-governed engagement of people that gather to pursue shared purposes. Typically, SSE organizations aim at societal innovation employing different values and modes of organizations. However, of their major drawback is to consistently assess the sustainability of their initiatives and improve their organization accordingly. Again, since those organizations rely, more or less explicitly, on principles that cannot be reduced to the premises of the dominant market-based rationale, a proper economic discourse should develop employing an alternative epistemology capable of bringing towards a coherent logical analysis of their unique key features. Due to its systemic outlook and focus on immaterial target, the Bio-economic epistemological proposition (firstly developed by Nicholas Georgescu-Roegen) seems appropriate to represent and assess SSE initiatives. However, no study ever attempted to employ this framework to study SSE organizations. Hence: is a Bio-economic informed conceptual framework a consistent epistemology to investigate SSE organizations and their sustainability? To answer this research question, the study explores in a case-study the opportunities and the limits to employ a Bioeconomic informed epistemology to qualitatively assess SSE organizations sustainability. To apply the mentioned epistemology in a qualitative research, a Bio-economic informed framework is proposed: the so-called ‘Agent-Activity-Value’. This outline organizes qualitative data gathered from diverse data sources in order to represent the case-study as a Bioeconomic System performing Bio-economic Processes. The case-study of the Association Sahel Vert in Wittenheim, (France) used. This association practice initiatives, research and education to integrate disadvantaged people into the sustainable development dynamic of the territory. Such Bio-economic investigation highlights how the association is structured according to its rationale. Conclusively, the study proposes insights about the durability of its initiatives contributing to the identification of organization’ sustainability proxies.

Subtheme: Solutions for an urban ecosystem

Justification: The research explores an epistemology to represent and analyze fundamental organizations of the urban ecosystem: those belonging to Third-sector/Social and Solidarity Economy. To detect sustainability within such organization a systemic Bio-economic approach is presented. The research develops as case-study studying a grass-root association targeting integrated development of a marginalized peri-urban territory. Briefly, the study explores the potential of an epistemology that envisions systemic solutions for organizations of urban ecosystems.

Keywords: Social and Solidarity Economy, Bio-economic epistemology, sustainability, systemic approach, case-study

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P85 - WHO IS WHO? Mapping trait variation and developing a digital key for *Draba* sp. in Svalbard

Green entrepreneurship

Janin Salzger¹

Courtney Brooks², Viktorie Brozova³, Maria Dance⁴

¹ University of Copenhagen

² University of Iceland

³ University of South Bohemia

⁴ University of Oxford

Abstract: The last edition of the “Flora of Svalbard” by Rønning came in 1996, but with very few changes from the first edition. The nomenclature is outdated, and new species and locations for rare species have been discovered. Today, the most updated flora available for Svalbard is the web flora: www.svalbardflora.no. This is a good source of information if you know what to look for, but it is lacking a keying system. Further to this, there are still several groups in Svalbard that are hard to key out with a dichotomous key. We are in the process of developing a digital key for *Draba* found in Svalbard using the framework developed within the ArtsApp project. These keys let you select multiple characters simultaneously (polyclave key) with the selection and elimination of traits are in no particular order. This makes more character data available in the key and minimizes the number of steps it takes to identify a plant.

In this project we are focusing on *Draba* because it is an evolutionary young genus with a tendency to hybridize. The features used to distinguish species can be ambiguous. This makes it hard to identify the species and the available keys are not working well. Thus a revision and development of a new key is required. To this end, we are gathering a representative subsample of the *Draba* population through field cruises in Svalbard. We will explore the trait variations and use this information to improve existing keys.

Keywords: taxonomy, biodiversity, *Draba* spp., Svalbard, arctic

Acknowledgements: Pernille Bronken Eidesen, The University Centre in Svalbard
Linn Voldstad, University of Bergen

P86 - Topsoil microbiological characteristics in relation to soil age and climate gradients on the Galápagos islands

Green entrepreneurship

Sebastian Socianu¹

Katharina Keiblinger¹, Franz Zehetner¹, Jirina Szakov², Martin Gerzabek¹

¹ University of Natural Resources and Life Sciences, Vienna

² Czech University of Life Sciences Prague

Abstract: Nutrient availability, decomposition and biogeochemical cycles are linked to soil microorganisms. Today it is crucial to understand how factors like weathering, parent material and climate influence soil microbes. Climate change affects natural and agricultural ecosystems. Research on soil microorganisms on the Galápagos islands is scarce. Hotspot volcanic islands ecosystems like Galápagos are an excellent opportunity to study soil weathering and climate influence of soil microbes.

This study aims to investigate how weathering, elevation and different parent materials influence microbial parameters on Galápagos undisturbed soils. The soils developed on lava flows and scoria deposits form a chronosequence (soil age between 0.97 and 1070 ka). The islands are characterized by a pronounced climatic gradient, with moisture increasing with elevation on the windward slope (elevation sequence). Topsoil samples were taken, extracellular enzyme activities (EEAs) were determined, including carbon, nitrogen and phosphorous acquiring enzyme activities. Moreover, total organic carbon (TOC), nitrogen (TN), dissolved organic carbon (DOC) and mineral N forms analysed. Finally, microbial biomass, basal respiration and substrate induced respiration were evaluated.

Preliminary results show that EEAs and microbial biomass decreased with increasing soil weathering, microbes might be nutrient limited in younger soils. EEAs increased with elevation regardless the parent material, indicating that microbes might be limited in soils with low soil moisture although nutrients are available. TOC and DOC decreased with elevation. TN increased with elevation on scoria while on lava was lower at higher elevations.

Microbial parameters are driven by a multiple environmental factors. While the degree to moisture, temperature and nutrient availability are limiting microbial abundance and activity, is also dependent on parent material and hence soil type. Climate change is likely to affect soils around the world. This research helps enriching knowledge on island terrestrial ecosystems and, hopefully to have a more comprehensive view on volcanic islands soil microbes.

Acknowledgements: I want to thank Katharina Keiblinger for her constant support. Franz Zehetner and Martin Gerzabek for the “once in a life time” opportunity they gave me. Astrid Hobel and Axel Mentler for their precious guidance during the laboratory analysis. I would like to say thank you to all the Galápagos Crew, every minute spent with you is vivid in my memory!

P87 - Beneficial ecosystem services linked to carbon sequestration in agricultural soils

Green entrepreneurship

Lena Bismark¹

Bastian Henriquez Blauth¹, Stefan Vilunger¹, Laurin Zillner¹

¹ University of Natural Resources Sciences and Life Sciences Vienna

Abstract: Justification: The CO₂ content in the atmosphere is increasing by 4.3 billion tons yearly. Organic carbon sequestration in soils could be a way to mitigate this trend with high potential and positive side effects.

Keywords: *Soils, Carbon sequestration, Ecosystem services*

The initiative “4 per mille - Soils for Food security and Climate” (also 4p1000) was launched by the French Minister of Agriculture at the COP21. Its objective is to increase the organic carbon matter stocks in soils by 4 ‰ per year to compensate anthropogenic carbon emissions in the atmosphere.

Against the background of multilateral initiatives like the 4 per mille initiative, in this paper we will discuss and analyse to what extent applying the carbon sequestration strategies influences soil properties and how they are linked with climate change resilience factors. We are going to evaluate how increasing carbon sequestration affects agricultural soils in Lower Austria.

For this cause, we surveyed 4 fields in Lower Austria. We measured the carbon contents of the soils as well as of the plants insitu with a CHNS analysis. Furthermore, we did tests on bulk density, water holding capacity, pH values and a photometrical nitrate analysis.

The field on which unconventional farming methods like no-till and returned crop residue were applied had a higher C-contents compared to the conventionally farmed fields. This underlines the hypothesis that high organic matter input is beneficial for the soils C-stocks. The exact and definitive effect of nitrogen addition on soil microbial biomass and community composition remains unclear hitherto and still needs reliable validation across different ecosystems. Implementing organic cultural methods will have positive effects increasing SOC stocks and will help to prevent nitrate leaching. Enhancing soil organic matter will improve the water holding capacity of soils, which will become an increasingly important factor as strong perception events will occur more frequently due to climate change.

Implementing the 4permille strategy will not only offset carbon in the atmosphere and help to mitigate climate change but will also have positive side effects on a local scale.

Acknowledgements: Rebecca Hood-Nowotny Priv.-Doz. MBA Ph.D.

Solutions for an urban ecosystem

P1 - Consideration of Flora and Fauna at the scoping stage of an Environmental Impact Assessment

Solutions for an urban ecosystem

Christopher Thoma¹

¹ University of Natural Resources and Life Sciences, Vienna (BOKU)

Abstract: The scoping section is the most important part in an Environmental Impact Assessment Report. Its outcome is the identification of key issues and potentially significant environmental impacts by expert opinion, survey and public consultation that should be addressed in an Environmental Impact Assessment. In this thesis a proposed vehicle access between Distillery Fields and Mardyke Parade in Cork, Ireland, is used as a case study in order to analyse the Flora and Fauna issues which must be taken into consideration at the scoping stage of an Environmental Impact Assessment. The investigation site was divided into blocks to display the different habitat types. The flora and fauna present in the study site and the results were determined by a desk-top study, interviews with Cork City Council, the Cork Bat Group and an Irish ecological consultant, Dr. Fennessy. Potential impacts on affected ecological features were examined as well as legislative constraints and possible mitigation measures.

Acknowledgements: In conclusion, the scoping process can be regarded as the most important stage in an

Environmental impact assessment. Its outcome is the identification of key issues and considerable environmental impacts. It was important to stick to the workflow, namely to undertake the desk-top study and to undertake the interviews to ensure nothing is missed.

P2 - An Outlook of Biogas Energy Prospects and Challenges: The Case of Syria

Solutions for an urban ecosystem

Ghaith Hasan¹

Hynek Roubík¹, Jana Mazancová¹, Jan Banout¹

¹ Czech University of Life Sciences Prague

Abstract: The civil war and the strong embargo on Syria have negative consequences for all sectors and affect the country's exploitation of underground energy resources. The low energy quantities production and still increasing demand for reliable energy consumption open potentials for alternative sources of energy. Recent decades have witnessed an increase in the production of organic waste from different agricultural, industrial and domestic sources. However, methods of organic waste management are often ineffective in terms of health, environment and economic sustainability. Biogas production from agricultural and animal waste is considered as one of the appropriate ways for generating renewable environmentally friendly energy in developing countries. The study focuses on the investigation of the feasibility of biogas production from small-scale plants in Syria with its prospects and challenges. The methodology combines primary data collection and the use of secondary sources. The research includes a field questionnaire survey targeting farmers (livestock farmers and Crop farmers) (N= 150) and key local experts (managers of government agricultural units, agricultural research managers and university professors) (N=30) in biogas to get full knowledge about their views on using the technology and their ability to implement it by using stratified random sampling and personal interviews. Although there is a real crisis in the securing of energy resources in Syria, biogas production technology has not been widely deployed yet due to the economic, technical, social, and other causes and difficulties. In spite of the lack of awareness about biogas technology, a large proportion of the survey sample showed interest in biogas technology and willingness to apply it if financial and technical support is provided. The results revealed that the basic conditions of the application of biogas production technology in Syria are available through the presence of suitable quantities of organic waste and the moderate climate in the region.

Keywords: Renewable Energy, Anaerobic Digestion, Organic Waste, Developing Countries, Biogas Technology.

Acknowledgements: Ghadeer Hasan, Nour Hasan, Raed Jafar, Haiyan Sulaiman.

P5 - NEAR-INFRARED SPECTROSCOPY: A TOOL FOR DETERMINING THE NITROGEN STATUS OF HYDROPONICALLY GROWN PLANTS

Solutions for an urban ecosystem

Constantine Gasseholm¹

¹ University of Copenhagen

Abstract: Nitrogen is an essential nutrient for many functions of plants, comprising of 1-5% of plant matter. This macronutrient plays a vital role in attaining adequate growth and development throughout all stages of a plant's lifecycle as it is a key component of chlorophyll, amino acids, nucleobases, and hormone regulation.

The processes that nitrogen and other nutrients contribute to, influence the production of a range of compounds that contain covalent bonds which vibrate and can be detected by near infrared spectroscopy (NIRS). Therefore, NIRS can be used as a tool to indirectly measure nutrient concentrations. This may serve as a valuable tool in hydroponic systems in which nutrient supply can be adjusted to meet plant requirements.

The aim of this project was to induce varying nitrogen concentrations in plants by supplying them with different ratios of nutrient solutions in a hydroponic growth medium and to subsequently investigate the ability of NIR spectroscopy to measure nitrogen status on fresh leaves of plants and evaluate its applicability for predicting nitrogen status in hydroponically grown plants

It was found that measuring NIRS on fresh leaves of tomato (*Solanum lycopersicum*) and basil (*Ocimum basilicum*) plants grown hydroponically under three different nitrogen treatments (control, minus N, plus N), resulted in models that could analyze spectra in the range of 1100-2500 nm and predict whether a sample was a tomato leaf or basil leaf, whether or not it belonged to the nitrogen deficient treatment group, and lastly – it could predict the %N content with an R^2_{cv} of 0.81.

In conclusion, NIRS is a promising tool to use on fresh leaves in order to assess the nitrogen status of a plant. However, further studies should be made on more plant species and different nutrients for it to be a significant sensor in automated hydroponic systems

P6 - Distribution, abundance and ecological specifics of Prague populations of the fire salamander (*Salamandra salamandra*)

Solutions for an urban ecosystem

Anna Filousová¹

¹ Czech University of Life Sciences

Abstract: Due to the high anthropogenic pressure in urban areas, populations of various species are being isolated and hence become vulnerable. This relates also to the fire salamander (*Salamandra salamandra*), in the capital city of the Czech Republic, Prague. In a fragmented environment, populations of salamander can become easily isolated due to their low vagility and high philopatry. There is currently no comprehensive information on the occurrence of this highly endangered amphibian in the capital. There is only information in NDOP Species Occurrence Database. My study contains the addition of data on species distribution in Prague. Based on a study of two Prague salamander populations study includes an estimate of population abundance and demonstrates winter activity at these localities. In literature there are not any information about winter activity of the fire salamander. All these information may help to comprehend the ecological aspects of the fire salamander and based on that help to conserve populations of fire salamander.

Acknowledgements: I would like to express my special thank to my supervisor, doc. Ing. Jirí Vojar, Ph.D. for his patient guidance and useful critiques of my work.

P27 - The impact of urban garden aesthetics on place attachment of non-participants in a neighbourhood

Solutions for an urban ecosystem

Tatyana Dmitrieva¹

¹ Wageningen University & Research

Abstract: Due to rapid urbanization, people experience problems with social integration, and there is a decline in social cohesion. Urban gardens are proposed as a measure for increasing social cohesion of people who participate in gardening. Additionally, there are many other positive effects on gardeners such as increased physical activity, health, well-being, fatigue reduction, relaxation, recreation, and reconnection to nature. However, only a limited number of people can take part in urban gardening and receive all these benefits because the amount of land is not sufficient for everyone. So, the question is how the benefits of an urban garden such as social cohesion and others can be extended to all residents of a neighbourhood. Garden aesthetics affect all people living in the area: they may not be engaged in gardening, they may also not participate in social events and meetings linked to the urban garden, but they definitely can see a garden every day and have some opinions about it. However, there is a lack of research that studies these effects. Thus, the main goal of this paper was to study the impact of urban garden aesthetics on place attachment of non-participants. Two gardens were selected by using the list of 'cues to care' for this purpose. The Q methodology was used to solicit opinions about the importance of garden aesthetics and their influence on place attachment. Three factors with different levels of place attachment were derived by using the tripartite model. The study concludes that there is a correlation between urban garden aesthetics and place attachment which depends on the following criteria: maintenance, diversity of plants, and garden visibility through the window or from the main entrance.

Acknowledgements: Supervisor: Dr. Thomas Hartmann

P28 - Protecting productive land and allowing urban growth? Can we have our carrots and eat them too?

Solutions for an urban ecosystem

Melissa McMullan¹

¹ Lincoln University

Abstract: Justification: In New Zealand, as well as international contexts, there is a tension between protecting productive land and allowing for urban growth. There are political and planning options that exist for managing this tension, however not all of these options naturally fit into the New Zealand land-use planning framework. This research examines what New Zealand, using the Canterbury region as a case study, can do to better manage the tension between protecting productive land and allowing for urban growth.

Keywords: Land-use, planning, peri-urban, agriculture, growth

Abstract: Currently, there is a housing crisis in New Zealand which has seen the creation of the National Policy Statement on Urban Development Capacity (NPS-UDC) in 2016. The NPS-UDC requires local authorities to build into their resource management plans sufficient development capacity, with supporting infrastructure, in order to meet housing demand, and as an extension of that, business needs. However, a large proportion of urban centres are surrounded by the most productive, or versatile, soils. These soils are considered precious as they are located between 1-3 on the Land Use Capability Index. This index indicates that these soils require the least amount of additional inputs such as fertiliser to produce food and can typically produce more crops per year than other areas. As urban centres expand into these productive areas there has been concern expressed by Horticulture NZ that productive land is not being adequately protected. One major issue is that once productive land is lost, it will never be able to be replaced. This loss of available productive land will put New Zealand's domestic and export vegetable and fruit markets at risk. In response to this, a National Policy Statement on Versatile Land and High-Class Soils has been mooted and is being considered at the moment. If it comes into force then it will require territorial and regional authorities to try to give effect to two policies that are conflicting. This research aims to understand how those affected by this tension believe it could be better managed.

Acknowledgements: Dr Suzanne Vallance, Department of Environmental Management, Lincoln University.

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P29 - Territorial study of landscape potential by analysis and factor synthesis of data of territorial analytical data of Rokycansko

Solutions for an urban ecosystem

Jiří Hájek¹

¹ Czech university of Life Sciences Prague, faculty of Environmental sciences

Abstract: I have evaluated the landscape potential for 10 types and 6 kinds of recreation in this thesis. I have used analysis, factor synthesis, description and cartographic visualization of data of territorial analytical materials.

I have added own acquired data to assess the landscape potential.

I have accomplished the assessment of the landscape by programming the toolbox in the software ArcGIS (Modelbuilderu). The Toolbox called: Landscapes_Potencial_DP_Hajek processes a complete synthesis of the insertion of data that must be processed in the data model f. T-Mapy (the latest version 3.4). Other materials must be processed according to the data model in this thesis (Tridnik.xls). The territorial extent in the tool can be changed as is needed, with the chosen input data.

The asset of my thesis is in a comprehensive examination and the maximum utilization of the available materials. This thesis is focused on the evaluation of recreational potential. It has showed the direction of possible development in using materials of territorial analytical materials in any areas. The final outputs represent the potential calculated by the tool from the territorially analytical materials corresponds to the reality.

Note: The tool (method) can be used very well for standardized landscape assessment, not just for recreational potential. For example, to assess sustainable development, disparities in landscaping, site designation, spatial planning, or to evaluate more complex issues of landscape engineering at national level. Thesis was awarded the Dean's Award on 13.6.2019.

Keywords: Territorially analytical materials, analysis of materials, factor synthesis, recreational potential, landscape potential

Acknowledgements: Ing. Lenka Růžičková, Ph.D.,

Ing. Tomáš Kotek, Ph.D

P30 - The role of edible weeds in food security amidst the African herbicide revolution in the Eastern and Southern Provinces of Zambia

Solutions for an urban ecosystem

Alysha Vehre¹

¹ Universität Hohenheim, Universität für Bodenkultur

Abstract: Concern continues to grow for global food security as rates of hunger and malnutrition rise. This trend is especially visible in developing nations like Zambia in which, 37% of the population experiences hunger. Currently, policies for addressing this issue have been directed toward maize production and increasing the use of agrochemicals. Periods of food inaccessibility paired with maize based nutrient-poor diets have resulted in a number of health implications. Edible weeds are often used to supplement diets of smallholder farmers and are typically higher in micronutrients than staple crops. However, growing rates of agrochemicals, specifically herbicides, in sub-Saharan Africa may pose a threat to edible weeds. As agrochemical use is expected to grow, it is important to understand the relevance of edible weeds in food security and how they could be adversely impacted by this trend. The study was conducted in the Eastern and Southern provinces of Zambia. Household interviews, field walks and stakeholder interviews were used to collect data on the types of weeds consumed, household consumption patterns and herbicide adoption rates. The role of agricultural weeds as a source for food is evident as households consumed an average of more than three weed species per household. The trend for consumption was especially high during times of food insecurity. Moreover, these weeds often had additional uses for fodder and medicine. In contrast, it was discovered that 30% of households use herbicides of which over 90% had only begun using them within the last five years. It was found that edible weeds do play an important role for smallholder farmers amidst a growing interest for herbicides, however further information is needed in order to understand how herbicides will affect the usage of these weeds and the people who rely on them.

Acknowledgements: This study was conducted under the supervision of Prof. Dr. Regina Birner and Research Fellow Thomas Daum from Universität Hohenheim as well as Dr. Christoph Shunko from Universität für Bodenkultur. The research and field work were carried out in tandem with Ms. Carolin Schweizerhof, whose project focuses on the knowledge and perception of herbicides and edible weeds in Zambia. In addition, this work was also made possible through the support by the foundation Fiat Panis.

P31 - PHA production from municipal organic waste

Solutions for an urban ecosystem

Vinayak Chabria¹

¹ University of Hohenheim

Abstract: Polyhydroxyalkanoates (PHA) are naturally occurring storage polymers produced chiefly by bacteria that share an optimistic future as a bioplastic due to their biodegradability and potential to be produced from renewable carbon substrates. Currently, a major hurdle to their widespread application is high production costs originating from production methods that are founded on the use of expensive pure microbial cultures. Alternatively, the use of mixed microbial cultures that do not require sterile conditions has been proposed for production and research.

The treatment of municipal organic solid waste has witnessed a paradigm shift in approach from disposal towards the recovery of valuable resources. A pilot plant aimed at converting municipal organic waste into PHA has been jointly commissioned and operated by Orgaworld, Paques BV and Delft University of Technology at the Lelystad Innovation Centre in the Netherlands. The project consists of three major pilot units:

(i) Anaerobic fermentation reactor (ii) Sequential batch reactor (SBR) for selective cultivation of PHA storing bacteria (iii) SBR for PHA accumulation and harvesting.

The anaerobic fermentation reactor serves as the site for hydrolysis where the organic waste is converted into a volatile fatty acid (VFA) rich leachate. This leachate is diluted and subsequently functions as the substrate for the reactor where the selective cultivation and enrichment of PHA producing bacteria takes place. A feast-famine regime of alternating periods of the presence and absence of carbon substrate is implemented in the reactor to selectively enrich the desired bacterial community. Finally, the PHA content of the enriched culture is expanded in the accumulation reactor.

The aim of the pilot is to make evident the economic and technical practicability of producing PHA from organic waste streams. The results of the pilot will be used to inform the future development of a full-scale commercial process.

Justification:

Urban environments produce huge quantities of organic waste and an efficient resource recovery scheme for the generated waste is currently lacking. The production of bioplastics (PHA) from the waste is an innovative and sustainable solution as it is biodegradable and reduces dependence on fossil fuels for plastic production. In addition, the process is closed-loop and can contribute to further the bio-economy.

Acknowledgements: Laurens Welles

Process Technologist and Internship supervisor

P32 - Dog professionals' prevalence of dog neutering advice, their reasons to advise neutering, and their opinions on its effects on health and behaviour

Solutions for an urban ecosystem

Pascalie E.M. Roulaux¹

¹ Wageningen University and Research

Abstract: Neutering dogs is common practice and believed to positively affect their health and behaviour. These claims are generally based on associative evidence and urban legends rather than causal evidence. Consequently, dog owners' decisions regarding neutering could be based on incorrect or incomplete information and neutering may have unforeseen side-effects. What information dog owners receive about neutering their dog from dog professionals is largely unknown. Therefore, we studied professionals' advice regarding neutering and their opinions on its effects. Our online questionnaire was filled in by 53 veterinarians and 75 dog behavioural therapists. We used chi-square tests to determine differences in the frequencies of advising to neuter and found that veterinarians (mean \pm standard deviation = 3.30 ± 0.8 on scale of 0-4) more often than behavioural therapists (1.07 ± 1.0) advise to neuter females ($\chi^2=83.5$, $P<0.001$, $df=4$), whereas both professionals advise to neuter males at the same frequency (veterinarians 1.27 ± 0.7 ; behavioural therapists 1.07 ± 0.7 ; $P=0.193$). We used Restricted Maximum Likelihood models to determine their reasons to advise neutering, which were expressed on five-point Likert scales from not relevant as a reason to advise neutering to main reason to advise neutering. Prevention of health problems was especially important for veterinarians and less so for behavioural therapists, and predominantly mentioned as a reason to advise neutering females rather than males (both P -values <0.05). Correction and prevention of unwanted behaviour were predominantly mentioned as reasons to advise neutering males rather than females ($P<0.05$). Both of these behavioural reasons for neutering were more important for veterinarians than for behavioural therapists ($P<0.05$). Following up on these specific outcomes, we found significant differences between the two professionals' opinions on both the health effects of neutering females and the behavioural effects of neutering males. In both cases, behavioural therapists were neutral about the effects of neutering whereas veterinarians believed these effects to be more positive (both P -values <0.001). We conclude that veterinarians and dog behaviour professionals disagree about the effects of neutering on a dog's health as well as behaviour, which could lead to mixed messages for the dog's owner. Communication between veterinarians and behavioural therapists could conform professional advice on neutering. This would be in the best interest of both the dog and the owner, even though especially the precise behavioural consequences of neutering dogs are currently understudied and far from clear.

Acknowledgements: Bonne Beerda and Ineke R. van Herwijnen

P33 - Can silicon and endophytic *Bacillus* spp. alleviate salinity stress in cucumber seedlings?

Solutions for an urban ecosystem

Nikolaos Kaloterakis¹

Sander van Delden¹, Gerlinde De Deyn¹

¹ Wageningen University and Research

Abstract: Keywords: **cucumber seedlings, salinity, silicon, endophytic *Bacillus* spp.**

Background: As water quality and availability decreases in many parts of the world, salinity is becoming a major abiotic stress factor that reduces yield even in soilless cultivation systems. Both silicon and plant growth promoting bacteria can promote plant health under salt stress conditions. This study was the first to assess the salt stress alleviating effects of independent and combined application of silicon and endophytic *Bacillus* species on 3 week old cucumber (*Cucumis sativus* L.) plants.

Methods: Cucumber seedlings were subjected to salt stress induced by 75 mM NaCl in a newly designed deep water culture system without any substrate. The response of shoot and root growth parameters was quantified following application of 1.5 mM Si in the presence or absence of bacterial consortium comprising of six endophytic *Bacillus* species.

Results: Salt stress resulted in a strong sevenfold decrease in plant biomass (from 3.14 g to 0.41 g). Silicon application resulted in a substantial increase in biomass comparing to untreated plants (from 0.41 g to 1.04 g), significantly alleviating salinity stress and increasing productivity. The beneficial impact of silicon on the growth of salt-treated plants was also observed for plant height, leaf area, specific leaf area as well as specific root length and root volume. The consortium of *Bacillus* species did not exhibit salt alleviating traits in the period of the study and under the current experimental setup using deep-water culture. Significant interaction between silicon and bacteria was not evident in this study, as indicated by the measured plant growth traits.

Conclusion: The beneficial effect of silicon on salt stress alleviation during the early growth stage of cucumber grown in soilless cultivation holds strong implications for its consideration as a vital element for horticultural nutrient solution recipes and therefore, crop production. In soilless cultivation systems where salinity is a yield-limiting factor and silicon availability is low, the addition of silicon is a beneficial agricultural practice.

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P54 - Sublethal effects of Bt on gypsy moth larvae and their natural enemies

Solutions for an urban ecosystem

Lukas Bruckner¹

Christa Schafellner¹

¹ Institute of Forest Entomology, Forest Pathology and Forest Protection, Department of Forest and Soil Sciences, University of Natural Resources and Life Sciences, Vienna

Abstract: Justification: Beneficial insects such as parasitic wasps make a major contribution to pest control in agricultural and forest ecosystems. However, chemical and biological applications have negative impacts on the populations of beneficial insects. Here, we investigated whether the administration of sublethal dosages of *Bacillus thuringiensis* against larvae of the gypsy moth affects survival of the life cycle stages, reproductive capacity, changes in the suitability of the host, and reduced emergence of parasitoids from treated host larvae.

Keywords: XenTari[®], *Bacillus thuringiensis*, parasitic wasp, natural enemies, non-target effects

Batches of third-instar larvae of the gypsy moth, *Lymantria dispar* (Lep. Erebididae) were force-fed with sublethal doses (Bt-0.375 µg/larva=LD₂₀, Bt-0.5 µg/larva=LD₄₀) of *Bacillus thuringiensis* (Bt) subsp. *aizawai* (product XenTari[®]) supplied with diet. Surviving larvae were then used as hosts in a choice experiment with the endoparasitic wasp *Glyptapanteles liparidis* (Hym. Braconidae). In total, 60 five to six days old female wasps were kept in cages together with Bt-treated larvae and untreated controls. For parasitization, each female was exposed to three Bt-0.375 µg larvae, three Bt-0.5 µg larvae and three control larvae (i.e. nine in total). To identify larvae from the three groups, we put a color mark on different sides of the head capsule. After 24 hours, the larvae were removed from the cages, placed individually in Petri dishes and reared in a climate chamber at 24°C under long day conditions until the parasitoid wasps emerged or the host larvae pupated.

In a second set of controlled parasitization experiments, we tested if sublethal Bt doses supplied four days after parasitization affected parasitization rates of the host larvae, numbers of wasps per host, development time of the parasitoids, wasp offspring sex ratio and wasp sizes.

In the choice experiment, parasitization rates in both Bt-treatment groups were equally high as in the control group (60%). The endoparasitic wasps obviously did not discriminate between Bt-treated and untreated hosts. The number of wasps per host larva was not significantly different between all three groups. Hosts surviving Bt treatments had no negative impact on the developing parasitoids.

P55 - The Big Ask for Climate Legislation - Friends of the Earth as Agents of Change

Solutions for an urban ecosystem

Susanne Leona Puhony¹

¹ University of Natural Resources and Life Sciences Vienna

Abstract: After decades of hesitation and doubt, private citizens as well as politicians increasingly seem to see the wicked problem of climate change as the serious threat to human livelihood and civilisation climate scientists make it out to be. These days, civil action is flaring up, with movements such as *Fridays for Future* bringing millions of people to the streets worldwide, demanding action. Since the creation of the United Nations Framework Convention on Climate Change (UNFCCC) and the Intergovernmental Panel on Climate Change (IPCC), the first Conference of the Parties and the approval of the Kyoto Protocol in the 1990s, the field of climate policy has slowly evolved and produced different national and international strategies to govern climate change. In 2008 the UK adopted the first legally binding emissions reduction framework law, the UK Climate Change Act 2008. A major driver of this policy innovation was the “*The Big Ask*” campaign of the environmental NGO (ENGO) *Friends of the Earth* (FoE), mobilizing the public and lobbying the government for a climate change bill. Based on the success of the UK campaign, FoE Europe endorsed national groups of the NGO to run the same campaign in other EU countries as well. Among them were Austria, Belgium, Ireland, and the Netherlands. The present work investigates the design of national Big Ask campaigns and their success to contribute to policy change. The applied theoretical framework is a synthesis of the Multiple Streams Framework and Policy Diffusion Theory to navigate the different aspects of the change process and to analyse the agency of NGOs as change agents. This study aims at providing a better understanding of the role and importance of ENGOs as policy entrepreneurs and representation of civil society and development drivers within the context of climate policy.

Keywords: Climate Policy, Policy Diffusion, Multiple Streams, Friends of the Earth, The Big Ask, Climate Change Act, Policy Change, ENGO, Policy Entrepreneur

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Dr. Sarah Louise Nash (sarah.nash@boku.ac.at)

P56 - The assessment of effects on international agreements and civil pressure on deforestation in tropical countries: the case of Indonesia and Brazil

Solutions for an urban ecosystem

Tereza Lysakova¹

¹ Faculty of Tropical AgriSciences, Czech University of Life Sciences Prague, Kamycka 129, 165 00 Praha 6 - Suchbát, Czech Republic

Abstract: Justification: Fast economic growth of the tropical countries often occurs to the detriment of the environment. Deforestation represents one of the main issues raising concerns on a global level due to its negative impact on the environment and local communities. The research assesses the global agreements, national policies and public pressure groups emerging as a response towards these unsustainable practices.

Keywords: deforestation, sustainable forest management, civil pressure, NGOs

Abstract text:

Economic progress of tropical countries has often prevailed over the environment and sustainable development. Deforestation represents one of the main issues in both case study countries of Indonesia and Brazil. The resulting environmental and social consequences connected with deforestation have recently become a pressing issue on a local as well as global level, especially in relation to its negative environmental impact. Deforestation affects the forest wildlife, causes serious loss of biodiversity and deteriorates lives and health of local people and indigenous communities. The environmental impact connected with forest fires also causes serious water and air pollution. Considering these negative impacts, various global agreements and policies on a national level were established, since the 1992 Earth Summit in Rio de Janeiro, to cease the adverse and unsustainable practices and promote sustainable management of the tropical forests and its protection. Although the situation has improved and the deforestation rates considerably decreased, the destruction of tropical rain forests still occur, despite existence of these policies. The NGOs and civil pressure groups also play an important role in mitigation of deforestation and protection of the environment. NGOs represent a powerful group capable to influence both public and the government sphere and an influential source of research and information. The recent public discussion about the usage of palm oil, about its production or environmental and ethical consequences raising public awareness on an international level, could serve as an example. The main intention of this research is therefore to assess the effects of international agreements and national policies on deforestation as well as an influence of NGOs and civil pressure on the public and policy makers Indonesia and Brazil.

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P57 - Taking uncertainties seriously: An analysis of ecosystem services in Turkey's Lake Eber in the light of anthropogenic changes

Solutions for an urban ecosystem

Zeynep Nur Tasci Nasir¹

¹ University of Hohenheim

Abstract: This presentation analyzes a drying lake in central western Turkey to see how anthropogenic factors influence the ecosystem services and how agents adapt to it. The presentation argues that we need to focus on the uncertainties associated with the anthropogenic changes rather than on the way an ecosystem would deliver its services in a new context in the future. Consequently, though the agents may adapt to such changes, they remain unsure of those uncertainties that emerge either in an unforeseeable way or that generate multiplier effects. The presentation is structured in four parts. Part I introduces the lake that the presentation focuses on and the ecosystem services it has traditionally been providing to the surrounding communities and the wildlife (e.g. reed harvest, fruit growth, fishing and duck hunting, moisture for plants). Part II focuses on the way anthropogenic factors (e.g. over exploitation of water for irrigational activities of farmers, industrial waste discharge into lake from nearby factories) that are causing the lake to dry and the uncertainties this is bringing along in the future use of the natural resource. Part III focuses on the way agents are trying to adapt their practices in order to preempt, neutralize, or utilize such uncertainties. Part IV ends with concluding remarks concerning the importance of focusing on uncertainties in the literature that deals with the future use of changed/deteriorated natural resources.

Acknowledgements: Prof. Dr. Claudia Bieling, Societal Transition and Agriculture, University of Hohenheim

P58 - Synthetic formate assimilation via the reductive glycine pathway in *Cupriavidus necator*

Solutions for an urban ecosystem

Guillermo Bordanaba¹

¹ Wageningen University

Abstract: Over the last decades, there has been an increase in the global energy consumption due to human activity. Land use dichotomy between energy demand and food security has become a major issue. Renewable energy must be captured, stored and dispatched on demand. However, only a feedstock with an almost unlimited capacity and scalability might truly displace fossil carbons. While electrochemical reduction of inorganic molecules enables a highly efficient reduction of CO₂ into simple molecules, microbial assimilation these feedstocks permits a sustainable production of value-added molecules. Formate arises as the most promising microbial feedstock for an integrated process. *Cupriavidus necator*, natural formate tolerant microorganism, harbors a fast and efficient formate dehydrogenase that reduces formate into CO₂ to produce reducing power. Yet, only an ATP-efficient pathway could dislodge the inefficient Calvin-Benson-Bassham cycle route that fixes the CO₂ produced from formate. The reductive glycine (rGly) pathway is the most efficient pathway to support aerobic formatotrophic growth. It is potentially able to support a high biomass yield by reducing and condensing two formate molecules and one CO₂ molecule to generate pyruvate. The glycine cleavage system (GCV) is the central engine of the pathway and it entails a thermodynamic bottleneck. Yet, it is already reported to sustain formatotrophic growth via plasmid-based expression. Only the reduction of formate into glycine has been engineered in *C. necator*. The assimilation of the glycine to produce biomass still has to be fully elucidated and optimized. Genomic engineering of the GCV and a rational engineering of a glycine assimilation route within the rGly pathway are crucial to enable a formatotrophic growth with further industrial applications. In this project, a GCV operon expressed from the genome that sustains formatotrophic growth is presented in *C. necator*. Also, a native glycine assimilation pathway is characterized. This glycine assimilation pathway potentially reduces glycine into pyruvate via production of serine or/and reduces glycine into 3-phosphoglycerate via glyoxylate and glycerate.

Acknowledgements: Nico J. Claassens

Arren Bar-Even

Systems and Synthetic Metabolism group at Max Planck Institute

Natalia Giner Laguarda

Ralstonians

Innovations in the food chain

P13 - Creating fibrous meat-like structures from PPI/pectin systems by simple shear structuring

Innovations in the food chain

Miek Schlangen¹

¹ Wageningen University

Abstract: Justification: My abstract fits the subtheme because with the ever growing world population, and all the accompanied environmental burdens, we need products with an alternative protein source to keep on feeding everyone. Meat analogues, which have an increased consumer acceptance when similar to real meat in structure, are such a product. Therefore, structuring of plant based proteins into meat analogues is an important innovation in the food chain.

Keywords: Meat analogues • High temperature shear cell • Shear-induced structuring • Protein-biopolymer systems • Macro- and microstructure

Abstract: Pea protein isolate with pectin was subjected to shear-induced structuring to understand fiber formation for creation of fibrous meat analogues. We investigated the effect of concentration (1.3 – 4.0 wt.%) of pectin added to pea protein isolate. Microstructural and mechanical properties of the structures obtained were analysed using scanning electron microscopy, X-ray tomography and tensile strength analysis. Pea protein isolate samples with 2.2 and 3.1 wt.% pectin showed fiber formation. However, fiber formation in pea protein isolate/pectin systems was very low in comparison to soy protein isolate/pectin systems. This difference was linked to the viscosity difference between the protein and the pectin phases. Tensile stress and strain analysis revealed that increasing concentration of pectin (1.3 – 4.0 wt.%) weakened the pea protein isolate structure. Anisotropy, as measured with tensile strength analysis, was not linked to fiber formation in pea protein isolate/pectin systems. Coarseness of samples with pectin increased upon higher pectin concentrations, which may be connected to a decreased strength and increased porosity, as measured with the tensile strength and X-ray tomography analyses. Additionally, porosity showed a possible link with fibrous nature as seen in the macrostructure. The concentration of pectin added to pea protein isolate was shown to play a key role in fiber formation through shear-induced structuring.

Acknowledgements: Floor Schreuders and Atze Jan van der Goot

P14 - Use of cricket flour as a substitute of meat in pate.

Innovations in the food chain

Nikodem Dominiak¹

¹ WULS - Warsaw University of Life Sciences

Abstract:

Title: Use of cricket flour as a substitute of meat in pate.

Subtheme: Innovations in the food chain

Justification: Animals breeding emits a lot of CO₂. It requires much space for pastures and consumes plenty of water. Cricket's breeding causes less pollution (greenhouse gases emission), consumes less water, do not need much space and it is highly efficient at feed processing. Therefore it is sustainable source of food.

Keywords: pate, cricket, cricket flour, meat

Main text:

Insects are a well known food in some regions. This little creatures contains plenty of great assimilable proteins which are good source of exogenous amino acids. Moreover, cricket flour is packed with vitamins and minerals such as vitamin B-12 and iron. Some insects are highly efficient at processing what they eat. They present a low risk of transmission of pathogenic infections. Insects produce fewer greenhouse gases and require significantly less land and water than cattle. Growing human population will cause really high demand for food. Feeding such a large population can become a big problem. Using crickets in the food industry is a possibility to solve it.

The aim of the project was to examine possibility of substitute certain percentage of animal meat into cricket flour and check some final product attributes. Research was carried out in three repetitions. The first was a control trial where pate has been made according to industrial production technology. The second one was a product wherein some of the meat has been replaced with soya protein. The last one was similar to previous one but instead of soya proteins, cricket flour was used. For this purpose the texture parameters were measured, the pH values and stickiness of the product were determined.

Acknowledgements: EngD Lech Adamczak

P15 - Assessment of Avenin Polymorphism in Selected Oat Varieties

Innovations in the food chain

Lucie Dostálíková¹

Petra Hlásná Čepková², Iva Viehmannová¹, Václav Dvořáček³

¹ Czech University of Life Sciences, Fac. of Tropical AgriSciences, Dept. of Crop Sciences and Agroforestry, Czech Republic

² Crop Research Institute, Gene Bank, Czech Republic

³ Crop Research Institute, Quality of Plant Products, Czech Republic

Abstract: Oat (*Avena sativa* L.) crop from Poaceae family is cultivated for starchy grains as a fifth cereal in world production. Popularity of oat grains consumption in human nutrition is increasing, thanks to well balanced nutritional composition. Avenins present one of the protein fractions - prolamins, which accounts 5-15% of the total seed proteins. Aim of this study was to characterize and evaluate polymorphism of avenins in oat seeds on the level of single seeds. For the mapping, a wide assortment (127 samples) of current and older registered varieties of oats and nude oats, including significant starting nursery materials was used. Four seeds from each variety were processed separately into single seed samples. The avenins isolation from the seed samples was done with 2-chlorethanol (2-Cl-EtOH) with 2% (w/v) SDS and 0.05% (w/v) pyronin Y. Avenins were then separated by SDS-PAGE method on polyacrylamide 12% (w/v) resolving and stacking gel on vertical electrophoresis. The resulting gels were assessed using two oat varieties (Poncho and Ranch) with defined protein bands as standard. Presence or absence of peptide band on gel was evaluated to create a dendrogram in DARwin programme. The results detected 26 variable bands in position between 20-31 kDa, intra-species polymorphism was also identified in 48 varieties from evaluated collection. The dendrogram outcome from single seed samples clearly showed relatively high polymorphism at the avenin level in tested collection. When comparing the origin of the varieties in individual clusters, it can be seen that it is very diverse; however, varieties with Czech origin were predominantly found in two clusters or they occur close to German varieties in dendrogram. Description of avenin polymorphism can help to determine the authenticity and purity of the seed as well as evaluate a relationship between oat varieties with relation to content of reactive gluten in each variety.

Acknowledgements: *This research was financially supported by the the project NAZV QK1810102 of the National Agency for Agricultural Research of the Ministry of Agriculture of the Czech Republic, and partially funded by the Ministry of Agriculture of the Czech Republic (no. RO0418) and by the Ministry of Agriculture of the Czech Republic, Subsidy Programme - the National Program for the Conservation and Use of Plant Genetic Resources and Agrobiodiversity (no. 6.2.5/51834/2017-MZE-17253).*

P16 - Attempt of microencapsulation of gamma-decalactone synthesized by yeast *Yarrowia lipolytica* W29 in batch culture

Innovations in the food chain

Natalia Górzyńska¹

Jolanta Małajowicz¹

¹ Warsaw University of Life Sciences Faculty of Food Sciences

Abstract: Justification:

Gamma-decalactone, a peach-like aroma compound, is largely applied in food. The production by using extraction from raw materials is not profitable, whereas chemical synthesis does not sit well with consumers' preferences. The research involved a biotechnological production of gamma-decalactone by *Yarrowia* yeast, cultivated in a bioreactor. The lactone was separated from medium by distillation (in articles published so far, concentration was indicated just by using GC). Lactone was also microencapsulated for the purpose of inspected release and application in foods.

Keywords:

Gamma-decalactone, *Yarrowia lipolytica*, bioreactor, batch culture, microencapsulation

Abstract text:

Gamma-decalactone (C₁₀H₁₈O₂) is an intramolecular 4-hydroxydecanoic acid ester. It takes the form of an oily, colourless liquid substance. What is more, its main feature is intense and creamy-peach fragrance, already discernable in very low concentration (approximately 0.088 ppm in aqueous solutions). It appears naturally in fruits and fermented dairy products. Thanks to biotechnological method of synthesis, based on oxidative degradation of fatty acids, the gamma-decalactone has gained the GRAS status and is located on a list of food additive.

In the research, an attempt was made to microencapsulation of gamma-decalactone, obtained by biotransformation of ricinoleic acid mediated by yeast *Yarrowia lipolytica* W29. Yeast multiplication and biotransformation reaction were carried on in the bioreactor, in batch culture, using castor oil as a substrate. For separation gamma-decalactone from the biotransformations medium in a pure form, the steam distillation was carried out. The distillate was extracted by using diethyl ether, then a solvent was evaporated on a vacuum evaporator. Received gamma-decalactone was subsequently subjected to a microencapsulation process by spray drying. The aim of the process of microencapsulation of the lactone was to check the stability and the effectiveness of controlled release in products, in which it can potentially be applied. Controlled in terms of time and place release of the substance improves the effectiveness of food additives, extends the scope of their use and guarantees the optimal dose of the supplement. The obtained results allowed to observe that the release of gamma-decalactone from the culture medium using steam distillation is associated with a partial (about 30%) loss of the product. The microencapsulation efficiency, depending on the carrier substance used and the drying parameters, ranges from 30% to 75%.

P17 - Characterization of the target mechanism on the plant plasma membrane H⁺-ATPase by phytotoxin tenuazonic acid

Innovations in the food chain

Nanna Weise Havshøj¹

¹ University of Copenhagen, Institute of Plant and Environmental Science, Section of Transport Biology

Abstract: The synthetic herbicides that are used today have a negatively environmental impact, finding new sustainable solutions are of great importance. Natural compounds are generally thought of as more environmentally friendly and are often easier degraded in nature. Elucidating and characterizing new natural compounds from microorganisms for herbicides can help create a more sustainable agriculture. Furthermore, can natural compounds be produced through transgene microorganisms in big scale production.

Key words: natural herbicides, plant plasma membrane H⁺-ATPase, phytotoxin, *Stemphylium loti*, tenuazonic acid

The plant plasma membrane (PM) H⁺-ATPase is involved in many vital mechanisms in the plant, such as creating the electrochemical gradient across the PM, stomata opening, nutrient uptake, and cell elongation. It is therefore often a target of pathogenic fungi. Elucidation and characterization of natural compounds produced by microorganisms targeting vital mechanisms in the plant, can potentially be used as natural herbicides or for synthesis of new herbicides. Such compounds could replace chemical herbicides which are used today and help in the creation of a more sustainable future. Fungal extract from phytopathogen *Stemphylium loti* were found to inhibit the activity of the plant PM H⁺-ATPase. Analysis of the fungal extract led to the find of tenuazonic acid (TeA) as a potent H⁺-ATPase inhibitor. The purpose of this project is to characterize the inhibition mechanism of the plant PM H⁺-ATPase by TeA.

Heterologous expression of the *Arabidopsis thaliana* PM H⁺-ATPase, AHA2 and C-terminally truncated mutants, in *Saccharomyces cerevisiae* were used to assay the ATP-hydrolysis of the H⁺-ATPases in dose-response to TeA. *In vitro* results showed that inhibition greatly depended on the autoinhibitory C-terminal of the H⁺-ATPase. The physiological effects of TeA on plant growth showed that seedlings grown on ½ x MS agar with TeA were severely affected even at small concentrations. Root growth were significantly inhibited by TeA, supporting the that TeA could be used as a natural herbicide.

Since *S. loti* is a phytopathogenic fungus, targeting the plant PM H⁺-ATPase by inhibition will result in membrane potential depolarization and eventually necrosis. But the endogenous fungal PM H⁺-ATPase is less affected by TeA, which is likely due to structural differences in the C-terminal regulatory domains. Fungi producing TeA as a toxin during plant infection can therefor target an essential plant enzyme without causing self-toxicity.

NB. I still have 8 out of 12 months left of my master thesis project, so I will hopefully have more results to show in November.

Acknowledgements: Anja T. Fuglsang Peter K. Bjørk

P18 - Determination of polycyclic aromatic hydrocarbons in smoked food of animal origin by application of the combined QuEChERS-EMR-Lipid-DLLME method

Innovations in the food chain

Tereza Slámová¹

Anna Sadowska-Rociek², Adéla Fraňková¹, Magdalena Surma², Jan Banout¹

¹ Czech University of Life Science in Prague

² University of Agriculture in Krakow

Abstract: Smoking is one of the oldest food preserving technologies. It has been used by mankind for over 10,000 years. Smoking is usually used for preservation of fish and its products as well as meat and meat products. The preservation effect is generally attributed to antioxidant and antimicrobial properties of phenolic compounds contained in smoke such as PAHs (Polycyclic Aromatic Hydrocarbons). PAHs transferred to product during food processing can be harmful for consumers, therefore an effective determination method is needed. The aim of this study was to develop an effective sample preparation procedure for the determination of PAHs in smoked fish products. Classical QuEChERS with PSA and C18 sorbents, and procedure with the use of EMR-Lipid material were used as two approaches. Furthermore, two techniques of extract preconcentration: under nitrogen stream and with the use of dispersive liquid-liquid microextraction (DLLME) were compared. The experiment was done using spiked samples of smoked mackerel from market. Sample analysis were done by gas chromatography-mass spectrometry. As a result, we obtained optimised sample preparation procedure composed of three steps: 1) QuEChERS extraction using water and acetonitrile followed by addition of NaCl and MgSO₄, 2) clean-up by EMR-Lipid material and 3) extract preconcentration by DLLME. The recovery rates within the range of 50-120% were received for all compounds with RSD values lower than 16.7% which was in accordance with EU criteria. This proposed method is fast and effective and can be successfully applied for PAHs determination in other heat-treated food of animal origin with high fat content.

Acknowledgements: I would like to address my acknowledgment to my supervisor doc. Ing. Jan Banout, Ph.D. for his leadership and patience. Also, to DSc. Anna Sadowska-Rociek, Ph.D. for her great support and hard work in the laboratory. Last but not least to Ing. Adéla Fraňková, Ph.D. for her logterm cooperation and support in the laboratory, guidance and that she linked me with doctor Sadowska-Rociek. This research couldn't be done without support of Internal Grant Agency within the Faculty of Tropical AgriScience.

P19 - Are Czechs ready to adopt the insects as food?

Innovations in the food chain

Karolína Bartáková¹

¹ Czech University of Life Sciences Prague

Abstract: In the Czech Republic, the people are historically conservative and neophobic. Additionally, the insects are considered to be mainly noxious pests. On the other hand, recent search for alternative protein sources caused an increased interest in entomophagy worldwide and this trend also drew certain attention in this country. To reveal the public opinion on eating insects in the Czech Republic, the online survey of more than 1000 consumers and few hundred visitors of selected food festivals was conducted. The obtained results indicate, that majority of the public have currently no experience with entomophagy and do not even have an interest to try or taste the insects in the future. More than half of the people who tasted insects as food considered this experience as positive; however, only minority of them eat insects regularly. The collected data also showed that the respondents interested in the entomophagy are willing to include mostly processed insects or products containing insect meal in their diet. On the contrary, no interest was generally found in eating whole raw insects. Regarding the species, crickets and locusts seem to be the most favorable insects for the consumption. Whole cockroaches and bugs are then the less popular insects from this point of view. Interestingly, popularity of insects in hidden form was found out to be not species dependent. Finally, almost 80 % of the respondents claimed, that they would accept the meat from the farm animals, which were partly fed by insect meal.

Keywords: Edible insects; Czech Republic; neophobia; novel food; acceptance

P40 - Effect of microwave radiation treatment on the quality of nuts, seeds and dried fruit

Innovations in the food chain

Petra Škvorová¹

¹ Czech University of Life Sciences Prague

Abstract: Fruit, nuts and poppy seeds are a frequent part of our diets. From a nutritional point of view, they contain a great amount of health enhancing substances. However, shelf-life is a big problem during their storage. Preservative treatments are used in order to extend the shelf-life. One of the options is using microwave radiation. The use of microwave radiation in food industry includes drying, pasteurisation, sterilisation, thawing, tempering and baking. The main advantages of microwave radiation are: increased energy savings, shorter processing time and lower operational costs. The main disadvantage is an uneven distribution of temperature. In order to overcome the disadvantages microwave radiation is often combined with other ways of food treatment. The aim of the study was to assess the effect of microwave radiation on dried fruit, nuts and poppy seeds in terms of various qualitative indicators. Resistance to rancidity was measured by acid and peroxide values. Dry matter content was determined gravimetrically, sensory analysis of samples was determined by profiling method. The results showed that the range of changes in foods depends on both the intensity of microwave radiation treatment and the storage time of samples after treatment. The results of sensory evaluation showed no significant negative effect of irradiation on the flavour of treated samples.

Subtheme justification: Microwave treatment is a new industrial physical way of treating foods combining four sanitation effects: disinfection, inactivation of enzymes, disinsection and drying. It includes drying, pasteurization, sterilization, defrosting, tempering or baking of food materials. Microwave drying reduces the drying time and improves the final product quality. Food products cooked in a microwave showed better taste, colour, quality and nutritional value than those cooked by other commonly used methods.

Key words: microwave radiation, nuts, poppy, dried fruit, rancidity, sensory evaluation

Acknowledgements: Thanks to my supervisor Lenka Kouřimská and to Jan Obdržálek and Jolana Trojáčková who contributed to the analyses of the samples. The work was supported by The State Agricultural Intervention Fund, project No. 15/001/16220/563/000008.

P41 - Examination of semi-dwarfing spring wheat cultivars on resistance to Fusarium head blight

Innovations in the food chain

Johanna Binder¹

Luisa Zazzi¹

¹ University of Natural Resources and Life Sciences, Vienna

Abstract: Due to the widespread dissemination and production of mycotoxin, the infestation of wheat with the fungi *Fusarium spec.* represents a worldwide dominating topic in research and crop breeding. Boosted by minimum tillage, unfavourable selection of wheat varieties and pre-disposing environmental constitutions, even the subtle infestation with *Fusarium head blight (FHB)* can lead to uselessness of the grain for human nutrition, feed or seed which causes high economic damage. From an ecological and economical point of view, the breeding of resistance against this crop disease will therefore gain increasing significance.

For this thesis the semi-dwarfing alleles *Rht-B1b* and *Rht-D1b* of the cultivars 'Bobwhite' and 'Monsun' were transferred by backcrossing into the cultivars 'Michael', 'C1', 'CM-82036' and 'E4-61-t' and planted in four repeats in two experiments on the field. During flowering, the ears were inoculated with *Fusarium culmorum* spores. The critical questions are to what extent plant height, anther retention, incidence and *FHB* severity are associated, if the date of flowering has an impact on the infestation and if there are neighbouring effects of short and long genotypes. The aspects anther retention, incidence and *FHB* severity showed pre-dominantly positive correlations and the plant height showed negative ones to the aspects mentioned above. Moreover, it was analysed if there are differences between the genotypes *Rht-B1* respectively *Rh-D1* with the *a* (tall) and *b* (short) alleles within the groups towards the examined aspects. Significant differences were found, but these effects varied in their intensity within the groups. The results show that genotypes with the *b* allele are more in-fested, have a higher anther-retention and shorter plant height than genotypes with the *a* allele. The genotype *Rht-D1b* tend to show the least favourable values to the resistance mechanisms.

Acknowledgements: Univ.Prof. Dipl.-Ing. Dr.nat.techn. Hermann Bürstmayr
Dipl.-Ing. Dr.nat.techn. Maria Bürstmayr

P42 - The utilization of ice as a by-product after freeze drying process in the production of soft and strong alcoholic drink.

Innovations in the food chain

Mikołaj Chomicz¹

¹ Warsaw University of Life Sciences SGGW

Abstract: Keywords: freeze drying, alcoholic drink, waste management, alcohol

Justification: The freeze drying is used as a low temperature drying, that provides a high quality products. Fruits contain a high amount of water, thus during their drying a lot of ice is sublimated. Therefore, the aim of the project was to check if the ice removed from fruits during freeze-drying and the crushed fruits that are waste after the process may enhance the flavour of alcoholic drinks. The ice was be used to dilute rectified spirit instead of water. This modification could be an interesting novelty in the alcoholic industry.

Abstract text: As part of the project, alcoholic drinks were made of different alcohol concentration (13 and 38% vol.) and ice obtained after freeze drying of different plant material. A half of the alcoholic drinks was made with ice after freeze-drying of raspberries or mint, lime and lemon drying (mojito taste). For this purpose, 4 kg of plant material were freeze-dried to obtain the ice. Afterwards, the ice was dissolved in spirit, following by the addition of water to obtain assumed concentration (13 or 38% vol.). The second half of alcoholic drinks was made with spirit-extracted fruits (12.5 g of dried fruits to 1 l of final product) that were collected as a by-product after freeze drying (e.g. crushed, fragmented or stuck). The filtered extract was then mixed with melted ice after freeze-drying to the concentration of 13 or 38% vol. Alcoholic drinks of the alcohol concentration of 13 or 38% were selected as the control samples.

The products that were obtained with ice that was removed during freeze drying, with waste dried fruits and the ice, as well as the control samples were then mark in an organoleptic test by 20 consumers that have evaluated: taste, aroma, and overall acceptance. For this purpose a 5-point scale for every property was used.

Acknowledgements: dr inż. (Eng) Magdalena Dadan
inż.(Eng.) Adam Zalewski

P43 - Food Safety in European Union's eastern neighbourhood: A case study from Moldova

Innovations in the food chain

Gijs Vincent van den Berg¹

¹ BOKU Vienna

Abstract: As part of the Association Agreement signed between Moldova and the European Union (EU) in 2014, Moldova is required to adjust the national food safety legislation to conform with European laws. The EU requires that the competent authority in an exporting country thoroughly monitors compliance of food safety standards by companies operating in that country. In the case of Moldova, the body responsible for food safety is the National Food Safety Agency (NFSA). In 2014, the Agency lacked the capacity to carry out independent controls necessary to meet the EU standards and were therefore not conform the Association Agreement. Once the NSFA can provide is has the capacity to carry out such controls, Moldovan companies can pass the approval procedure for inclusion in the list of countries which can export to the EU without extensive procedures. For Moldova, a country with a large agricultural sector, such agreement can form a stable trade relation with the EU, which can contribute to Moldova's economic growth. Over the past years many capacity development projects to improve the national food safety system in Moldova were launched. For example, the EU launched the EU Twinning Project "Support to the National Food Safety Agency of Moldova". Also, the Food and Agriculture Organisation of the United Nations (FAO), the Lithuanian State food and Veterinary service and the German development agency GIZ have been involved in large projects. However, at this moment very little is known about the effectiveness of the projects to improve the national food safety system and evaluation report have not been published. Moreover, the perceived corruption index (CPI) in Moldova is very high compared to most EU countries and therefore I am investigating to what extend the projects have an actual lasting impact and to what extend the implement legislation is enforced on a local level and how this impacts the food safety of exported goods.

P44 - Exploring the ear posture as an indicator for the emotion of dairy cows

Innovations in the food chain

Shen Dan¹

Louise Kremer¹

¹ Animal Production Systems, Wageningen University and Research

Abstract: Animal emotion plays an essential role for identifying the welfare states of animals. Among all the behavioural measures, ear postures might be practical indicators of the positive/negative emotional state of dairy cows. It is assumed that cows display loose ear postures when they are relaxed, whereas erected ears when they are stressed. Nevertheless, the previous studies on the ear posture of cows find inconsistent results. This might be because the previous studies failed to disentangle the two discrete emotional components: valence and arousal. The aim of our study was to validate ear postures (axial: AX; forward: FW; upright: UP; backward: BW; downward: DW; asymmetric: AS) as indicators of positive and negative anticipation of cows based on the theory of valence and arousal. For this aim, we compared the proportion of ear postures of cows between positive and negative anticipation to the cues during an anticipation test inside a test arena. Cows showed higher proportion of AX and FW ears during positive anticipation, and conversely higher proportion of UP and AS ears during negative anticipation. These results, in combination with previous research findings related to ear posture, suggest that AX ears may indicate positive anticipation, while UP and AS may indicate negative anticipation, and FW ears may indicate high arousal states of cows. However, we did not observe loose ear postures including BW and DW ears, which were assumed to indicate positive emotion with low arousal levels, during the anticipation test. This is possibly because food reward as a positive cue always induced high arousal states, which was not the condition for cows to display the loose ear postures. To conclude, the present study validated the indication of several ear postures, especially the erected ears (UP and FW), for the positive/negative anticipation of cows.

Acknowledgements: I thank Louise Kremer for supervising our experiment and my thesis work, Laura Webb for addressing some statistical issues, and Joop van der Werf for solving some technical issues during the experiment.

P45 - Food Matters: How Food Changes Our Gut Microbiome And Its Role In Alzheimer's Disease

Innovations in the food chain

Julia Haarhuis¹

¹ Wageningen University and Research Centre

Abstract: Alzheimer's disease (AD) is the most common form of dementia and its prevalence is increasing. According to previous research, AD pathogenesis comprises the accumulation of proteins in the brain tissue and neuroinflammation. It is recently found that AD pathogenesis might be influenced by the gut microbiome composition (GMC). Omega-3 poly-unsaturated fatty acids (n-3 PUFAs) are known to maintain a healthy GMC. This indicates that n-3 PUFAs possibly influence AD pathogenesis through the GMC.

The underlying mechanism of how n-3 PUFAs could affect the GMC in a way this delays AD development is still lacking. To clarify how this works, we performed a literature research in several databases with the use of our key words. In addition to our results, we developed a schematic overview of the mechanism, showing how n-3 PUFAs could delay AD pathogenesis through the gut microbiome composition.

According to our results, a shift in the GMC can lead to dysbiosis. Dysbiosis is characterized by gram-negative and noncommensal microbiota. This goes along with increased levels of lipopolysaccharides (LPS) and decreased levels of short-chain fatty acids (SCFAs), called endotoxemia. Endotoxemia activates an innate immune response, possibly leading to neuroinflammation. n-3 PUFAs are shown to promote commensal gut bacteria and a diverse GMC. We found that a diverse GMC and increased levels of commensal bacteria in the gut induce eubiosis, which might be preventive against AD development. Future research could use our results to look further into the possible preventive role of n-3 PUFAs against AD development through the GMC.

Acknowledgements: I want to acknowledge the very helpful contributions of my supervisor Dr.ir. Ondine van de Rest.

P49 - Ethnobotanical study of medicinal plants with antidiabetic activity in Peru, Ecuador and Bolivia.

Innovations in the food chain

Eloy Fernandez Cusimamani¹

Nayla Rodriguez Mora¹

¹ Czech University of Life Sciences Prague

Abstract: In South America, more than 80% of the population makes use of traditional medicine and uses around 3,000 medicinal plants to treat different diseases. About 800 species of plants with antidiabetic properties have been reported based on ethnobotanical studies of medicinal plants worldwide.

This study summarizes knowledge about the management of medicinal plants with antidiabetic activity, within the framework of traditional medicine practiced in three countries of Latin America, Bolivia, Ecuador, and Peru. A list of medicinal plants based on ethnobotanical studies in the traditional medicine of the countries under study and applied to the treatment of diabetes was prepared. The data was obtained from articles, books and other sources on the internet, published between the years 2008-2018.

There were obtained 85 medicinal species distributed among 73 genera and 40 botanical families. The botanical families with the highest representation of species were *Asteraceae* (11 species, 12.9%), *Gentianaceae* (9, 11.6%) and *Fabaceae* (7, 8.2%), followed by three other families each represented by 4 species, as well as three other families each represented by 3 species.

It was concluded that people resort to the use these medicinal plants as part of their family tradition or use it as a strategy to lower costs in the treatment of their disease. However, scientific studies show the antidiabetic properties of most of the most representative species used in the traditional medicine of the mentioned Andean countries.

Keywords: Bolivia, Peru, Ecuador, Diabetes, traditional medicine, medicinal plants.

Subtheme Justification: In simple words, ethnobotanical knowledge is important to produce a more realistic and sensitive understanding and management of natural environmental resources for sustainable development.

P66 - NMR Biomarkers of Cold Stress Resistance in Honey Bees

Innovations in the food chain

Saethyeol Lee¹

¹ Czech University of Life Sciences Prague

Abstract: Justification: This study has found the metabolic differences between honey bees which fell into chill-comas and those who did not fall into chill-comas. This has the application potential for bee keepers who are overwintering their hives and can help sustain a honey bee colony's population over longer periods of time.

Honey bees fall into a comatose state in the ambient temperature ranges of 9 to 12°C with cold death occurring at -2 to -6°C. This study placed honey bees (*Apis mellifera*) into low temperature (7.6°C), and observed honey bees falling into a comatose state. We found that approximately the half of the honey bees fell into a chill coma, and the others did not fall into a comatose state but remaining alert. To determine the metabolic differences between honey bee group which fell into a comatose state and the honey bee group which did not fall into a comatose state, the present study used ¹H NMR spectroscopy to measure the metabolomic responses.

This study detected 11 of significant metabolic features: AMP, acetate, carnitine, glutamine, methylguanidine, NAD⁺, o-phosphocholine, phenylalanine, putrescine, trehalose, and β-alanine. Trehalose, as well as amino acids were higher in both honey bees groups. However, all of the significant compounds in the non-coma honey bee group (except for phenylalanine) was 1.2 times to 2.4 times higher than in the honey bee group which fell into a comatose state. The highest compound was disaccharide, trehalose which is known as a blood sugar compound in insects, and is also an important cryoprotectant for insects. Amino acids, alanine and proline which are typical energy precursors of insects, were not detected in the present study. However, glutamine concentrations were significant in the non-coma honey bees group as well as carnitine which is crucial for fatty acid oxidation.

Key words: Honeybee, *Apis mellifera*, Cold resistance, Chill coma, NMR analysis

Acknowledgements: I would like to offer my gratitude to the faculty and school staff of the Czech University of Life Sciences Prague. I have special thanks for my supervisor Doc. Ing. Jaroslav Havlík, Ph.D., for his support, as well as Pavel Mrňa, Dr. Alberto Jan Ruiz Del Valle, Dr. Martin Kamler.

P67 - mpact of balancing feed rations at medium and large-scale dairy farms in Kenya on milk production and margin above feed costs

Innovations in the food chain

Pierre Pouban-Couzard¹

¹ Wageningen University & Research

Abstract: Commercial dairy farming on medium and large-scale farms (MSFs and LSFs) is a growing activity in Kenya. Imbalanced rations and poor-quality feeds constrain milk production per cow and the profitability of the dairy farm. The objective of this pilot study was to assess the effects of ration balancing on milk production per cow and the margin above feed costs (MAFC) in Kenyan MSFs and LSFs. The so-called Rumen8 nutrition model that predicts milk production per cow and MAFCs based on animal characteristics and ration composition was used. Across 15 farms, cows in early- and mid-lactation were selected. Yields and days in lactation were recorded. Feed quality was estimated based on feed ingredients according to tropical feed tables. Rations were balanced for each farm and, after the implementation of the improved feed diet, milk production data was collected after 30 and 60 days following implementations. Farmers' perception of feed formulation and improved feeding was assessed at the end of the study through individual interviews. The analysis of baseline feeding practices revealed imbalanced rations that are inadequate towards meeting cows' requirements. A word of caution is in place here as the nutrients supplied were calculated from estimated dry matter intakes (DMIs) and nutritive values from the SNV feeding table. The SNV table was populated during 2018 with mean values for about 250 feeds from East African feeding tables. Based on the SNV table and estimated DMIs, mean rations were deficient in metabolisable protein (MP) by 5.6% and in excess of metabolizable energy (ME) by 4.9% ($P < 0.05$). MSFs reflected higher productivity than LSFs and presented tendencies towards 25.5% additional productivity per cow and 65.6% additional MAFC. On balanced diets, average milk yields tended to increase by 15.4% in MSFs and 44.8% in LSFs. MAFC improved by 17.4% and 78.7% in MSF and LSF respectively. The improvements in milk production per cow and MAFC were analysed using a linear regression model. Observed farm results were closer to their potential for milk yields per cow ($R^2 = 0.65$) than for MAFC ($R^2 = 0.43$) ($P < 0.05$). Farmers were generally not able to achieve the potential milk production per cow and MAFC. The majority of the farmers involved in the pilot mentioned that they improved their understanding of feeding and dairy farming as a result of the use of the feed balancing program. The main constraints encountered while aiming to balance the diet were the availability of quality feed ($n = 9$) and feed costs ($n = 3$). The results of the study suggest that diet balancing has the potential to improve milk production per cow and profitability among Kenyan MSFs and LSFs. In order to achieve a sustainable use of nutrition balancing models in Kenya, improving farmers' knowledge and feed quality are needed.

Acknowledgements: Jos Creemers

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P68 - NMR Chemometric Analysis of Czech Wine

Innovations in the food chain

Anna Mascellani¹

Gökçe Hoca¹, Alberto Juan Ruiz del Valle¹, Jaroslav Havlík¹

¹ Faculty of Agrobiological Sciences, Food and Natural Resources Department, Czech University of Life Sciences, Kamýcka 129, 165 21 Prague 6-Suchbátka, Czech Republic

Abstract: Wine is a complex product with qualities attributable specially to variety, fermentation conditions, environment and sensorial properties. Wine is an expensive food product, which is under a strict control of EU or member states legislation. Proper labelling of origin or use of variety and quality labels requires effective analytical methods for control. Nuclear magnetic resonance (NMR) is a powerful spectroscopic method with an application in food fraud control. We acquired spectra of more than 900 wine samples from Salon vín České Republiky that every year select the 100 best wines from all over the Czech Republic. We used 500.23 MHz spectrometer, 1D noesy pulse sequence, 128 scans. More than 30 compounds were assigned using 2D spectral data and Chenomx database. Spectra were phased, baseline corrected, aligned and binned. Non-target analysis was carried out by using MetaboAnalyst software resulting in development of discrimination models (ROC > 0.6) capable of discrimination of red vs. white wines, Czech vs. Moravian wines but also discrimination of some varieties vs. others (e.g. Hibernál or Pinot gris). Additional metadata obtained from Salon vin were correlated with spectral features revealing role of sugar and acids composition in wine quality rating by sensory panel. In conclusion, NMR is a prospective method wine quality assessment.

Acknowledgements: I acknowledge Jaroslav Havlík for the supervision during the project, as well as Gökçe Hoca and Alberto Juan Ruiz del Valle for the help during sample preparation.

P69 - Labelling environmental sustainability of food by novelty “Green-score”. Two case studies on the labelling by PlanetProof and Oatly.

Innovations in the food chain

Luca Blankevoort¹

¹ Wageningen University & Research

Abstract: ABSTRACT

This paper pleads for transparency in the sustainability of food, by means of food product labelling. In this, consumers should see at one glance how (un)sustainable the food product is. First, a review of scholarly literature on environmental sustainability is conducted, considering its assessment criteria and on its relation to climate change mitigation. Then, the paper examines frontrunners in sustainability labelling of food, and outlines how they are flawed, serving as a basis for the proposed improvements in the conclusion. For this, two case studies are conducted on subsequently two organizations that label food products: PlanetProof and Oatly. Firstly, it argues that PlanetProof’s use of a logo as label does not provide transparency on which criteria the product performs well (and which not). Also, it found that PlanetProof’s protocol method allows products to be labelled as ‘planet proof’ even if it performs badly on greenhouse gas emissions, as long as it compromises on another criteria, like biodiversity enhancing. Secondly, it found that Oatly’s use of a [CO₂e] number as a label makes comparison between different products easy, but lacks comprehensiveness on environmental sustainability. On this basis, the novelty is introduced, build on the new “Nutri-score” health label for food: “Green-score”, which makes it possible to see at one glance how (un)sustainable a food product is.

P70 - Impact of sequential above-and belowground herbivory on performance of *Delia radicum* and glucosinolates level in root tissues of *Brassica oleracea*

Innovations in the food chain

Toyanath Joshi¹

Peter Karssemeijer¹, Joop J. A. van Loon¹

¹ Wageningen University and Research

Abstract: Sequences of herbivore induction can influence plant-mediated aboveground and belowground herbivores interactions. Most of the studies are concentrated on the effect of aboveground herbivores on belowground herbivores having the same feeding guilds. Indeed, the different feeding guilds and sequence of herbivores induction can influence the plant-mediated aboveground-belowground herbivore interactions. We investigate whether sequential induction of aboveground leaf chewing, and phloem-feeding herbivores *Plutella xylostella* (Lepidoptera: Plutellidae) and *Brevicoryne brassicae* (Homoptera: Aphididae) may have effects on the performance of the belowground herbivore *Delia radicum* (Diptera: Anthomyiidae) sharing the same host plant *Brassica oleracea* var. *gimmifera*. Furthermore, we investigated the induced responses of the plant due to the mechanism of aboveground-and belowground herbivores interactions and time point feeding of *D. radicum* in *Brassica oleracea* var. *gimmifera* plant. The aboveground specialist herbivore *P. xylostella* had negative effect on belowground herbivore *D. radicum* when it arrives later. Our study indicated that the later arriving herbivores could modify induced plant responses over early arriving herbivore *D. radicum*, and supported the physiological hypothesis overriding effect of *P. xylostella*. The mechanisms of aboveground herbivores *P. xylostella* and *B. brassicae*, and belowground herbivore *D. radicum* interactions showed a positive effect on plant biomass. Moreover, the aboveground-and belowground herbivory significantly increased primary compounds concentration and glucosinolates level. The total glucosinolates induction was recorded almost two-fold compared to herbivores non-exposed plant's roots. Apparently, the level of indole glucosinolates was recorded higher compared to aliphatic and aromatic glucosinolates. Among the types of individual indole glucosinolates, neoglucobrassicin was recorded higher.

Keywords: Above-and belowground interactions, glucosinolates, *Brassica oleracea* var. *gimmifera*, *P. xylostella*, overriding effect

Acknowledgements: **Acknowledgments** We would like to acknowledge the people from the Laboratory of Entomology, Wageningen University Research (WUR). Also, Ms. Julia Friman, Ph.D. candidate, laboratory of Entomology, WUR for her supporting role in data analysis and validation.

P71 - Gluten effect on the gut microbiota in human

Innovations in the food chain

Bc. Petr Šmíd¹

Pavla Bartáková¹, Ing. Ivo Doskočil Ph.D.¹, doc. Ing. Lenka Kouřimská Ph.D.¹

¹ Czech University of Life Sciences Prague

Abstract: Subtheme: Innovations in the food chain

Subtheme justification: Humans are colonized by many microorganisms soon after birth. These microorganisms constitute a human microbiome. The human microbiome consists of many probiotic organisms as *Lactobacillus spp.* and *Bifidobacterium spp.* The gut microbiome plays an important role in the digestion of non-digestive parts of food and in the prevention of many diseases. The microbiome is capable to regulate the human immune system. Probiotics are characterized by some specific properties such as the ability to pass a human gastrointestinal tract without any changes and be able to multiply themselves. The most important ability of probiotics is adhesion on intestinal mucosa cells and also interaction with intestinal epithelia.

Keywords: Gluten; probiotics; adhesion; gut model; *in vitro*.

The ability of adhesion in the gluten enriched environment (in concentrations 5; 2,5; 0,5 µg/ml) was the aim of this study. Tests were made *in vitro* on the colorectal adenocarcinoma cell of colon HT29 and Caco-2. Tested strains were *Lactobacillus plantarum* and *Lactobacillus brevis*. Adheration of *L. plantarum* strain under the gluten enriched environment (concentration 5 µg/ml) was almost by 7 % less, than in the non-gluten environment. *L. brevis* strain adhered better than *L. plantarum* in total and its adhesion in the gluten enriched environment (concentration 5 µg/ml) was even by 4 % higher than in the non-gluten environment. There wasn't shown any significant interference of adhesion ability in this study. However, the study didn't bring information whether gluten can influence the adhesion of tested strains positively or negatively it is evident, that there is a different effect on both strains. *L. brevis* strain showed better adhesion activity than *L. plantarum* in gluten enriched environment. Moreover, our experiment showed that with the decreasing concentration of gluten is the adhesion ability of both strains increasing. Based on our results, *L. plantarum* has lower adhesion ability than *L. brevis* in gluten enriched environment. Our results shown mild effect of gluten on mikrobota adhesion.

P89 - Spatial extent of habitat effects on scavenging rates

Innovations in the food chain

Mithun Samarder¹

¹ University of Hohenheim

Abstract: The ecology of scavenging communities is relevant to understand because these communities play a key role in the overall functioning of an ecosystem and in food webs resilience. The interactions between scavengers and different habitats affect their feeding behavior, their community composition and the competition between these species. Our study analyses the relationship between the spatial extent of forest and meadow habitats, and the scavenging rate. Our initial hypothesis was that the forest area will have a higher scavenging rate, because the structure of this habitat is a suitable living space for many facultative and opportunistic scavengers. However, our results show that scavengers were more efficient in the meadow compared to the forest and the extent of the distance also shows a significant impact on the scavenging rate in both habitats. The ecological significance of our study suggests that scavenging rate is influenced by the type of habitat. Open habitats such as meadows are preferred by scavengers and have a low vegetation height that helps adapted scavengers to detect their food source efficiently.

Acknowledgements: I always wanted to be a student of Landscape Ecology. Unfortunately, I did not get the chance to study my favourite subject at my previous university. Though I completed my bachelor in Agrotechnology but always had the dream to study Ecology. I would like to thank Professor Dr. Frank Schur, who made my dream true by giving the chance to work in Landscape Ecology. I would like to express my greatest gratitude to the entire member who helped me and supported me during my project. Finally, I would like to thank my mother who always encourages me about my work and waiting for me in Bangladesh to see my success.

P90 - The effect of different dietary protein levels on muscle growth dynamics in Nile tilapia (*Oreochromis niloticus*)

Innovations in the food chain

Bart Van Rijn¹

¹ Aquaculture and Fisheries Group, Wageningen University

Abstract: As the demand for agricultural products is expected to rise by 50 percent between 2012 and 2050, more fish will have to be produced in order to feed the growing population. In order to increase the efficiency of this production, more research has to be done on muscle growth dynamics, as little is known about this for a lot of species. Nile tilapia (*Oreochromis niloticus*) is one of those species about which only little is known. That is the reason why, in this study, we wanted to find out what the effect of protein was on muscle growth dynamics in Nile tilapia. 960 fish with an initial weight of 63.4g (SD =1.3) were reared in tanks for 6 weeks and fed twice a day, at a fixed percentage of their body weight, with one of 16 diets containing varying levels of protein and energy. After those 6 weeks, muscle tissue samples were taken from 12 fish (6 from the highest protein-to-energy ratio and 6 from the lowest) and analysed for muscle fibre diameter distribution among the samples. No clear difference could be found in hyperplastic growth, as the percentage of small fibres (<20 µm) was similar among the diets. However, increased numbers of fibres with a diameter between 60 and 70 (P<0.05, one-way ANOVA) and between 70 and 100 µm (P<0.01, Kruskal-Wallis) for the high protein intake diet could possibly indicate a positive effect of protein on hypertrophic growth. More research will be needed to be able to implement knowledge of muscle growth dynamics in practical feed formulation and aquaculture, but these results are a first step in increasing our knowledge on hyperplasia and hypertrophy in Nile tilapia.

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P91 - The impact of ultrasound treatment on maturation of apple brandy alcoholic beverages

Innovations in the food chain

Adam Zalewski¹

¹ Warsaw University of Life Sciences

Abstract: The aging of alcohol is an extremely time-consuming process. During the contact of alcohol with wood, there is an extraction process and a series of chemical reactions resulting in the desired compounds formation responsible for the sensory characteristics. The use of technologies enabling the acceleration of this process seems to be very important, as in addition to obtaining more attractive sensory characteristics in a shorter time, economic benefits are generated, enabling shorter storage and more efficient marketing of the product.

Ultrasound treatment (sonication) is one of the most promising non-thermal methods used to intensify processes based on mass and / or heat transfer. There are reports in the literature regarding the possibility of using sonication to enhance the drying process, osmotic dehydration or extraction of bioactive compounds from plant matrices. Based on the effects that sonication causes, it can be expected that the use of this method will be advisable in supporting the process of maturation of brandy high-alcoholic beverages, which runs in wooden barrels. Therefore, the aim of the project was to check the effects of ultrasound and the mixing process on the extraction of substances contained in wood immersed in a distillate of cider. The test material was a distillate made of fermented apple juice. After the fermentation process, the cider was distilled. The obtained distillate was mixed with distilled water (to obtain a mixture with 40% alcohol content) and oak chips characterized by different roasting level and stored in the dark for two weeks. The product prepared in such a way was cyclically subjected to ultrasound treatment at a frequency of 24 kHz and power of 400 W. Sonicated product was compared to the material that was mixed cyclically and to the sample that was matured without any treatment. The degree of extraction was controlled by measuring the color of the alcoholic drink using CIE L*a*b* system, calculating on the basis of the obtained results the total color change ΔE and by measuring the total polyphenol content by the Folin-Ciocalteu method. The obtained results indicate that it is possible to use ultrasounds to modify the course of the maturation of apple brandy.

P92 - The Superfood Quinoa: Investigating the Bitter and Sweet Quinoa (*Chenopodium quinoa*) for Agriculture in Germany

Innovations in the food chain

Maria Lubkoll¹

Nils Reinosch¹, Sandra M. Schmöckel¹

¹ University of Hohenheim

Abstract: *Chenopodium quinoa* (quinoa) is a pseudo-cereal that has gained much attention in recent years as a superfood because of its beneficial nutritional composition and absence of gluten. However, quinoa seeds have an outer layer of bitter tasting saponins that have to be abraded or washed off with extensive processes before sale and consumption. To date, much of the quinoa is imported for consumption and only minor amounts are produced in Germany and Europe. Naturally occurring accessions of quinoa without saponins (called ‘sweet quinoa’) are existing. So why are these sweet quinoas not cultivated in Germany? We investigate several sweet and bitter quinoa accessions currently grown in a field station at the University of Hohenheim. In the process, we focus on overall growth behavior (such as plant biomass and yield) and test if there is a link with saponin biosynthesis (i.e. secondary metabolism). We also explore other factors that may be limiting the growth of sweet quinoa accessions in Germany, such as bird predation or fungal growth. Moreover, the recently sequenced genome of quinoa allowed identification of the probably causal gene for this ‘sweet’ phenotype. Jarvis et al. (2017) found that this candidate gene encodes a bHLH transcription factor. They hypothesized that a truncation of this transcription factor in the sweet accessions is likely reducing the saponin biosynthesis, therefore causing a ‘sweet’ phenotype. Hence, we test if the sweet accessions used in our study also have this underlying causal gene, which would pose vital information for future quinoa breeding using molecular markers.

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P93 - Selected groups of insects as a valuable part of food chain. Massive production, technology issues.

Innovations in the food chain

Anna Wieczorek¹

¹ Warsaw University of Life Science

Abstract: Food produced from insects is still only a regional product and from the point of view of Europeans treated as exotic, mainly due to bad connotations. Individual species of insects can be a source of valuable protein, fat, vitamins and essential minerals.

In comparison with traditional animal production systems, they have low spatial and breeding requirements as well as high feed conversion efficiency. Insect cultures emit much less greenhouse gases and ammonia per unit of protein produced. Insects should be a safe source of protein in the production of food and feed. There are many commercial farms focused on the production of insects, however, there is a lack of systematized knowledge about the conditions of breeding and conducting safe processing. Due to the great need for manual work, mass production of edible insect proteins in Europe has been expensive and its price is comparable to that of meat. In order to make mass production, in addition to the purchase and consumption of insects, it is necessary to develop breeding and harvesting methods as well as processing technologies, including monitoring the safety and quality of insect production (proteins) to reduce costs and ensure food and feed safety. Consideration should also be given to monitoring processes throughout the distribution, such as controlling the conditions of packaging, storage and transport. Further cost reduction measures include the development of cheap culture media, e.g. from organic waste. The paper presents research on the conditions of conducting and processing selected groups of insects for food purposes and the possibility of using them as desired food products .

Keywords: entomophagy, insect protein, edible insects

Acknowledgements: dr (EngD) Adam Ekielski (project supervisor)

P94 - The application of ultrasounds in yeast dough preparation process

Innovations in the food chain

Maciej Panasiuk¹

Adam Zalewski¹

¹ SGGW/Warsaw University of Life Sciences

Abstract: Subtheme: innovations in the food chain

Justification: throughout the world each bakery use autolyse method in production of yeast cake. Many of them also add powdered enzymes (transglutaminases, proteases, amylases). Despite of it, the dough often lies 12 hours before baking. After that time it is much easier to handle and it has better texture. Ultrasounds applied in this process may improve the texture of the final product and reduce the time of the dough preparation.

Keywords: ultrasounds, yeast cake, enzymatic process in flour

Authors: Maciej Panasiuk, Adam Zalewski

Presentation preferences: poster presentation

The application of ultrasounds in yeast dough preparation process

The autolyse method in the dough preparation is an enzymatic process, which takes place when the dough is resting for a long period of time. That method has a tremendous importance in processing a great variety of yeast doughs as ciabattas, baguettes and pizza doughs. This method is crucial since its application improves the sensory quality of baked goods. In literature there are some reports linked to the possibility of ultrasounds application in order to enhance the heat and mass transfer based processes. Since the yeast dough preparation is a very time consuming process ultrasound may play an important role.

The aim of this study was to investigate the impact of ultrasounds applied during dough preparation on the quality of baked dough. To do that, four samples of dough were prepared. Two of them were treated by ultrasounds for 30 to 60 minutes. At the same time control samples were prepared in the same conditions but without ultrasounds application. Afterwards, the doughs were baked at 260°C, and then all the batches were subjected to textural and sensory properties evaluation.

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