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Session 1 - Circular Economies in Agri-Food Systems at different levels

Convener - Kai Schwaerzel, Bruno Gerard, Mangi Lal Jat, Santiago Lopez Ridaura

Speaker	Titel	Abstract	Kind of presentation
Adrián González Rosell, Maria Blanco Fonseca	**Resilience and circularity in the WEFE nexus: a participatory system dynamics approach**	**The circular economy has become a key piece to achieve sustainable development. Circularity is essential when addressing interdependencies within the water, energy, food and ecosystems (WEFE) nexus. This research develops a participatory system dynamics**	**Oral (normal length)**

		model (SDM) to identify the main interconnections within the WEFE nexus in Andalusia (Spain). In addition, it evaluates how nexus-compliant policies contribute to moving towards a circular economy in this region. Based on stakeholder assessment, the main nexus challenges and policy objectives were identified. Water availability is a limiting factor for food production in the region. Regarding conflicting objectives, significant trade-offs were identified between water saving objectives and energy requirements. Alternative sources of water, such as the reuse of treated wastewater, contribute to mitigating water scarcity, especially in the context of adaptation to climate change. Results show that participatory modelling approaches are essential to design effective policy measures aiming at enhancing resilience and circularity in the WEFE nexus.	
Ana Turetta	**Multifunctionality of agriculture and impacts on the Nexus food, water and energy security**	**By 2030, it is estimated that the world population will be 8.3 billion people, increasing the pression in energy, water, food, land use and mineral extraction, especially in the developing world. These estimates indicate the immediate need to adopt interventions that can minimize these impacts. There is a lot of talk about sustainability, but it is still rare to make the results of integrated evaluations available on various topics. When considering the integrated Nexus Food-Water-Energy (F-W-E) assessment, this fact is even more challenging. Considering the importance of the agricultural sector in Brazil and the existence of areas in different stages of degradation, it becomes strategic for interventions that can generate socio-economic and**	**Poster only**

		environmental benefits and positive impacts to the tripod F-W-E. Thus, the present study is based on the Ribeirão das Lajes dam (RJ), a core area for the water supply of the second largest city in Brazil – Rio de Janeiro. A methodological approach will be developed that will generate an integrated assessment tool to evaluate the impact of agriculture practices in the Nexus F-W-E. Thus, the first stage of the project consists in an expert's consultation. To support the experts, a meta-analysis regarding the performance of different agricultural practices were presented. The results of this first stage were very promising. The project data base was criticized and validated by the experts; a set of landscape attributes as well as the indicators to monitoring it was defined; and, the level of impact of each agricultural practice in F-W-E was established; that's also contributes for a better understanding about resilience of agriculture systems face to climate change. All the information will be used to modelling to generate a decision-making tool, based on the evaluation of a land use intervention - which may be technical or political.	
Edward Yeboah	**Cassava growth and yield as affected by integrated use of organic and mineral fertilizers in the transition savannah zone of Ghana**	**A field experiment was carried out at Nkoranza Technical Institute (N 07°33.086', W 001°42.767') to study the effect of sole application of three different types of organic fertilizers and the integration of their half rates with half dose of recommended NPK for cassava production. The experimental design was Randomized Complete Block Design (RCBD) with three replications using an improved cassava variety 'bankyehemaa'. The treatments consisted of sole application of three**	**Poster only**

		organic fertilizers (Organova, Biodeposit and Cow dung) applied at 100 kg N/ha and the combination of their half rates (50 kg N/ha) with 50-20-20 kg/ha, untreated Control and 100-40-40 kg/ha NPK. The parameters assessed included plant height and stem girth, number and weight of root per plant, root length and diameter, root, leaf and stem biomass yield, incidence and severity of Africa Cassava Mosaic Virus (ACMV) disease and cassava litter (leaf) fall. The data collected were analysed using ANOVA with statistical software Genstat edition 12th at a probability level of 5%. Treatments increased plant height and stem girth significantly with the exception of Biodeposit applied solely or in combination with 50-20-20 kg/ha NPK. The highest stem girth and height were produced by the 100-40-40 kg/ha NPK and 50kg N/ha Organova + 50-20-20 kg/ha NPK respectively. Applying the organic fertilizers either solely or in combination with 50-20-20 kg/ha NPK increased the fresh root weight per plant and root yield significantly. Incidence and symptom severity of ACMV disease were significantly minimal in the applied treatments with the exception of the 100kg N/ha Biodeposit. The application of the organic fertilizers at 50 kg N/ha combined with 50-20-20 kg/ha NPK could therefore be recommended for optimal yields of cassava to cut down on sole dependence on inorganic fertilizer use.	
Helder Araujo	A model of sustainable agriculture landscapes in	Drylands are fragile socio-ecological systems that cover 41.3% of the world's land and are home to 2.1 billion people. These regions are venerable because of the historical and current inadequate land use. As in the	Oral (normal length)

		drylands using nexus approach	**whole world, the major driver of dryland degradation is land-use practices associated with unsustainable agriculture. However, agriculture is essential for economic development and poverty reduction in dryland regions. Therefore, integrative landscape planning is needed to address the challenges in agricultural landscapes, and it can be achieved by combining key ecosystem services with adequate agricultural practices. We investigate how agricultural landscapes produce and keep ecosystem services focused on water, energy, and food together. We first estimate the production of a set of ecosystem services in three types of agricultural landscapes in Caatinga, the largest South America dryland: one that combines conservation and agriculture use, one well-protected, and one degraded. Then, we simulate changes in the structure of these landscapes to see how such changes influence the production of ecosystem services. Our results suggest that ecosystem services associated with the provisioning of groundwater, biomass energy, and food increase together in landscapes up to 50% natural land cover. However, the rest of the landscapes must keep agricultural practices with crop diversity, crop rotations, and mixed farming with crop-livestock systems. Impacted areas must be avoided because at least 12% of this land cover already affect negatively the supply groundwater and food production in the landscape. Policy rules, practices, and incentives must priories planning landscapes focused on interactions between mixed farming and restoration ecology to keep ecosystem services and resilient landscapes. These actions are urgent because many dryland regions**	

		are threatened and might lose their resilience capacity, and consequently, their potential for sustainability.	
Juan José Cadillo Benalcazar	Evolutionary analysis of the role of the agri-food system in human society of Europe: Implications for the circularity, efficiency and sustainability of agriculture	In pre-industrial times, agriculture was the driver of the evolution of human societies. While recycling nutrients in accordance with the pace of natural cycles, it guaranteed a limited surplus for the rest of society. It was Low-External Input Agriculture (LEIA). After the Industrial Revolution, agriculture became the recipient of a great surplus—generated by the urban economy. Its role became to feed cities with high-quality food at an affordable cost. This goal was obtained through large injections of fossil energy inputs, which altered dramatically the density and pace of flows in the agro-ecosystems. It became High-External Input Agriculture (HEIA). In the last two decades, in Europe, the agricultural sector has become a major importer of commodities—predominantly feed for animal production. Those commodities are used not only for domestic consumption but also for export. It is becoming High-External Throughput Agriculture (HETA), in which farmers are becoming increasingly irrelevant. For example, over the last 20 years, while they increased their GDP from agriculture by 3x, the Netherlands lost 25% of their farmers! The 'circularity' in agri-food systems can be studied at three different levels, namely, 'agricultural production', 'the whole food system', and 'international trade'. A novel system of accounting is used in this contribution to characterize two sustainability criteria and identify key sustainability problems in existing agri-food systems: 1. Desirability for urban society: (i) the expected flows of	Oral (normal length)

		food products (quantity) for domestic consumption; (ii) acceptability of the dependence on imports (level of openness) and (iii) stress on rural communities.. 2. Feasibility and viability: (i) environmental pressure matrix—assessing the supply capacity and the sink capacity of the environment, required by agricultural production; (ii) end-use matrix—assessing the profile of production factors in the economy (funds and flows) required by agricultural production.	