BOOK OF ABSTRACTS

I. SESSION DESCRIPTION

ID: S1c

Agroecology and nature-based solutions as transformative pathways towards sustainable agriculture

Hosts:

	Name	Organisation	E-mail
Host:	Mario Torralba Johanna Schild		m.torralbaviorreta@vu.nl johanna.schild@pbl.nl
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Abstract:

The historical pursuit of hyper-efficient and productive goals has trapped European food systems in an unsustainable trajectory, underpinned by inequitable tele-coupled social-ecological dynamics with severe negative impacts on ecosystem services in Europe, and beyond. Some major consequences include a general homogenization of agricultural landscapes, the decline of biodiversity, and the increasing impoverishment of rural communities. Despite policy goals aimed at addressing key issues such as biodiversity loss, water quality degradation, and climate change mitigation, achieving meaningful progress towards achieving these goals remains a challenge within the confines of conventional agricultural paradigms. In this session, we advocate for a transformative shift towards food systems dominated by agroecological principles and nature-

based solutions tailored for farming systems, which could revitalize rural communities while contributing to ecosystem services and food security.

Central to this transformation is the pivotal role of farmers as agents of change. By embracing agroecological principles and nature-based solutions, farmers can catalyze a shift towards environmentally conscious practices, enhancing their resilience and productivity. This transformative potential spans ecological benefits, such as biodiversity conservation and soil health restoration, economic advantages through alternative business models and income diversification, and social gains by fostering community engagement.

In this context, it becomes evident that successful transitions to more sustainable farming practices necessitate a holistic understanding that integrates the ecological, economic and social dimensions.

There are multiple studies and initiatives that could serve as examples of best practice. However, these initiatives are often isolated, and there is not a completely clear overview of how the principles of agroecology are being applied.

By examining both successes and failures, as well as identifying potential blocking factors (ecological, social, economic, political or other), we can develop a more comprehensive understanding of the challenges and opportunities associated with advancing towards a more sustainable agricultural future. These insights not only inform policy-making but also empower stakeholders to navigate the complexities of agricultural transformation with greater efficacy.

Goals and objectives of the session:

By bringing together experts on nature-based solutions, agroecology, ecosystem services and transformative change, the objectives of the session are:

- Facilitate the exchange of knowledge and experiences on agroecology-related research and implementation, showcasing successful case studies and initiatives that demonstrate its transformative potential for supporting ecosystem services.
- Foster collaboration and networking among participants working towards common goals in promoting nature-based solutions and agroecology and sustainable food systems.
- Highlight shared challenges to mainstreaming nature-based solutions and agroecological principles in food systems, as well as opportunities for overcoming them.

Planned output / Deliverables:

Depending on the interest of participants in the session, the session will kickstart the process of working together in a synthesis scientific manuscript focused on the topic of the session

II. SESSION PROGRAM

Room: Expert Street 6

Date of session: 21st of November 2024

Time of session: 11:00-12:30

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
11.00-11.05	Johanna	Schild	PBL Netherlands Environmental Assessment Agency	Session introduction
11.05-11.17	Susana	López Rodríguez	Wageningen University & Research	Diversified agricultural systems as a nature based solution to increase biodiversity and productivity
11.17-11.29	Sophie	Meier	Leinbniz Institute of Ecological Urban and Regional Development	Assessing wild bee habitat from landscape features
11.29-11.41	Jiri	Louda	Jan Evanglista Purkyne University in Usti nad Labem	The farmer's and resident's perspectives on implementation of nature-based solutions on agricultural land
11.41-11.53	Ton	de Nijs	National Institute for Public Health and the Environment (RIVM)	Social cost-benefit analysis of field margins in the Hoeksche Waard, the Netherlands
11.53-12.20	Solen Marjolein	le Clech' Lof	Wageningen University & Research	Co-creation discussion about challenges and opportunities from different perspectives in small groups
12.20-12.30	Mario	Torralba Viorreta	VU University Amsterdam	Wrap-up

III.ABSTRACTS

The first author is the presenting author unless indicated otherwise.

1. Social cost-benefit analysis of field margins in the Hoeksche Waard, the Netherlands

First authors(s): Ton de Nijs
Other author(s): Martina Paulin, Michiel Rutgers, Jasmijn Otte, Remon Koopman
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Field margins are strips of land with grass or flowers on which no crops are grown. They are located between fields or between a field and a ditch. When designed for this purpose, field margins support natural pest control. As a result, there are fewer pests, less crop protection products need to be used, and less of these products end up in ditches. Field margins support the natural control of pests by insects. As a result, fewer pests. The field margins also increase biodiversity and pollination. They also limit the nitrogen and phosphate run off into the ditch. In addition, a more attractive landscape for recreation is created. The European Union wants to encourage the creation of field margins. RIVM has therefore calculated whether the benefits of field margins outweigh the costs over the course of 30 years (2025-2055). This so-called social cost-benefit analysis (SCBA) was done for the Hoeksche Waard because of its large amount field margins. In this SCBA, the effects on eight themes have been calculated. These include crop production, pollination, pest control, water quality, climate, recreation and biodiversity. The benefits of field margins for people, nature and the environment appear to be about the same as the costs. Basically, a more attractive landscape and lower costs for the water board to purify surface water outweigh a smaller cropping area and the costs for farmers to create the margins. Two 'benefits' that cannot be expressed in monetary terms and have therefore been assessed ecologically are also greater with field margins. It concerns biodiversity and the self-cleaning capacity of water and soil. Twelve variants have been calculated for this study in order to be able to take uncertainties into account. Seven of the twelve variants showed higher benefits than costs, such as the effects on health and less crop protection products in ditches, could not be included in this SCBA. If it had, the calculated benefits would probably have been greater. An additional advantage is that field margins along ditches help to achieve the goals of the Water Framework Directive for plant protection products. The costs now lie mainly with farmers and co-financing government bodies. RIVM sees opportunities to create new revenue models in which the costs and benefits are distributed more fairly among the various parties involved.

This can make it more attractive for farmers to build field margins. This SCBA can be used for this.

Keywords: social cost benefit analysis, field margins, functional agrobiodiversity, sustainable agriculture, Hoeksche Waard.

2. Assessing wild bee habitat from landscape features

First authors(s): Sophie Meier
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Pollinating species such as wild bees contribute both to produce crops and to maintain biodiversity and ecosystem functions. Wild bees are strongly linked to diverse landscapes and agricultural intensification is a challenge for them to find appropriate habitat. A wild bee habitat indicator was developed that consisted of a map with the potential spatial distribution of wild bees which is supposed to function as a proxy for the ecosystems' pollination services in Germany (Meier et al. 2021). This indicator was developed based on the ESTIMAP pollination indicator (Zulian et al. 2013). Hereby, experts estimated the habitat quality of different ecosystem types, considering both nesting and feeding opportunities for wild bees.

To validate the ESTIMAP expert assessment, we assessed the link between wild bee occurrence and the proportion of different ecosystem types in studies conducted in Germany and neighboring countries in a meta-analysis. Hereby, we collated results from field studies conducted between 2012 and 2022.

The meta-analysis indicated that semi-natural habitat, groves, and extensive grassland is preferred by wild bees in some cases even for flowering crops. At the same time in crop land, intensive grassland and forest the wild bee abundance and richness is less stable and could fluctuate more strongly during the vegetation season. The meta-analytical results of the field studies go more or less in line with the expert-based assessment of the different potential of ecosystems to provide wild bee habitat and pollination service. Potential research gaps are discussed, as well as limitations concerning generalizing field studies.

In the future, information that could not been assessed in a meta-analysis will be synthetized qualitatively, such as effects of topography on wild bees, small-scale habitat characteristics and

management practices. Furthermore, the results from studies measuring the link between habitat characteristics and pollination service will be collated.

Keywords: Ecosystem service, Spatial analysis, Biodiversity

3. Diversified agricultural systems as a nature based solution to increase biodiversity and productivity

First authors(s): Susana López Rodríguez
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Nature based solutions for agriculture such as diversification provide an alternative to conventional practices that can lead to a transformation towards sustainable agriculture. Diversified systems combining different crops, integrating non-crop vegetation and agroforestry have been proved to increase biodiversity in agriculture. Additionally, because of the diversity of products obtained, diversified systems increase the resilience of farmers against crop failure. However, diverse systems are not appealing to farmers as they have been associated with low productivity. When comparing diversified and simplified systems though, often only the productivity of the main crop is considered, overlooking the diversity of products obtained in diversified systems. The aim of this research is to evaluate the productivity of diversified agricultural systems considering all the products obtained.

We performed a global meta-analysis comparing the productivity of different diversified systems against simplified control systems. We used Land Equivalent Ratio (LER) as an indicator of productivity. LER was developed to measure the productivity of intercropping considering all the products obtained, and we adapted it to apply it to diversified agricultural systems including crop rotation, orchards with herbaceous soil cover, intercropping and different forms of agroforestry. LER measures the relative land needed in simplified systems to produce the same output as diversified systems, that is, it measures the relative productivity of the land.

We found that diversified agricultural systems are in general more productive than simplified systems. All systems but orchards with soil cover (compared to bare soil) needed less land to produce the same output as in simplified systems. Intercropping, crop rotation and alley cropping are significantly more productive than simplified sole systems. Diversified systems are

therefore a nature-based solution for agriculture that not only benefits biodiversity and acts as an insurance against crop failure, but it can also help to improve productivity.

Keywords: Agroforestry, intercropping, crop rotation, productivity, soil cover

4. The farmer's and resident's perspectives on implementation of nature-based solutions on agricultural land

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Long-term pressures on agricultural efficiency, based on synthetic fertilisers, pesticides and intensive technologies, are reducing biodiversity and the ability of landscapes to provide ecosystem services (ES). In the same time the risk of natural hazards due to climate change is increasing and threatening farmers. Changes in farming practices (organic fertilisers, crop rotation, promotion of local production, implementation of nature-based solutions (NBS) can reverse this negative trend. Introducing these changes may increase costs for farmers. Their willingness to make these changes depends on many factors, which are the focus of our research. Perceptions of ES by farmers, and barriers hindering their willingness to implement NBS were studied using semi-structured interviews with farmers, but also the willingness of residents to participate in these changes e.g. by accepting a price increase of agricultural production. Farmers were asked to rank selected ES based on the perceived usefulness for their business. The results show that regulation of hazards and extreme events is of a low priority for majority of them because they value other ES more (production of food; formation/protection of soils). Administrative burden and complicated ownership structure are most important barriers. People's preferences towards sustainable agriculture (including implementation of NBS) were investigated using the choice experiment. We will present the results of the synthesis of the three above mentioned mythological approaches to show the holistic view on the use of ecosystem services concept to foster nature based solutions implementation in agroecology.

Keywords: nature-based solutions; farmers; barriers; interviews; choice experiment