BOOK OF ABSTRACT

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I. SESSION DESCRIPTION

ID: B9

Agro-biodiversity and ecosystem services at work to meet the SDGs

Hosts:

	Title	Name	Organisation
Host:	Ms	Sarah Jones	Bioversity International / King's College London
Host:	Dr	Louise Willemen	University of Twente-ITC
Host:	Dr	Natalia Estrada-Carmona,	Bioversity International / Wageningen University

Abstract:

The Sustainable Development Goals (SDG) are pivoted on the idea that environmental conservation and elimination of poverty and hunger can be achieved in tandem. To meet this ambitious agenda, agricultural landscapes face the dual challenge of increasing food production and societal well-being while reversing the negative impacts of this production on the environment. Agricultural landscapes need to provide multiple ecosystem services (ES) beyond food. Understanding how ES flow across a landscape helps determine where and how far on-farm biodiversity and practices can be managed to boost ES and human wellbeing.

Depending on the presence and management of varieties, species, ecosystem components, ABD can contribute to specific ES at the field, farm and landscape level. As such, changes in ABD will affect ES supply and their beneficiaries. As yet, there is little guidance available for farmers and land planners about how to use agricultural biodiversity (ABD) to ensure nutritive benefits and maintain other ecosystem services (including water regulation, soil nutrient cycling, carbon sequestration, cultural heritage) to achieve multiple SDG targets in tandem. Experiments (e.g. field trials), data mining (e.g. meta-analyses) and models (e.g. maps, role playing games, equations) can help to identify how changes to ABD may affect ES

and therefore potential trade-offs between ES and people and provide guidance on land management (for example which crops, trees, grass to plant where and how).

Goals and objectives of the session:

In this session we aim to stimulate discussion on the status and gaps in knowledge of how to manage ABD to contribute to multiple ecosystem services at different scales (e.g. farm and landscape), in the context of SDG planning in rural areas.

We invite participants from the growing community of science and practice to contribute to this session by sharing evidence, experience, and methods for putting agrobiodiversity to work for a food secure and sustainable future. Participants can contribute through an oral presentation and active participation during the group discussions.

This session is organized in collaboration with:
• ESP Thematic Working Group on Rural Landscapes.
• CGIAR Collaborative Research Programme on Water Land and Ecosystems

Planned output / Deliverables:

• Strengthening the community of practice for researchers working on the ES provided by ABD in rural landscapes for achieving multiple SDGs
• Explore the opportunity for a joint publication of work presented in the session and discussion results (e.g. One Ecosystem, Ecosystem Services)

Related to ESP Working Group/National Network:

Biome Working Groups: B9 – Rural landscapes

Date of session: Thursday, 18 October 2018
Time of session: 8:45 – 13:00

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
8:45–9:00	Sarah	Jones	Biodiversity International and King's College London	**Introduction** to the session
9:00–9:15	Maxime	Fossey	INRA	**Agricultural systems as ecosystem service providers**: from conceptual framework to operational tools in territory planning
9:15–9:30	Sarah	Jones	Biodiversity International and King's College London	Can the **Agrobiodiversity Index** foster more sustainable landscape management for biodiversity conservation and food and nutrition security?
9:30–09:45	Trinidad	del Río	University of Twente	Remote sensing for mapping ecosystem services to support **evaluation of restoration interventions** in rural landscapes
09:45–10:00	Carolina	Montealegre-Talero	Universidade de São Paulo	Landscape structure affects **pollinator and natural enemy spillover**: A meta-analysis
10:00–10:15	Shafique	Matin	Teagasc Food Research Centre	**Mapping High Nature Value Farmlands** to Understand the Attached Ecosystem Services

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Time	First name	Surname	Organization	Title of presentation
11:30–11:45	Moha	Haddouch	UNDP	Enhancing **bee pollination services** to promote sustainable development in the Inzerki traditional apiary space
11:45–12:00	Natalia	Estrada–Carmona	Biodiversity International and Wageningen University	**Water use efficient** and nutritious crops around two reservoir in Burkina Faso: trade–offs and synergies
12:00–12:15	Nina	Hagemann	Helmholtz Centre for Environmental Research – UFZ	Maintaining **soil–related agro**-ecosystem functions and services: Challenges and Opportunities
12:15–12:30	Louise	Willemen	University of Twente	Aggregate effects on ecosystem services from **certification of tea farming** in the Upper Tana River basin, Kenya
12:30–13:00	Louise	Willemen	University of Twente	**Group discussion and session wrap–up**

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III.   ABSTRACTS

The abstracts appear in alphabetic order based on the last name of the first author. The first author is the presenting author unless indicated otherwise.

1. *Type of submission:* **Abstract**

B. Biome Working Group sessions:B9 Agro-biodiversity and ecosystem services at work to meet the SDGs

Remote sensing for mapping ecosystem services to support evaluation of restoration interventions in rural landscapes

First author: Trinidad del Río

Other author(s): Louise Willemen; Andy Nelson; Otto Beukes

Affiliation, Country: University of Twente, Netherlands

Considerable efforts and resources are being invested on implementing a large number of conservation and restoration interventions in rural areas. Satellite Remote Sensing (RS) and Geographical Information Systems (GIS) are powerful tools for ecological and environmental assessments, especially in large and remote areas. We based our research on the rural landscape of the Baviaanskloof Hartland Conservancy, South Africa, where several rehabilitation actions are being implemented to overcome decades of small livestock farming which has led to extensive land degradation. Interventions included revegetating of degraded areas, long term livestock exclusion and essential oil production as an alternative to goat and sheep farming; or a combination of the above. In this study we explored the potential of using Sentinel-2 vegetation indicators combined with GIS data to map ecosystem services in order to support ex-post evaluation of these restoration interventions. We assessed six ecosystem services linked to the objectives of the interventions: erosion prevention; regulation of water flows; climate regulation; biomass for oil production; forage availability; the presence of indicator indigenous vegetation. First, we estimated the ecosystem service supply based on collected field data. Second, we explored the relationships between RS and GIS data with the estimated ecosystem services derived from field measurements. Finally, we compared the provision of ecosystem services between intervened and non-intervened sites using field and remotely sensed based calculations. We found that RS could be used to evaluate restoration interventions when ecosystem services mainly depend on vegetation, such as for soil erosion.

Keywords: Sentinel-2 , Vegetation indices, Indicators, Revegetation

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2. *Type of submission:***Abstract**

Water use efficient and nutritious crops around two reservoir in Burkina Faso: trade-offs and synergies.

First author: Natalia Estrada Carmona
Other author(s): Jones S. , Laporte M.A., Arnaud E.
Affiliation, Country: Biodiversity Interantional and Wageningen University, France

Plant species (herb, shrub and tree) and community traits regulate many agroecological processes (e.g. soil erosion control, soil nutrient cycling and pollinators' habitat), which cascade into the provision of ecosystem services. The linkages between agricultural biodiversity, ecological processes and ecosystem services and trade-offs between production and service outcomes are poorly researched, limiting our ability to guide the selection of species in restoration and tree planting efforts that are fit-for-purpose and persist under local environmental stress factors based on their intrinsic traits. We started filling these knowledge data gap using two case studies in Burkina Faso for traits related to water use efficiency and human nutrition contribution. We identified trait attributes by combining global and regional datasets for all the crops available in current farming systems around two reservoirs, including underutilized crops, shrubs and trees in the region. We used this information to assess the trade-offs and synergies with farm production outcomes associated with crop diversification using nutritious and water use efficient crops, using the whole-farm model FarmDESIGN. Our study shows that few crops are both water use efficient and highly nutritious, but a small number of crops are moderately water use efficient and highly nutritious, or the other way around. Carefully designed diversified farming systems therefore have the potential to help sustainably attain both nutrition and water related goals. Nonetheless, the adoption of moderately to high water use efficient and nutritious crops could lead to trade-offs for farmers. For example, we show increasing the nutritional content can lead to smaller margins from sales due to their relatively low market value. Similarly, some nutritious crops will also potentially demand higher labor inputs which can negatively affect some household members, in particular, women. Our results demonstrate the applicability of harmonizing and compiling global datasets for guiding sustainable agriculture production for livelihoods and nutrition and identifying potential challenges and market opportunities.

3. *Type of submission:* **Abstract**

Enhancing bee pollinsation services to promote sustainable development in the the Inzerki traditional apiary space

First author: Moha Haddouch
Affiliation, Country: UNDP, Morocco

The traditional apiary of Inzerki, the largest of the old collective apiaries in the world, is bearing witness to a real ingenious human civilization, rooted in the tradition which has highlighted for several centuries the Argan tree and the bee colonies associated with it.The transhumance of beekeepers on the inzerki site has several advantages linked to an extended sunshine, an appropriate altitude of nearly thousand meters and a relatively temperate climate.An abundance of melliferous plants, such as thyme, lavender, palm trees, Acacias, Argan and medicinal plants. An isolation that makes it easy to stand guard on the site and the natural regeneration of vegetation makes it an exceptional territory.Howerver, the yellow bee habitat is undermined by extreme weather events exacerbated by climate change and transformative human activities. The circular economy project for the conservation of Agrobiodiversity, in the Souss-Massa region, implemented by the Agricultural Development Agency with the support of the UNDP and the GEF is seeking to implement a management plan that integrates both natural and cultural capital through the establishment of market based instruments to promote pollination of the Saharan yellow bee and conserve biodiversity including : (i) the existing government supported compensation scheme for grazing set-asides in critical forest habitat, (ii) crowdfunding to help investmenting in natural and cultural sites, (iii) monetizing the value of bee pollination and(iv) and valuing the cultural heritage site of inzerki.

Maintaining soil-related agro-ecosystem functions and services: Challenges and Opportunities

First author: Nina Hagemann

Other author(s): Dr. Christian Schleyer

Affiliation, Country: Helmholtz Centre for Environmental Research – UFZ, Germany

Agro-ecosystems provide a broad range of ecosystem services for the well-being of humans. They serve, for example, as a carbon pool, produce biomass, and are of crucial importance for biodiversity conservation. However, these services and the underlying ecosystem functions are endangered due to the increasing pressure on agro-ecosystems, especially soils. Thus, in Europe agricultural, environmental, and rural policies are increasingly focusing on soil protection and measures to preserve ecosystem functions of agro-ecosystems, and thus to ensure the provision of important ecosystem services. They do so by setting financial and other incentives for farmers and other land users to adopt environment-friendly farming practices beyond those legally required. Greening and agri-environmental climate measures of the EU Common Agricultural Policy are examples, but also information campaigns. However, the (cost-)effectiveness of those policies has often found to be low, frequently failing to initiate the intended behavioural change.There is a growing body of literature presenting theoretical and conceptual insights as well as empirical case studies on the determinants for the limited (cost-)effectiveness of those soil-related policies and thus on ways to (better) preserve soil-related agro-ecosystem functions and services. Identifying and analysing these barriers is crucial for designing and implementing policies that will successfully encourage land users to apply sustainable farming practices. Important barriers identified range from economic, ecologic, technical, and administrative reasons. They also include barriers that are difficult to capture and address like cultural aspects, social issues, or personal aspects (e.g., individual perceptions of nature, and objections against changing traditional practices).This paper systematically reviews the relevant academic and grey literature, clusters the determinants into thematic topics, and shows the relevance of those barriers in general, and in different selected European countries in particular. Finally, it discusses the potential of 'nudges' and (other) relevant soil-related policies to effectively address these barriers.

Keywords: Agro-ecosystems, soils, ecosystem functions, policy instruments

5. *Type of submission:* **Abstract**

Can the Agrobiodiversity Index foster more sustainable landscape management for biodiversity conservation and food and nutrition security?

First author: Sarah Jones

Other author(s): Simon Attwood, Roseline Remans, Fred Werneck, Fabrice DeClerck, Christine Negra

Affiliation, Country: Biodiversity International, France

Mainstreaming agricultural biodiversity in food systems contributes to multiple aspects of sustainability and enables policymakers, agri-business leaders, and other decision-makers to make significant progress toward their commitments to the Sustainable Development Goals and the Aichi Biodiversity Targets. Yet despite its importance, the role of agricultural biodiversity in sustainable food systems is still not well understood, data on various elements of agricultural biodiversity are often scattered across disciplines, institutions and databases, and there is no consistent way of tracking it across diets, markets, production, seed and genetic resource conservation systems. We present the prototype version of Bioversity International's Agrobiodiversity Index (ABDI), outline its structure and function, and compare initial ABDI scores for a cross-section of countries and companies. The ABDI is a tool for synthesizing and scoring data on multiple elements of agricultural biodiversity, focusing on the domains of i) markets and consumption, ii) sustainable production and iii) genetic resource use and conservation. The ABDI uses global, national and company level databases and data sources to measure the status of agricultural biodiversity and progress towards managing this sustainably. The ABDI has been designed to help countries to track progress towards multiple Sustainable Development Goals (and their Targets) and Aichi Biodiversity Targets. For instance, the ABDI synthesises data relevant to SDG Targets 2.1, 2.4, 2.5, 6.4, 12.2, 12.6, 15.1, 15.9, and Aichi Biodiversity Targets 2, 4, 7 and 13, and as such can help in orientating policy and practice towards these. We discuss to what extent it could motivate companies, public and private investors to uptake more sustainable practices in agri-food systems, and stimulate collective action towards sustainable landscape management among farmer, retailer and consumer associations.

Keywords: agrobiodiversity, sustainable food systems, biodiversity conservation, SDG

Capturing agrobiodiversity in ecosystem service models

First author: Sarah Jones, Francesco Tacconi

Other author(s): Natalia Estrada-Carmona, Justin A. Johnson, Sylvia L. R. Wood

Affiliation, Country: Biodiversity International / King's College London, France

Ecosystem services from agricultural land are often assessed assuming a single management practice is applied everywhere and without accounting for agricultural biodiversity on-farm, such as hedgerows, cover crops, intercropping, crop rotations and agroforestry. In reality, crops in smallholder farming systems often grow alongside trees and are inter-mixed with other crops in many configurations which lead to a set of diverse outcomes for a wide range of ecosystem services beyond food, such as wildlife connectivity, firewood, forage, pollination. Two key obstacles prevent agrobiodiversity from being better represented in ecosystem service models: i) lack of consolidated understanding of agrobiodiversity effects on ecosystem services, ii) difficulty mapping agrobiodiversity across cropping systems and scales (e.g. field up to national levels). This paper contributes to tackling the first of these obstacles. We present a methodology and results from a systematic literature review documenting the evidence of how selected agrobiodiversity scenarios, including agroforestry, intercropping, and use of cover crops, contribute (or not) to soil erosion control and nutrient retention. We apply the MESH modelling tool in the context of pasture expansion in Tanzania to model the effect of contrasting agricultural biodiversity scenarios on these ecosystem services. Results show there is a notable difference in ecosystem service impacts from incorporating agrobiodiversity into ecosystem service models as compared to business as usual agriculture. However, there is a shortage of comparable studies for many agrobiodiversity scenarios. Further work to capture agrobiodiversity in ecosystem service models will help identify options for achieving multi-functional farms and landscapes.

Keywords: Agrobiodiversity, ecosystem services, MESH

Mapping High Nature Value Farmlands to Understand the Attached Ecosystem Services

First author: Shafique Matin

Other author(s): Stuart Green

Affiliation, Country: Teagasc, Ireland

High Nature Value (HNV) farmland comprises land where agriculture supports, a high level of species and habitat diversity, or the presence of species of European conservation concern, or both. Conservation of natural resources and halting the degradation of ecosystem services are key environmental objectives of the European Union and are priorities in Ireland's National Rural Development Plan for 2014-2020. Précised mapping of HNV farmland distribution for appropriate targeting of conservation measures is thus a prerequisite. In this work, we have proposed a methodology to identify HNV farmlands at parcel scale using object-based geometric shape analysis approach using a SPOT 6 satellite image. Each of the segmented image (multi-resolution) polygons were evaluated for seven geometric parameters (i.e., Perimeter, roundness, boarder index, compactness, texture (GLCM), average length of the edges and number of edges in each polygon). The result suggests a Gaussian distribution of the data where mid-range values generally represents HNV farmlands compared to low and high end values. Such précised HNV farmland map at parcel scale may qualify the purpose of identifying areas with high potential to deliver multiple ecosystem services.

Keywords: HNV farmland, Object based classification, Parcel geometry, GLC

Agricultural systems as ecosystem service providers: from conceptual framework to operational tools in territory planning

First author: Maxime Fossey, Celine Bustany
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Affiliation, Country: INRA, Rennes, France, INRA, Rennes, France

Agricultural systems represent one of the most human-dominated ecosystem and are facing several challenges. Indeed, while agricultural systems are crucial for food security via their major role of providing provisioning services (food, fiber and/or energy), they are increasingly recognized for their role in regulating ecosystem services that are key for human well-being and society at large. Thenceforth, agricultural landscape management must move from the single yield issue towards multiple ecosystem services (ES) provider. This entails a better understanding and quantification of the whole range of agricultural system services, but also an integration of the ecosystem services concept in territory planning. The present work develops a process-based framework of ecosystem services assessment as a tool to support decision-makers in land management and territory planning. The conceptual framework, oriented towards agricultural systems analysis, proposes to disentangle the system into two major components that are soil, as biophysical support of the system, and cropping systems, a major driver of ES supply. Based on the analysis of soil-cropping systems interactions on ES supply, the conceptual framework intends to reach the required holistic approach namely the explicit consideration of soils as an integral component of agricultural systems within a redrawn cascade model and the development of a science-technical knowledge based tool support, decreasing uncertainty of planning outcomes and incenting their implementation in territory planning. The framework was applied to a case study of peri-urban and agricultural areas included in the fast-growing and economically dynamic metropolitan area of Nantes-St Nazaire, France and its use as a decision-support tool is discussed.

Keywords: Soils, Agricultural systems, Ecosystem services, Processed-based assessment, Territory development

Landscape structure affects pollinator and natural enemy spillover: a meta-analysis

First author: Carolina Montealegre-Talero

Other author(s): Andrea Larissa Boesing, Jean Paul Metzger

Affiliation, Country: Departamento de Ecologia, Instituto de Biociências, Universidade de São Paulo, Brazil

Cross-habitat spillover, defined as the movement of individuals between distinct habitat types, is an important connectivity process that can at the same time allow species to survive in fragmented landscapes and contribute in ecosystem services provision. However, the links between landscape structure characteristics and spillover movements are still poorly understood. We performed a meta-analysis of 25 studies and found that multiple landscape features have a strong effect on pollinator and natural enemy spillover movements. Particularly, crop cover and habitat type were key features modulating pollinator movements into crop fields, while habitat and matrix types were important for natural enemy spillover. Those results suggest that landscape complementation processes and edge effects are relevant to explain species spillover movements. Particularly complex landscapes, with soft edges, and higher abundance of natural habitats are more favorable for spillover movements. The great majority of the studies included in this analysis were developed in crops from temperate regions; therefore there is urgent need to develop empirical research in tropical and subtropical regions, where spillover movements can be particularly important to integrate biodiversity conservation with the provision of ecosystem services.

Keywords: agricultural landscape, ecosystem services, pest control, insect pests

B. Biome Working Group sessions:B9 Agro-biodiversity and ecosystem services at work to meet the SDGs

Aggregate effects on ecosystem services from certification of tea farming in the Upper Tana River basin, Kenya.

First author: Louise Willemen

Affiliation, Country: University of Twente –ITC, Netherlands

Agriculture sustainability standards and certification are considered a promising approach to incentivize and support environmental conservation and improved livelihoods in rural areas. However, evidence of impact is limited by methodological challenges that hamper the quantification of certification-induced changes, especially at an aggregate, cross-farm, level. Responding to this evidence gap, this paper aims to estimate the aggregate watershed level changes to ecosystem services from the adoption of Rainforest Alliance tea certification in the Upper Tana River watershed in Kenya. The concept of ecosystem services bridges natural and social systems, and is therefore a suitable measure to evaluate impacts on people and nature with one single measure. In this study we: i) apply ecosystem service models to estimate the effect of adopting farm-level practices prescribed by certification on the watershed-level delivery of selected ecosystem services, and; ii) evaluate the spatial modelling applications for their ability to quantify impact with the objective to guide future decision making. To inform model development and parameterization, we visited tea growers in the study area and collected information on management practices before and after certification. We also evaluated model outcomes for their sensitivity to input data and model choice. We found that adoption of agricultural practices prescribed in the certification standard substantially reduces sediment export into watercourses, with certification resulting an estimated vast reduction of sediment load compared to a without –certification scenario. However, certified farmers' increased use of fertilizer to boost productivity is estimated to result in greater nitrogen and phosphorous loads post-certification.

Keywords: Impact assessment, voluntary sustainability standards, certification, InVEST, SWA