



BOOK OF ABSTRACT

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I. SESSION DESCRIPTION

ID: T10b

Towards multifunctional landscapes – assessing and governing synergies between biodiversity conservation and ecosystem services

Hosts:

	Title	Name	Organisation
Host:	Prof.	Martin Volk	UFZ–Helmholtz Centre for Environmental Research, Department Computational Landscape Ecology, Permoserstr. 15, 04318 Leipzig, Germany
Co-host:		Anna Cord, Inge Liekens, Michael Beckmann	

Abstract:

World-wide increase in human population, market globalization, dietary shifts and urbanization are increasing the pressure on natural resources. The resulting demand-driven land use changes lead to trade-offs between agricultural production, biodiversity conservation and other ecosystem services like clean water, erosion control or soil fertility. Understanding and balancing these trade-offs has a high priority on the policy agenda to promote sustainability and to avoid undesirable societal outcomes. So far, however, we lack the knowledge, empirical



evidence and the tools to support the selection of optimal land use and management strategies while accounting for specific landscape characteristics.

This session seeks for contributions that use indicator-, model- or multicriteria optimization-based approaches to develop land use strategies that mitigate land use conflicts and support synergies between multiple ecosystem services and biodiversity conservation. We welcome theoretical examples as well as applied case studies. Studies should present procedures or tools that: i) disentangle and quantify the multifaceted links between ecosystem services and biodiversity, and ii) support the design and evaluation of policy options that help to reconcile conflicting demands and to ensure the provision of ecosystem services and conservation of biodiversity.

Goals and objectives of the session:

With this session, we aim to bring together an interdisciplinary group of presenters working on the identification and development of land use strategies that minimize potential conflicts and that support synergies between multiple ecosystem services and biodiversity conservation. Specifically, we aim to: i) provide an overview of the variety of approaches to assess trade-offs and synergies, ii) show case studies that develop land use strategies which mitigate land use conflicts and support synergies, iii) connect researchers that develop tools for stakeholders implementing these strategies, and vi) identify research gaps and the road ahead to better inform decision-making in land use and management. This session is strongly linked to the activities of ESP working group TWG 10 – ES in Trade-off analysis & Project evaluation.

Planned output / Deliverables:

Either an open access publication summarizing the state-of-the-art of available methods or a policy brief on suitable policy instruments to reconcile conflicting demands (depending on the content and focus of the presentations). Tools or approaches that are presented in the session will be added to the database for trade-off tools that is in the making for TWG 10.

Related to ESP Working Group/National Network:

[Thematic Working Groups: T10 – ES in Trade-off analysis & Project evaluation](#)



II. SESSION PROGRAM

Date of session: Tuesday, 16 October 2018

Time of session: 8:45 – 13:00

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
8:45–9:00	Martin	Volk	UFZ– Helmholtz Centre for Environmental Research	Towards multifunctional agricultural landscapes: Assessing and governing synergies between food production, biodiversity and ecosystem services
9:00–9:15	Martin	Schönhart	University of Natural Resources and Life Sciences Vienna	Exploring trade–offs and synergies between ecosystem services and biodiversity in an Austrian landscape
9:15–9:30	Paul Eric	Aspholm	NINA	Forest multi–functionality as a framework for cross–sectoral brokerage
9:30–9:45	Michael	Beckmann	UFZ– Helmholtz Centre for Environmental Research	A bird’s eye view over ecosystem services in Natura 2000 sites across Europe
9:45–10:00	Sven	Lautenbach	University of Heidelberg	Trade–offs between carbon storage, crop yield production and water supply at the global scale – comparing different planning horizons



Time	First name	Surname	Organization	Title of presentation
10:00–10:15	Laura	Maebe	Gembloux Agro–Bio Tech, University of Liège	Balancing forest ecosystem services by adapting their management to the forest type and the ecological context: a case study in Southern Belgium
11:30–11:45	Heera	Lee	Karlsruhe Institute of Technology	Trade–offs among cultural ecosystem services, species richness and carbon storage in a multifunctional landscape – a case study in Saxony, Germany
11:45–12:00	Ting	Li	State Key Lab. of Urban and Regional Ecology, Research Center for Eco–Environmental Sciences, Chinese Acad. of Sciences	Bundling ecosystem services for detecting their interactions driven by large scale vegetation restoration: enhanced services while depressed synergies
12:00–12:15	Ana	Portela	Faculdade de Ciências da Universidade do Porto	Freshwater habitat conservation and ecosystem services: searching for common ground to improve river management
12:15–12:30	Julen	Gonzalez–Redin	James Hutton Institute	Exploring sustainable development pathways in debt–based economies: The case for palm oil production in Indonesia
12:30–12:45	Rita	Lopes	CENSE – Center for	Applying dynamic collaborative modelling to inform sustainable



Time	First name	Surname	Organization	Title of presentation
			Environ- mental and Sustainability Research; NOVA University of Lisbon	land use strategies: embracing diversity to tackle ecosystem services conflicts
12:45–13:00				Session discussion and conclusion

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**

T. Thematic Working Group sessions: T10b Towards multifunctional landscapes – assessing and governing synergies between biodiversity conservation and ecosystem service

A bird’s eye view over ecosystem services in Natura 2000 sites across Europe

First author: Michael Beckmann

Other author(s): Christopher Hassall, Bartosz Bartkowski, Anna F. Cord, Andrea Kaim, Michelle Kalamandeen, Patricia Landaverde–González, Joana L.B. Melo, Ralf Seppelt, Caitriona Shannon, Tomáš Václavík, Brenda Maria Zoderer, Yoni Gavish, Lisanne Hölting, Lars Langer, Marija Milanović, Julia Osterman, Sebastian Preidl, Ronny Richter, Yunxia Wang, Guy Ziv

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

The European Natura 2000 network is today the largest coordinated network of protected sites in the world and is considered a huge step forward in the attempt to protect nature and biodiversity. Within the Natura 2000 network, “Special Protection Areas” (SPAs) are designated specifically for the protection of birds, which are often regarded keystone species. At the same time, these SPAs also provide many ecosystem services (ES). We analysed data from 3757 Natura



2000 SPAs and translated positive and negative impacts listed by conservation managers into indicators of the use of nine provisioning, regulating and cultural ES. In a second step, we analysed the conservation status of habitats provided for 486 bird species that occur within the SPAs. We find that, overall, the use of ES is considered by SPA managers to affect conservation goals of bird habitats more negatively than positively. ES associated with livestock keeping and fodder production are recorded as having the highest fraction of positive impacts on SPAs, ranging from 88% and 78% in the Boreal biogeographic region to 20% and 6% in the Mediterranean. The use of ES varied according to dominant habitat class, highlighting the dependence of specific ES on associated ecosystem functions. For instance, fibre production was the predominant ES throughout forest habitats while crop, fodder and livestock exhibit similar patterns of dominance across agricultural landscapes. In contrast, the use of wild food and recreation activities are seen as causing mainly negative effects across all bird habitats. Our analysis suggests that most uses of ES result in negative effects on the conservation goal of protecting bird habitats. Furthermore, we find that intensification of cropland is considered mostly negative for all bird groups. These outcomes should be considered when implementing future conservation strategies.

Keywords: Species conservation, Ecosystem services, Synergies, Trade-offs, Natura 2000, Special Protected Areas

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

T. Thematic Working Group sessions: [T10b Towards multifunctional landscapes – assessing and governing synergies between biodiversity conservation and ecosystem service](#)

Exploring sustainable development pathways in debt-based economies: The case for palm oil production in Indonesia

First author: Julen González Redín

Other author(s): Gary Polhill, Terence P. Dawson, Rosemary Hill, Iain J. Gordon

Affiliation, Country: James Hutton Institute, Aberdeen, UK, United Kingdom

The current debt-based economic system requires the accumulation of more and more debt to finance economic growth, while future economic growth is needed to repay the debt ultimately. And so the cycle continues. This paper explores the environmental impacts of the debt-growth cycle in Indonesia, the world's largest debt-based producer of palm oil. Our empirical Agent-Based Model analyses the future effects (2017–2050) of power relations and imbalances



between debt-driven economic forces (i.e. banks, firms) and conservation forces on two ecosystem services (ES) (food production, climate regulation) and biodiversity. The model shows the extent to which Business As Usual and alternative scenarios enhance trade-offs and synergies among these indicators. The exception is found under specific policy and governance contexts, which enhance synergies between crude palm oil production, CO₂ emissions and biodiversity. Our analysis suggests a lesson for developing countries facing issues with land-use conflicts and ES trade-offs: ES synergies under sustainable development pathways are potentially achievable; yet, this requires a shift in economic capitalist forces to partially support environmental conservation, as well as to reinforce the state's role in protecting the environment.

Keywords: social-ecological system, ecosystem services trade-offs, debt, governance, Agent-Based Model.

3. *Type of submission: Abstract*

T. Thematic Working Group sessions: [T10b Towards multifunctional landscapes – assessing and governing synergies between biodiversity conservation and ecosystem service](#)

Trade-offs between carbon storage, crop yield production and water supply at the global scale – comparing different planning horizons

First author: Sven Lautenbach

Other author(s): Anita D. Bayer, Almut Arneth

Affiliation, Country: GIScience group, University of Heidelberg, Germany

We analyzed trade-offs of different land use options with respect to three ecosystem services (carbon sequestration, food provisioning and water provisioning) at the global scale. Thereby, we want identify possible pathways to reach three related SDGs. The LPJ-GUESS dynamic vegetation model is used to simulate the ES provision of global land under different allocation of land use (potential natural vegetation and 4 major crop types) considering climate, atmospheric CO₂ levels, irrigation water availability, and the distribution of protected areas. A multi-objective genetic algorithm has been used to identify Pareto-optimal solutions with respect to the three objectives and constraints in form of protected areas and biophysical limits of the different crops. The analysis is performed at a 1°x1° grid cell resolution for three time horizons current, short term planning and long term planning horizon. The optimization approach takes



the current level of ecosystem service provisioning as a constraint into account. Results indicate a potential for a simultaneous increase of all three services. Spatial patterns of land use for the solutions have been analyzed by means of a cluster analysis.

Keywords: carbon sequestration, land use, scenario analysis, trade-off analysis, optimization

4. *Type of submission:* **Abstract**

T. Thematic Working Group sessions: T10b Towards multifunctional landscapes – assessing and governing synergies between biodiversity conservation and ecosystem service

Trade-offs among cultural ecosystem services, species richness and carbon storage in a multifunctional landscape – a case study in Saxony, Germany

First author: Heera Lee

Other author(s): Sven Lautenbach

Affiliation: Institute of Meteorology and Climate Research, Atmospheric Environmental Research (IMK-IFU), Karlsruhe Institute of Technology (KIT), Garmisch-Partenkirchen, Germany

The Free State of Saxony aims at expanding the forest cover by afforestation programs. Such afforestation programs will have different impacts on multiple ecosystem services causing trade-offs or synergies between them. Understanding the relationships among multiple ecosystem services is a pre-requisite step to address proper policy implications. In this study, we investigated relationships among cultural ecosystem services (i.e., observation of organisms and landscape aesthetics), biodiversity (i.e., plant species richness (including all plant, indigenous, archaeophytes, neophytes, threatened, wind-pollinated, self-pollinated and insect-pollinated species) and butterfly richness) and carbon sequestration (i.e., current carbon pool) in the Mulde basin in Saxony, Germany. We analysed the relationships between the different indicators based on correlation analysis and principal components. Our results showed mixed relationships between biodiversity and cultural ecosystem services. Butterfly species richness appeared to be positively related with both cultural services. Plant species richness was, however, not clearly related to the observation of organisms. Carbon sequestration showed low correlations with cultural services indicators. The first principal component represented mostly the plant species richness indicators, while butterfly species richness and the two cultural services were most important for the second principal component. Cultural services were mostly orthogonal to the plant species richness indicators. These results provide essential information for spatial



planning. For areas with high butterfly richness and cultural services, conservation programming seems a development option, but negative feedbacks of higher visitation rates should be taken into account.

Keywords: Cultural ecosystem services, trade-off analysis, carbon sequestration, species richness, spatial planning

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

T. Thematic Working Group sessions: [T10b Towards multifunctional landscapes – assessing and governing synergies between biodiversity conservation and ecosystem service](#)

Bundling ecosystem services for detecting their interactions driven by large scale vegetation restoration: enhanced services while depressed synergies

First author: Ting Li

Other author(s): Yihe Lü, Bojie Fu

Affiliation, Country: State Key Laboratory of Urban and Regional Ecology, Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences, China

Bundling ecosystem services gives us a comprehensive understanding of multiple services in landscape-scale, which is useful for delineating the clustered distribution of services and informing the potential impacts of synergies and trade-offs to policy-makers. Although the spatial distribution and interactions of bundle types have been detected in several researches, there is little understanding of changes of spatial clustering in ecosystem service and how the tradeoffs or synergies shift over time. Here, we conducted a case study in the Loess Plateau, the core area of vegetation restoration of China, to explore changes of spatial distributions, bundle types and interactions of multiple services in a rapid restoration period from 2000 to 2015. Comprehensive methods including measurable proxies, biophysical indicators and the InVEST model were used to quantify 10 ecosystem services in this research. We found (1) ecosystem services were generally improved, especially in provisioning services and carbon sequestration. (2) Spatial clustering analysis revealed changes of clustered distribution patterns and bundle types. Firstly, a more evident aggregation of ecosystem service bundles in cities was observed in 2015. Secondly, each cluster was characterized by a high value most regulating services although the provisioning services were improved, implying the increment of heterogeneity among services. (3) Trade-offs between ecosystem services occurred more frequently, which was observed between regulating services. However, the synergies were weakened to some



extent, which was mainly concentrated in provisioning and regulating services. The research gives us a better understanding of the interactions between multiple services in a restoration landscape. Ecological restoration programme plays an important role in the enhancement of ecosystem services, which however, could lead to the expanding gaps between services. This should be taken into consideration in further landscape-scale ecosystem service management, that how to improve the services as well as mitigating potential trade-offs and facilitating synergies.

Keywords: ecosystem service bundles, changes, synergies and trade-offs, comprehensive assessment, ecological restoration

6. *Type of submission: Abstract*

T. Thematic Working Group sessions: [T10b Towards multifunctional landscapes – assessing and governing synergies between biodiversity conservation and ecosystem service](#)

Applying dynamic collaborative modelling to inform sustainable land use strategies: embracing diversity to tackle ecosystem services conflicts

First author: Rita Lopes

Other author(s): Pedro Clemente, Nuno Videira, Rui Santos, Paula Antunes

Affiliation, Country: CENSE – Center for Environmental and Sustainability Research – NOVA School of Science and Technology – NOVA University Lisbon, Portugal

Sustainable tourism activities have been growing in recent years with different niches emerging and attracting more conscious and demanding tourists. These new tourism models benefit from the ecosystem services (ES) provided by natural areas and call for strategies that are capable to preserve these services and accommodate all the associated complexity. Different authors have been working on one hand, in the development of integrated participatory modelling processes, where different value dimensions of ES could be articulated to support decision-making processes. And on the other hand, other research work has been highlighting the importance of mapping ES through participatory processes to inform policies. Building upon these approaches, this research proposes the combination of a System Dynamic Model (SDM) that considers behavior over time and multidimensions of ES, with GIS approaches to include territorial specificities, in a collaborative platform. This work aims to foster a more equitable and sustainable management of ES, allowing to test policy alternatives according to landscape characteristics and social dynamics to understand possible pathways to achieve a desired future



vision. This process is being tested in Southern West of Portugal, where a tourism network, Association Rota Vicentina (ARV) aims to manage and promote nature tourism in the region, local communities' engagement along with the preservation of natural resources as a sustainability model for local economy. A collaborative process engaging key stakeholders has already been taking place and will feed the proposed approach with results from a) a participatory mapping of ES provided by the area; b) structured interviews to local businesses; c) a visioning workshop. Distinct services are delivered by this area with different intensity throughout the territory, calling for methods that capture time and space features contributing for tailored made policies according the regional specificities that potentiate synergies among multiple ES, and identify and mitigate potential conflicts.

Keywords: Collaborative dynamic modelling, Multimethod approach, Tailored made strategies, sustainable tourism

7. *Type of submission:* **Abstract**

[T. Thematic Working Group sessions: T10b Towards multifunctional landscapes – assessing and governing synergies between biodiversity conservation and ecosystem service](#)

Balancing forest ecosystem services by adapting their management to the forest type and the ecological context: a case study in Southern Belgium

First author: Laura Maebe

Other author(s): Hugues Claessens, Marc Dufrêne

Affiliation, Country: Management of forest resource Laboratory, Department of Biosystem Engineering, Faculty of Gembloux Agro–Bio Tech, University of Liège, Belgium

Trade-offs between wood production and other ecosystem services (ES) are common. Understanding these trade-offs is a first step to ensure a balanced supply of ES from forests to society. Only few studies, however, consider the influence of the management and the ecological context such as the topography or the type of soils on these trade-offs. We, therefore, assessed the impacts of management and the ecological context on the supply of ES and their trade-offs. The assessment focused on six ES (wood production, carbon sequestration, flood and erosion control, clean water, recreation) based on an improved Burkhard's matrix (Burkhard et al., 2009). We considered two types of forest with contrasting management and six types of ecological context ranging from productive soils to more restrictive sites and less productive soils. This matrix was applied on one hand, to map the supply of ES in four



municipalities in Southern Belgium and on the other hand, to investigate the impacts of three scenarios (i.e. three different management strategies) on them. The improved Burkhard's matrix showed that the differences among ES vary depending on the forest type and the ecological context. Trade-offs appeared only in some combinations of forest and soil type. The maps of ES allowed identifying the hot (synergies between ES) and cold (trade-offs between ES) spots in the territory. The changes in ES supply among the three scenarios and the current supply were quantified to identify the best management options. In conclusion, a forest is not like another in terms of the trade-offs among ES. Depending on their type, ecological context and management strategy, they provide different sets of ES. This heterogeneity is important to map to identify the hot and cold spots and to take actions in these specific areas (i.e. the cold spots) to ensure a balanced supply of ES.

Keywords: Forest, management, ecological context, trade-off, ecosystem services

8. Type of submission: **Abstract**

T. Thematic Working Group sessions: [T10b Towards multifunctional landscapes – assessing and governing synergies between biodiversity conservation and ecosystem service](#)

Freshwater habitat conservation and ecosystem services: searching for common ground to improve river management

First author: Ana Paula Portela

Other author(s): Cristiana Vieira, Cláudia Carvalho-Santos, João Gonçalves, Isabelle Durance, João P. Honrado

Affiliation, Country: Faculdade de Ciências da Universidade do Porto and CIBIO-InBIO – Centro de Investigação em Biodiversidade e Recursos Genéticos, Portugal

River ecosystems provide key goods and services to human societies such as water, energy, food or recreation. Despite this, river ecosystems are among the most threatened worldwide. Unprecedented pressures endanger freshwater biodiversity and compromise the supply of ecosystem services (ES). In this context, it becomes increasingly important to articulate conservation and management strategies in freshwater ecosystems to ensure biodiversity conservation and ES supply. In this study we aim to investigate the spatial coincidence between river habitats of high conservation value and the supply of key freshwater ES, in Northern Portugal, to outline guidelines for improved river management. Two freshwater habitats protected under the European Union's Habitats Directive were assessed: 91E0* – Alluvial forests



with *Alnus glutinosa* and *Fraxinus excelsior*, and 3260 – Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitriche–Batrachion* vegetation. The spatial distribution of these habitats in the study area was assessed from official cartography and modelled with the species distribution modelling (SDM) package *biomod2* in R. The focal ES were water supply and sediment retention, assessed through the corresponding models in *INVEST*. Spatial coincidence between habitat occurrence and ES supply was assessed through overlap and correlation analyses. We found a spatial resolution mismatch between the publicly available habitat distribution datasets and the relevant resolutions and scales for ES modelling. However, we were able to bridge the gap between the two datasets, by modelling the potential distribution of the target habitats for the study region with an SDM approach. Our results suggest high spatial congruence between the supply of the focal services and habitat occurrence in mountain areas of the study region, highlighting the need to protect and sustainably manage mountain rivers and upper catchments. We outline management guidelines linking to the relevant scales and policy/planning instruments.

Keywords: alluvial forests, aquatic vegetation, Habitats Directive, sediment retention, water yield

9. Type of submission: **Abstract**

T. Thematic Working Group sessions: [T10b Towards multifunctional landscapes – assessing and governing synergies between biodiversity conservation and ecosystem service](#)

Exploring trade-offs and synergies between ecosystem services and biodiversity in an Austrian landscape

First author: Martin Schönhart

Other author(s): Katrin Karner, Erwin Schmid

Affiliation, Country: University of Natural Resources and Life Sciences Vienna, Institute for Sustainable Economic Development, Austria

Competing private and societal demands on particular ecosystem services (ESS) and ecological functions typically create land use conflicts in rural landscapes. We present stakeholder driven land use scenarios that consider the two opposing land use strategies land sharing (LSH) and land sparing (LSP) and a balanced scenario (BAL) for the Austrian Mostviertel region. LSH describes a multifunctional land use system that shall ensure biomass output and biodiversity at the same site, while LSP separates land use from nature protection. The land use scenarios are linked to climate change scenarios and implemented in a quantitative integrated modelling



framework (IMF) to analyze potential synergies and trade-offs among diverse ESS, such as carbon sequestration, biomass production, or nutrient cycling, and biodiversity under climate change. The IMF links the bio-physical process model EPIC, the regional bottom-up land use optimization model PASMA[grid] and divers surrogate indicators for ESS and biodiversity. IMF results reveal declining production values (i.e. provisioning services) for LSH and LSP by 20% and 30% compared to the reference situation. Other ESS improve under both land use scenarios but results are highly sensitive to indicator choices. Particularly biodiversity indicators require a careful definition according to regional challenges. The IMF turned out to provide plausible results in general and stimulated a vivid debate about future land use options among regional stakeholders. It revealed the most likely and preferable landscapes from a stakeholders perspective.

Keywords: integrated modelling framework, land sharing, land sparing, ecosystem services, biodiversity

10. Type of submission: **Abstract**

[T. Thematic Working Group sessions: T10b Towards multifunctional landscapes – assessing and governing synergies between biodiversity conservation and ecosystem service](#)

Forest multi-functionality as a framework for cross-sectoral brokerage

First author: Jiska van Dijk, Graciela Rusch

Other author(s): Rusch, G. M., Wam, H.K., Aspholm, P.E. & Gundersen, V.

Affiliation, Country: Norwegian Institute for Nature research (NINA), Norway

Presenting author: Paul Erik Aspholm

FLERUT is a network-building project of scientists and natural resource users for addressing challenges of multiple ecosystem services (ES) functions and values generated by forest in Norway. FLERUT uses a case study of a peri-urban forest area that provides multiple recreational opportunities for city dwellers in Oslo, but which overlaps with areas of high biodiversity and cultural heritage values and forest production activities. A proposition of gazetting the area as a forest national park is currently under evaluation. Through a stakeholder participatory process, FLERUT will identify and assess important ES currently generated by this forest area and evaluate possible changes in ES if the area becomes protected and the responses of the users to these changes. We use an integrated ecosystem services valuation framework (Jacobs et al. 2016) to



raise awareness about the challenges and opportunities of setting up protected areas in highly populated areas; specifically: i) the use of the Cascade Model (Haines-Young & Potschin 2013) to structure the understanding of ES generation and their benefits; ii) a tiered approach to ES mapping according to the spatial scale of the geographical context (Grêy-Remaney et al. 2015); iii) tailoring the level of detail of ES data to policy instrument objectives (Gómez-Baggethun & Barton 2013); iv) raising awareness about the sources of uncertainty associated with ES assessments and mapping (Barton et al. 2018), and v) assessing the nature of the interactions among ES following the framework for understanding Sustainable Development Goals (SDG) interaction (Nilsson et al. 2015). The novelty of our approach is the implementation of Nilsson's framework to analyse and highlight the different interactions and value creations between the different sectors involved and how these change as a consequence of assigning the national park status to our study area.

Keywords: Forest ES valuation, SDG interlinkages, Value changes

11. Type of submission: **Abstract**

[T. Thematic Working Group sessions: T10b Towards multifunctional landscapes – assessing and governing synergies between biodiversity conservation and ecosystem service](#)

Towards multifunctional agricultural landscapes: Assessing and governing synergies between food production, biodiversity and ecosystem services

First author: Martin Volk

Other author(s): Anna Cord, Angel Demiguel, Annelie Holzkämper, Andrea Kaim, Katrin Karner, Nele Lienhoop, Heike Nitsch, Erwin Schmid, Martin Schönhart, Jörg Schramek, Michael Strauch, M., Ana Tarquis Alfonso, Emma van der Zanden, Astrid van Teeffelen, Nynke Schulp, Peter Verburg, Barbara Willaarts, Nina Zarrineh, David Rivas, Nina Hagemann

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

The increasing demand for agricultural products calls for an improved understanding of synergies between biodiversity, ecosystem services and for the development of supporting policy measures. The BiodivERSA-funded project TALE contributes to such an improved understanding by identifying trade-offs and synergies between food production, biodiversity and ecosystem services, developing scenarios on how future land use can look like under different policy priorities (land sharing, land sparing and balanced), identifying optimal land use strategies and analyzing existing policy measures to assess their effectiveness to support such



strategies. Agricultural landscapes in Germany, Switzerland, Austria, The Netherlands and Spain served as study areas. The methodological steps of the project consist of i) designing and implementing a systematic stakeholder integration process in all project phases to ensure practical relevance, ii) developing a set of land use scenarios and land use policies and iii) developing a framework that links biophysical and statistical models with optimization algorithms. Moreover, TALE provides an innovative open online learning environment for experts, students and the general public. Stakeholder guidelines were developed to initiate a bottom-up process for ensuring co-design of knowledge within the project. The use of stakeholder-defined scenarios as model input provided information on their impact on selected ecosystem services and biodiversity. Furthermore, explorative modelling was carried out to explore limits but also further potential of providing several ecosystem services of a region. Combining the scenario simulations with the results of the explorative modelling indicates where, for instance, agro-environmental measures can be implemented most efficiently. By analyzing policy instruments and combining stakeholder integration with scenario and explorative modelling the project helps to identify priority areas for land use systems, specific areas suitable for intensification or find the best locations for environmental measures. Thus, TALE solves multi-criteria problems to support landscape multifunctionality.

Keywords: Agricultural landscapes, biodiversity, trade-offs, synergies, multifunctionality