Working title: Stakeholder integration in agri-food and land use systems transformation: governmental and non-governmental strategies for biodiversity-friendly agriculture and land use

Doctoral candidate: Hannah Bücheler, M.Sc. Agricultural Economics, University of Hohenheim

First supervisor: Prof. Dr. Claudia Bieling
Second supervisor: Jun.-Prof. Dr. Arndt Feuerbacher
Mentor: Dr. Maria Lee Kernnecker

Research needs and objective

The continuous decline of biodiversity in European agricultural landscapes demands transformative changes in the agri-food and land use system (Mupepele et al. 2021). This need for change is commonly recognised by scientists and policy makers. Attempts to adjust agricultural policies are reflected in the reform process of the European Common Agricultural Policy (CAP), especially in form of the Green Deal and the underlying biodiversity and farm-to-fork strategies. However, current endeavours of the CAP are criticised as not being sufficient to halt biodiversity decline due to mindsets and political processes that hamper rethinking (Pe'er et al. 2019), divergent interests and limited political will (Pe'er and Lakner 2020), among other factors. Policies are still centred around achieving productivity and stable markets instead of considering biodiversity aspects (Mupepele et al. 2021). Agri-environmental schemes (AES) are generally the most widespread and common approach to incentivise farmers to implement sustainable practices, but also show "limited success in preserving biodiversity" (Tyllianakis and Martin-Ortega 2021, p. 10) thus far.

As adjusting single elements of the agri-food system is not effective in preserving biodiversity, it is necessary to think beyond farming and take into consideration "multiple leverage points" (Mupepele et al. 2021, p. 1069) to holistically transform the agri-food and land use system.

The issue of agri-food and land use system transformation is highly relevant for society but controversial. Biodiversity is a public good and provides external benefits in form of ecosystem services (Kehl 2015). Demonstrations and initiatives like "save the bees" highlight the public interest in a biodiversity-friendly agriculture. At the same time farmers are worried about their (global) competitiveness. Thus, perspectives and interests related to agri-food and land use system transformation for biodiversity conservation vary strongly among stakeholders.

Transdisciplinary research is one approach "to tackle fundamental societal challenges" (Lang et al. 2012, p. 40) such as agri-food and land use systems transformation. Collaboration between science and society is essential for knowledge production that does justice to the complex challenge and its diverse aspects (Pearce et al. 2022). Actively including stakeholders in scientific collaboration projects falls under the umbrella of co-creation (Kurzhals et al. 2022; Hakkarainen et al. 2022). Integrating different stakeholders' perspectives increases legitimacy and ownership of results, and accountability of involved actors (Hirsch Hadorn et al. 2006; Lang et al. 2012). Generally, due to the complexity of current challenges, such as biodiversity loss, integrative and transdisciplinary approaches are more and more common practice in sustainable sciences (Norström et al. 2020), environmental research (Oteros-Rozas et al. 2015) and transformation science (Defila and Di Giulio 2018). In contrast to general change, transformation describes fundamental changes (Renn 2019) that lead from the current state of a system to a desired future and is thus future-oriented.

Within transdisciplinary research, integrative scenario development is one approach to depict the range of possible futures (Thorn et al. 2020). Considering the needs of those affected is key for transformational changes and finding a consensus. Consideration is possible if relevant stakeholders and civil society are integrated in the definition process of scenarios, thus forming a cooperation between academic and non-academic actors (Hirsch Hadorn et al. 2006; Norström et al. 2020). Or as Pe'er and Lakner put it, cooperation is essential "to generate replicable, scalable success stories" (2020, p. 174). Scenario development leads to a set of different story lines of possible futures (Hichert et al. 2021) without assessing different impacts and interdependencies. However, model simulation of scenarios and results evaluation allows assessing scenario impacts.

Thus far, the literature provides reviews on integrative scenario development approaches in different contexts and focuses, but not especially targeting the agri-food and land use system transformation. Thorn et al. (2020), for example, focus on participatory scenario planning in the context of mountain social-ecological systems. Hölting et al. (2022) review current co-design projects with farmers, but exclude other stakeholder groups. Thus, integrative scenario planning in the context of agri-food and land use systems transformation is not yet sufficiently covered. Kurzhals et al. (2022) identify challenges and barriers in co-creation processes in general but without addressing the example of scenario development. Thus, a knowledge gap exists regarding challenges and potentials in the method application of scenario development approaches. Furthermore, as outlined above, existing reform approaches are not sufficient to call it a transformation towards a biodiversity-friendly agri-food and land use system. The integrative development of transformation scenarios that fit the purpose of ecological-economic modelling would be a relevant addition to literature.
Moreover, literature focuses on the public sector and agricultural policy instruments, while largely excluding private-sector potentials in this regard. Generally, there is a research gap regarding non-governmental, private-sector engagement for biodiversity-friendly initiatives. More specifically, an overview and typology of non-governmental instruments is missing, especially with regard to their ecological, economic and social potential. These findings are key to understand the potential contribution of the private sector to foster initiatives, and to integrate private initiatives in overall strategies in addition to public efforts to preserve biodiversity.

Based on the above outlined research gaps, this dissertation aims to i) provide a literature review of integrative scenario development methods in the context of agri-food and land use systems including an assessment of challenges and potential solutions ii) co-produce transformation scenarios for biodiversity-friendly agri-food and land use system in Germany in collaboration with a practice council (national level, focus on policy measures), and iii) review and typologise/categorise non-governmental instruments for biodiversity conservation and assess their ecological, economic and social potential.

Research questions

The overarching topic of the dissertation is stakeholder integration in the context of agri-food and land use systems transformation towards more biodiverse agriculture and land use. Thus, the core research interest is how stakeholders and integrative methods can contribute to a transformation of the agri-food and land use system in Germany – including the governmental and non-governmental scope. Based on this and the research needs the following research questions are formulated.

1. Integrative scenario development:
    a. What are current methodological approaches for integrative scenario development in agri-food systems transformation?
    b. Are there (procedural or institutional) obstacles in the methods application and what are solutions to avoid or overcome them?

2. Transformation scenarios:
   What are transformation scenarios for a biodiversity-friendly agri-food and land use system in Germany based on an integrative approach?

3. Potential of non-governmental instruments and initiatives:
    a. What types of non-governmental instruments and initiatives for biodiversity-friendly agri-food systems exist in Germany?
    b. What is the ecological, economic and social potential of these instruments and initiatives? How do local stakeholders assess the ecological, economic and social potential of regional programmes and initiatives in a certain region? (using districts in Lower Saxony, Mecklenburg-West Pomerania, Thuringia or Baden-Württemberg as prospective case studies)

The dissertation project is embedded in the research programme “Bewertung agrar- und ernährungspolitischer Transformationspfade hin zu einem biodiversitätsfreundlichen Landnutzungs- und Ernährungssystem” (BEATLE) in a junior research group, whose overall aim is to develop an ecological-economic market model, to co-produce transformation scenarios and to co-evaluate the results to jointly generate transformation knowledge. It will focus on the research objective “development of transformation scenarios jointly with involved actors (co-design) and the potential check of non-governmental instruments”.

Literature

Defila, Rico; Di Giulio, Antonietta (Eds.) (2018): Transdisziplinär und transformativ forschen. Eine Methodensammlung. Springer Fachmedien Wiesbaden. Wiesbaden, Germany: Springer VS (Open).

Hakkarainen, Viola; Mäkinen-Rostedt, Katri; Horcea-Milcu, Andra; D'Amato, Dalia; Jämsä, Johanna; Soini, Katriina (2022): Transdisciplinary research in natural resources management: Towards an integrative and transformative use of co-concepts. In *Sustainable Development* 30 (2), pp. 309–325. DOI: 10.1002/sd.2276.

Hichert, Tanja; Biggs, Reinette; Vos, Alta de; Peterson, Garry (2021): Scenario development. In Reinette Biggs, Rika Preiser, Alta de Vos, Maja Schlüter, Kristine Maciejewski, Hayley Clements (Eds.): The Routledge Handbook of Research Methods for Social-Ecological Systems. London: Routledge, pp. 163–175.

Hirsch Hadorn, Gertrude; Bradley, David; Pohl, Christian; Rist, Stephan; Wiesmann, Urs (2006): Implications of transdisciplinarity for sustainability research. In *Ecological Economics* 60 (1), pp. 119–128. DOI: 10.1016/j.ecolecon.2005.12.002.

Hölting, Lisanne; Busse, Maria; Bülow, Stefanie; Engler, Jan O.; Hagemann, Nina; Joormann, Ineke et al. (2022): Co-design: Working with farmers in Europe to halt the loss of biological diversity. In *Ecological Solutions and Evidence* 3 (3). DOI: 10.1002/2688-8319.12169.

Kehl, Christoph (2015): Was kostet die Natur?: Nomos.

Kurzhals, Kerstin; Uude, Katrin; Sormani, Eva; Chak, Choiwai Maggie; Banze, Madleen (2022): Das Co-Creation Toolbook. Methoden für eine erfolgreiche Kooperation zwischen Hochschule und Gesellschaft. Wiesbaden: Springer Gabler. Available online at http://www.springer.com/.

Lang, Daniel J.; Wiek, Arnim; Bergmann, Matthias; Stauffacher, Michael; Martens, Pim; Moll, Peter et al. (2012): Transdisciplinary research in sustainability science: practice, principles, and challenges. In *Sustainability Science* 7 (S1), pp. 25–43. DOI: 10.1007/s11625-011-0149-x.

Mupepele, Anne-Christine; Bruelheide, Helge; Brühl, Carsten; Dauber, Jens; Fenske, Michaela; Freibauer, Annette et al. (2021): Biodiversity in European agricultural landscapes: transformative societal changes needed. In *Trends in Ecology & Evolution* 36 (12), pp. 1067–1070. DOI: 10.1016/j.tree.2021.08.014.

Norström, Albert V.; Cvitanovic, Christopher; Löf, Marie F.; West, Simon; Wyborn, Carina; Balvanera, Patricia et al. (2020): Principles for knowledge co-production in sustainability research. In *Nature Sustainability* 3 (3), pp. 182–190. DOI: 10.1038/s41893-019-0448-2.

Oteros-Rozas, Elisa; Martín-López, Berta; Daw, Tim M.; Bohensky, Erin L.; Butler, James R.A.; Hill, Rosemary et al. (2015): Participatory scenario planning in place-based social-ecological research: insights and experiences from 23 case studies. In *Ecology and Society* 20 (4). DOI: 10.5751/ES-07985-200432.

Pe'er, Guy; Lakner, Sebastian (2020): The EU's Common Agricultural Policy Could Be Spent Much More Efficiently to Address Challenges for Farmers, Climate, and Biodiversity. In *One Earth* 3 (2), pp. 173–175. DOI: 10.1016/j.oneear.2020.08.004.

Pearce, BinBin J.; Dallo, Irina; Choi, Victoria; Freihardt, Jan; Middel, Cédric N. H. (2022): Forks in the road: Critical design moments for identifying key processes in stakeholder interaction. In *GAIA - Ecological Perspectives for Science and Society* 31 (4), pp. 222–230. DOI: 10.14512/gaia.31.4.6.

Pe'er, Guy; Zinngrebe, Yves; Moreira, Francisco; Sirami, Clélia; Schindler, Stefan; Müller, Robert et al. (2019): A greener path for the EU Common Agricultural Policy. In *Science (New York, N.Y.)* 365 (6452), pp. 449–451. DOI: 10.1126/science.aax3146.

Renn, Ortwin (2019): Die Rolle(n) transdisziplinärer Wissenschaft bei konfliktgeladenen Transformationsprozessen. In *GAIA - Ecological Perspectives for Science and Society* 28 (1), pp. 44–51. DOI: 10.14512/gaia.28.1.11.

Thorn, Jessica P. R.; Klein, Julia A.; Steger, Cara; Hopping, Kelly A.; Capitani, Claudia; Tucker, Catherine M. et al. (2020): A systematic review of participatory scenario planning to envision mountain social-ecological systems futures. In *Ecology and Society* 25 (3). DOI: 10.5751/ES-11608-250306.

Tyllianakis, Emmanouil; Martin-Ortega, Julia (2021): Agri-environmental schemes for biodiversity and environmental protection: How we are not yet "hitting the right keys". In *Land Use Policy* 109, p. 105620. DOI: 10.1016/j.landusepol.2021.105620.