

Balancing Biodiversity and Economic Viability: Farmers' Motivations and Challenges in Nature-Protected Areas

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Balancing Biodiversity and Economic Viability: Farmers' Motivations and Challenges in Nature-Protected Areas

Dissertation

zur Erlangung des Grades

Doktorin der Agrarwissenschaften (Dr. agr.)

der Agrar-, Ernährungs- und Ingenieurwissenschaftlichen Fakultät

der Rheinischen Friedrich-Wilhelms-Universität Bonn

von

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aus

Kiel (Deutschland)

Bonn 2025

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Tag der mündlichen Prüfung: 17. Oktober 2025

Angefertigt mit Genehmigung der Agrar-, Ernährungs- und Ingenieurwissenschaftlichen Fakultät
der Universität Bonn

ACKNOWLEDGEMENTS

I want to express my heartfelt gratitude to Prof. Dr. Gerhard Schiefer, Prof. Dr. Wiltrud Terlau as well as Prof. Dr. Thomas Döring for not only giving me the chance to embark on this thesis but also for their reliable and continual support throughout. I would like to extend my warm thanks to the International Center for Sustainable Development (IZNE) at the Hochschule Bonn-Rhein-Sieg, University of Applied Sciences, Germany, which has been instrumental in funding the publications of my articles.

Angela Turck
Königswinter, June 2025

SUMMARY

Biodiversity loss is one of the most urgent environmental challenges, particularly in nature-protected areas (NPAs), where agriculture and conservation come together. Farmers play a central role in land management and can significantly influence ecological outcomes through their practices. Despite the agricultural sector being widely recognised as having an impact on biodiversity, participation in conservation efforts is inconsistent and the levels of commitment are often insufficient. This study looks at the economic, social, and psychological drivers that influence farmers' engagement in biodiversity conservation within NPAs, using Maslow's Hierarchy of Needs as an analytical framework.

The research is based on a unique triangulation of complementary qualitative and quantitative findings derived from the "Diversity of Insects in Nature-Protected Areas (DINA)"-project and its subsequent associated studies, which examine farmers' land use trilemma, hesitations and aspirations. The DINA-project was funded by the Federal Ministry of Education and Research (BMBF) as part of the Action Programme for Insect Conservation. Together, these empirical data sources collected provide a multi-faceted understanding of the factors influencing farmers' willingness to implement biodiversity-friendly practices. Applying Maslow's model to the agricultural sector provides a structured approach to understanding how economic security, regulatory stability, social belonging, recognition, and self-actualization collectively determine farmers' decision-making processes.

By integrating psychological theory with solid empirical evidence from the DINA-project and its related studies, this research offers a comprehensive framework for understanding the complex motivational factors and constraints that farmers deal with in biodiversity conservation. The findings demonstrate that effective interventions have to address the full spectrum of farmers' needs, from economic security to self-actualization, and also that they have to be integrated into a supportive social and regulatory environment. Combining Maslow's motivational theory with empirical insights produced by the research streams provides a comprehensive basis for designing targeted, flexible, and socially embedded conservation incentives that align with the realities of farming life. In conclusion, the study recognises that a meaningful and sustainable engagement with biodiversity conservation in NPAs depends on a holistic understanding of farmers' needs and motivations. Only by addressing these needs in a structured and integrated manner can policymakers strengthen the long-lasting commitment necessary to biodiversity-friendly practices.

ZUSAMMENFASSUNG

Der Verlust der biologischen Vielfalt stellt eine der dringendsten ökologischen Herausforderungen dar, insbesondere in Naturschutzgebieten (NSG), in denen sich Landwirtschaft und Naturschutz überschneiden. Landwirte nehmen eine zentrale Rolle bei der dortigen Landbewirtschaftung ein und können durch ihre Praktiken die ökologischen Ergebnisse erheblich beeinflussen. Obwohl die Auswirkungen des Agrarsektors auf die Biodiversität allgemein anerkannt sind, ist die Beteiligung der Landwirte an Naturschutzmaßnahmen uneinheitlich und das Engagement oft unzureichend. In der vorliegenden Studie werden die wirtschaftlichen, sozialen und psychologischen Faktoren untersucht, die das Engagement der Landwirte für den Erhalt der Biodiversität in NSGs beeinflussen. Im Rahmen der Analyse findet die Maslowsche Bedürfnispyramide als analytisches Instrumentarium Anwendung.

Die vorliegende Untersuchung stützt sich auf eine einzigartige Triangulation komplementärer qualitativer und quantitativer Erkenntnisse aus dem Projekt „Diversität von Insekten in Naturschutz-Arealen (DINA)“ sowie den daraus hervorgegangen verbundenen Studien zum Landnutzungs-Trilemma, den Bedenken und den Bestrebungen der Landwirte. Das DINA-Projekt wurde vom Bundesministerium für Bildung und Forschung (BMBF) im Rahmen des Aktionsprogramms Insektenschutz gefördert. Die empirischen Datenquellen liefern ein vielschichtiges Verständnis der Faktoren, die die Bereitschaft der Landwirte zur Umsetzung biodiversitätsfreundlicher Praktiken beeinflussen. Die Anwendung des von Maslow entwickelten Modells auf den Agrarsektor ermöglicht eine strukturierte Herangehensweise, um die Determinanten wirtschaftlicher Sicherheit, regulatorischer Stabilität, sozialer Zugehörigkeit, Anerkennung und Selbstverwirklichung zu analysieren. Die Integration psychologischer Theorie mit soliden empirischen Erkenntnissen aus dem DINA--Projekt verwandten Studien schafft die Basis für ein umfassendes Verständnis der komplexen Motivationsfaktoren und Zwänge, mit denen Landwirte bei der Erhaltung der Biodiversität konfrontiert sind.

Die Ergebnisse der Untersuchung legen nahe, dass wirksame Interventionen das gesamte Spektrum der Bedürfnisse von Landwirten adressieren müssen, von wirtschaftlicher Sicherheit bis hin zur Selbstverwirklichung, und dass sie in ein unterstützendes soziales und regulatorisches Umfeld integriert werden müssen. Die Verbindung der Motivationstheorie nach Maslow mit den empirischen Erkenntnissen aus den Forschungsschwerpunkten bietet eine fundierte Grundlage für die Gestaltung zielgerichteter, flexibler und sozial eingebetteter Anreize für den Naturschutz, die sich an den Realitäten des landwirtschaftlichen Lebens orientieren. Die Studie gelangt zu dem Schluss, dass ein sinnvolles und nachhaltiges Engagement für den Erhalt der Biodiversität in NSGs von einem ganzheitlichen Verständnis der Bedürfnisse und Motivationen der Landwirte abhängt. Es ist evident, dass eine

Berücksichtigung der Bedürfnisse auf strukturierte und integrierte Weise durch die politischen Entscheidungsträger einen wesentlichen Faktor für die Stärkung des notwendigen langfristigen Engagements für biodiversitätsfreundliche Praktiken darstellt.

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LIST OF ABBREVIATIONS

AI	Artificial Intelligence
BMBF	Federal Ministry of Education and Research (Bundesministerium für Bildung und Forschung)
CAP	European Common Agricultural Policy
CATI	Computer-Assisted Telephone Interviews
DINA	Diversity of Insects in Nature-Protected Areas (Project name)
EU	European Union
FAO	Food and Agriculture Organisation of the United Nations
IAASTD	International Assessment of Agricultural Knowledge, Science and Technology of Development
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
NGO	Non-Governmental Organization
NPA	Nature-Protected Area
NSG	Naturschutzgebiet
OECD	Organisation for Economic Cooperation and Development
SCOAP	Security, Control, Orientation, Attachment, and Pleasure
SDG	Sustainable Development Goal
SDT	Self-Determination Theory
WBGU	German Advisory Council to the Federal Government on Global Environment Change (Wissenschaftlicher Beirat der Bundesregierung Globale Umweltveränderungen)
WWF	World Wide Fund For Nature

1 INTRODUCTION TO THIS THESIS

1.1 Research Project Overview

The research project, entitled “Balancing Biodiversity and Economic Viability: Farmers’ Motivations and Challenges in Nature-Protected Areas” addresses one of the most pressing challenges currently facing modern agriculture landscapes: the tension between biodiversity conservation, economic viability and compliance with societal and political demands. This challenge is also very pronounced for farmers operating within or near Germany’s Nature-Protected Areas (NPAs). These areas are designated by law to protect biodiversity, preserve natural landscapes, and promote ecological sustainability. At the same time, they continue to support agricultural production, which leads to conflicts over land use that are characterised by particular complexity.

This dilemma is commonly referred to in academic literature as the land use trilemma. Foundational analyses by Tilman et al., Foley et al., and Godfray et al. demonstrate that efforts to increase agricultural productivity often come at the expense of biodiversity and environmental sustainability, while measures to protect biodiversity can constrain food production and farm incomes (Tilman et al. 2002; Foley et al. 2005; Godfray et al. 2010). This perspective emphasises trade-offs at farm or landscape level, where individual land users, most notably farmers, have to manage competing demands.

A more systemic perspective is offered by the German Advisory Council on Global Change (WBGU) in its 2020 report *Rethinking Land in Anthropocene*. Here, the trilemma refers to the global and multifaceted challenge of simultaneously achieving three interrelated and critical global objectives: climate change mitigation, biodiversity conservation, and food security. These three overarching goals compete for the finite and increasingly contested resource of land (WBGU 2020). This perspective is closely connected to the planetary boundaries framework developed by Johan Rockström and colleagues, which identifies land-system change, biodiversity loss and climate change as key thresholds that must not be crossed to maintain a safe operating space for humanity (Rockström et al. 2009; WBGU 2020; Fischer and Bohn 2022). Rockström’s research demonstrates that the expansion and intensification of agriculture has already resulted in global land use exceeding sustainable limits, thereby causing significant impacts on ecosystem stability and long-term food security.

These two perspectives (micro-level trade-offs experienced by farmers and macro-level planetary goals) are deeply interlinked. Effective responses to the land use trilemma have to integrate both the lived realities of land users and the frameworks that guide sustainability agendas. Within the European context, and particularly within Germany’s Nature Protected

Areas (NPAs), the land use conflicts are especially acute. Farmers in or adjacent to NPAs are required to balance their contributions to biodiversity objectives, as outlined in the European Union's Common Agricultural Policy (CAP) and the European Green Deal, with their own economic stability and the need for maintaining productive efficiency. The resulting trilemma – the balance between food security, climate change mitigation and the need to preserve biodiversity – are focus of this dissertation. Previous studies document that farmers are required to comply with a complex set of policies, including the European Union's Common Agricultural Policy (CAP). While the CAP historically prioritised productivity and market stabilisation, it has progressively incorporated objectives related to biodiversity protection and climate mitigation (*OECD Business and Finance Policy Papers* 2023). Despite these policy shifts and the acknowledgement of the land use trilemma and its broad impacts, a considerable research gap persists concerning how farmers themselves perceive and manage these conflicting demands in their daily decision-making, particularly within the specific regulatory and ecological context of NPAs in Germany. Farmers operating within or in the immediate vicinity of NPAs frequently find themselves at the center of this conflict, compelled to comply with strict environmental regulations and societal expectations that demand the delivery of public goods, while simultaneously striving to maintain economic viability. International assessments such as the IAASTD Global report, along with reviews by Scherr and McNeely, and Vijay and Armsworth, emphasis the dual role of protected areas: they are not only essential for biodiversity conservation, but also remain important for agricultural production. This dual function makes them focal points of land use tensions (Albrecht & Engel, 2009; Scherr & McNeely, 2008; Vijay & Armsworth, 2021).

This dissertation aims to address this gap by investigating how this challenge is pronounced for farmers operating within or near Germany's Nature-Protected Areas (NPAs). These areas are legally designated to safeguard biodiversity, preserve natural landscapes, and promote ecological sustainability. At the same time, they continue to support significant agricultural activity, resulting in particularly complex land use conflicts.

In this context, and in line with the international goals such as the Sustainable Development Goals (SDGs), especially SDG 15 (Life on Land), which calls for halting of the biodiversity loss and the promotion of sustainable use of terrestrial ecosystems, this research contributes to an in-depth understanding of the social, economic and regulatory pressures that influence farmers' decision making in NPAs. By focusing on their motivations, challenges, and adaptive strategies, this dissertation contributes new insights to an area that was previously identified as lacking research.

By applying a mixed-method approach, this study integrates three distinct scientific articles to examine the challenges, hesitations and aspirations of farmers in German NPAs, as well as their motivations. This approach brings together qualitative methods, such as semi-structured questionnaire and focus group discussions, and quantitative methods, namely surveys of farmers' attitudes and behaviours. The combination of these methods allows for a comprehensive exploration of both external and internal factors influencing farmers. External factors include market pressures, societal expectations and regulatory frameworks, while internal factors include personal values, economic goals and perceptions of conservation.

The primary goal of this research is to provide actionable insights for policymakers, conservationists and other stakeholders, highlighting how agricultural productivity can be aligned with biodiversity goals. The findings emphasise the importance of involving farmers as key stakeholders in biodiversity initiatives, advocating participatory approaches to environmental management that incorporate farmers' perspectives alongside ecological objectives.

1.2 Thematic Integration of Research

This cumulative dissertation is based on three interrelated scientific articles, each addressing distinct but complementary aspects of the overarching research question. Together, they form a coherent narrative that examines how farmers in German NPAs navigate the trilemma of biodiversity conservation, agricultural productivity and economic pressures.

First Article: “Farmers are caught in Tri-Dilemma - Objectives and Challenges for Biodiversity in German Nature-Protected Areas”

The first article establishes the theoretical foundation for the entire dissertation by introducing the concept of the “trilemma of land use”. This trilemma refers to the conflicting demands faced by farmers to achieve food security, contribute to climate change mitigation and enhance biodiversity conservation. The article emphasises that these demands are not independent but interlinked, creating a complex decision-making environment for farmers.

This article is based on a qualitative study that draws on findings from the German inter- and transdisciplinary project named “Diversity of Insects in Nature-Protected Areas (DINA)”. Through a semi-structured questionnaire and interviews conducted with farmers, policymakers and other stakeholders, the study captures their experiences. The qualitative approach enables an in-depth analysis of the policy and regulatory frameworks, particularly the CAP, which significantly shape farmers' decisions in NPAs. The study identifies key obstacles faced by farmers, including strict restrictions on pesticide use and habitat conservation obligations while attempting to maintain economically viable farms. This sets the stage for the following

articles by emphasising the external pressures – economic, regulatory and societal – that shape farmers' choices.

Second Article: “Hesitations and Aspiration of Farmers in Nature-Protected Areas”

Building upon the macro-level insights of the first article, the second article shifts the focus to the micro-level experiences of farmers. It explores the socio-economic and psychological dimensions of farmers' behaviour and decision-making processes concerning biodiversity conservation. Using both qualitative and quantitative methods, this article investigates how individual farmers experience and respond to these pressures. The focus is on hesitations that arise when farmers are expected to implement biodiversity-enhancing practices that go beyond the regulatory requirements, such as cross compliance under the CAP. A key finding – and an added value to the existing literature - is that, while financial incentives such as subsidies and compensation payments are crucial motivators, other factors, such as societal recognition, autonomy in decision-making, and the desire to uphold a family farming tradition, are equally important in shaping farmers' behaviour. This study uncovers that farmers' willingness to engage in biodiversity conservation is also strongly influenced not only by material incentives, but also by a desire for greater appreciation of their role, flexibility in implementing measures, and recognition as active partners in nature conservation. Earlier research has primarily examined the role of incentive-based models in motivating biodiversity engagement (Burton et al. 2008; Dessart et al. 2019). However, this study provides new empirical insights from the context of German NPAs. By employing a triangulated research design that combines farmers' stated preferences (CATI surveys) with exploring underlying attitudes (focus groups), this study provides a nuanced understanding of farmers' perspectives. Notably, the qualitative discussions reveal previously undocumented scepticism toward result-based payments, despite general support in survey responses. These insights contribute to a better understanding of the socio-psychological and institutional barriers, thereby enriching the ongoing debate about the practical design of agri-environmental policy. The article further examines how farmers perceive financial risks associated with adopting more sustainable practices and discusses their aspirations for securing financial incentives and gaining recognition for their contributions to environmental conservation.

By highlighting how individual-level factors interact with broader structural challenges, this article offers insights that bridge the findings of the first and third articles, underscoring the complex interplay between personal motivations and systemic pressure in the context of biodiversity-friendly agriculture.

Third Article: “Farmers’ Economic Demands and Motivations for Biodiversity in Nature-Protected Areas: A Maslow-based Evaluation”

The third article deepens the analysis by introducing a theoretical framework based on Maslow’s Hierarchy of Needs to explore the interplay between farmers’ economic and psychological motivations (Maslow 1943). This study synthesises the findings of the previous two articles to propose a more complete understanding of what drives farmers’ engagement in biodiversity-friendly initiatives. The research combines quantitative survey data with focus group discussions to explore how basic needs (i.e. financial security) and higher-level needs (i.e. autonomy, competence, and social inclusion) influence farmers’ willingness to adopt biodiversity-friendly practices. The focus group discussions, conducted with a subset of farmers from earlier stages of the study, provide the opportunity to examine their attitudes and preferences regarding different types of financial incentives, specifically action-based and result-based payments.

A key contribution of this article is its evaluation of the effectiveness of financial incentives in promoting long-term biodiversity conservation. While action-based payments provide compensation for specific conservation activities, result-based payments reward measurable biodiversity outcomes. The findings indicate that while financial incentives address immediate economic concerns, achieving sustainable biodiversity goals require a more integrated approach that combines economic incentives with measures that address farmers’ psychological needs, such as recognition and autonomy.

By synthesising the structural and individual-level findings of the first two articles, the third article emphasises the importance of designing policy frameworks that align with both the material realities and psychological motivations of farmers. This study concludes that strengthening long-term commitment to biodiversity conservation requires moving beyond financial incentives to address broader social and emotional factors.

The three articles, when considered collectively, present a logically structured narrative, as illustrated in figure 1. The progression is as follows: firstly, structural challenges at the macro-level are addressed (Article 1); secondly, individual experiences at the micro-level are discussed (Article 2); and thirdly, a comprehensive theoretical synthesis is provided in Article 3.

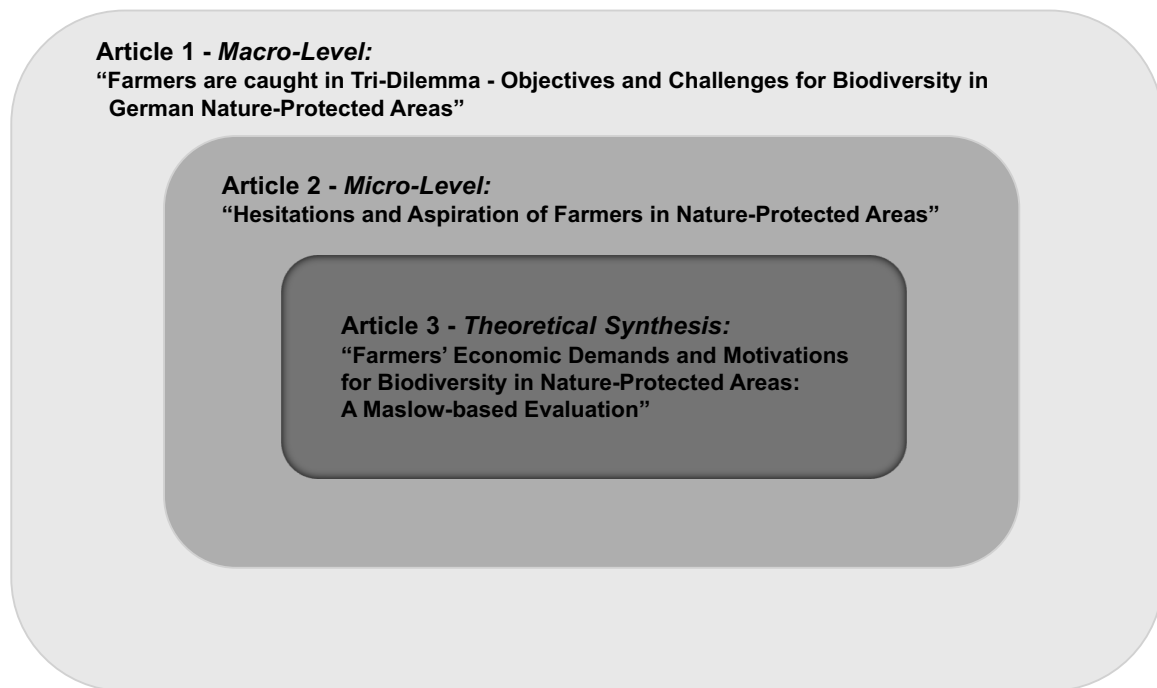


Figure 1: Visualising the Dissertation's Narrative: A Structured Path (own illustration)

The visual representation highlights the interconnectedness and sequential flow of how each article plays a key role, building on previous research to provide a comprehensive and integrated overview of the key issue.

The combination of qualitative and quantitative methods, complemented by the incorporation of focus group discussions, a further qualitative approach, ensures a comprehensive understanding of the intricate socio-ecological systems within NPAs. The research offers a valuable contribution to existing literature by providing insights into ways in which economic and psychological drivers influence farmers' engagement in biodiversity-friendly initiatives, thus offering actionable recommendations for policymakers and stakeholders.

1.3 Methodological Framework

The research methodology used in this dissertation employs a mixed-method approach to integrate qualitative and quantitative data providing a multidimensional understanding of the complex socio-ecological systems within NPAs. By combining both methods, the research captures the multi-dimensional significance of the challenges, motivations and decisions faced by farmers in NPAs.

This methodology, as shown in figure 2, unfolds in a sequence of interconnected phases. The first phase, the **qualitative component**, begins with a semi-structured questionnaire and interviews with farmers and other relevant stakeholders. This stage identifies key patterns and

themes in farmers' experiences and challenges, which then inform the subsequent quantitative phase. The second phase, the **subsequent quantitative component**, incorporates Computer-Assisted-Telephone Interviews (CATI) survey, conducted with a more expansive sample of German farmers. The survey provides statistical data on farmers' attitudes towards biodiversity conservation, their economic needs, and their willingness to adopt new practices if provided with adequate incentives. The third and final phase returns to **qualitative methods** through focus group discussions to learn more about farmers' perspectives on action-based and result-based support. Fig. 2 demonstrates that this integrated methodological framework provides a multi-dimensional exploration of the socio-ecological complexities within NPAs. It connects individual experiences with statistical trends, offering a base for useful insights that can guide policy and practice.

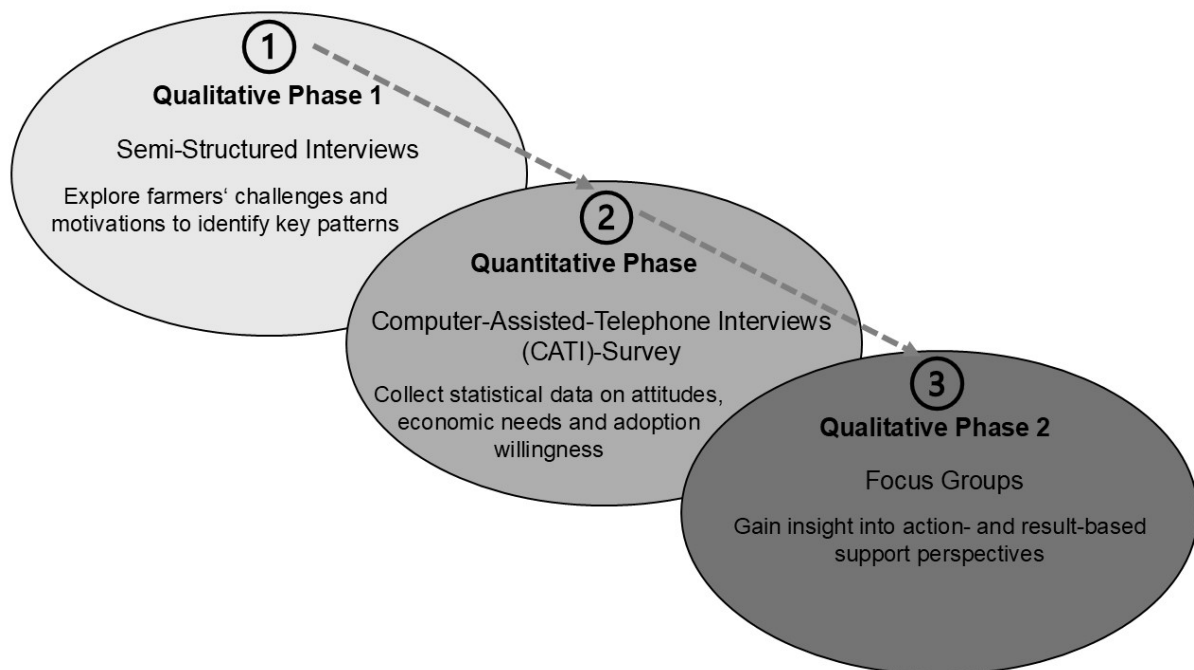


Figure 2: Mixed-Method Research Methodology for Socio-Ecological Research in NPAs (own illustration)

1.4 Aim of the Thesis, Claim and Contribution to the Scientific Discourse

The thesis, entitled “Balancing Biodiversity and Economic Viability: Farmers’ Motivations and Challenges in Nature-Protected Areas”, is based on the recognition of the pressing environmental issue: the accelerating loss of biodiversity due to agricultural practices. The research addresses the intricate and complex web of interactions of agriculture, biodiversity conservation and economic viability, focussing on German farmers operating in NPAs. These

farmers are at forefront of environmental stewardship but are also confronted with the challenge of ensuring economic sustainability of their operations.

At the core of this research is the idea that effective biodiversity conservation in NPAs can only be achieved through collaborative efforts involving all key stakeholders, notably farmers. This thesis makes an important contribution by adopting a stakeholder approach, that acknowledges farmers not as objects of regulatory control, but as active participants whose knowledge, experience and cooperation are crucial to the success of conservation efforts. The central claim of the thesis is that long-term biodiversity conservation in NPAs will only be successful if the economic realities and psychological motivations of farmers are respected alongside environmental objectives.

This thesis is part of the “Diversity of Insects in Nature-Protected Areas (DINA)” research initiative, funded by the Federal Ministry of Education and Research (Bundesministerium für Bildung und Forschung, BMBF). The DINA project, which was conducted from May 2019 to April 2023, adopts a collaborative research initiative combining trans- and interdisciplinary scientific findings and integrating socio-ecological perspectives with scientific research to address key predictors of biodiversity, including habitat fragmentation, land use and the ecological stress caused by agricultural activities. One of its objectives is to develop sustainable strategies that balance agricultural production with the conservation of insect diversity, a vital component of broader biodiversity. To achieve this, the project incorporates socio-ecological dimensions by investigating the interactions and commitments of stakeholders, ensuring their perspectives are included (Lehmann et al. 2021).

The thesis advances the discourse on biodiversity conservation and sustainable agriculture by offering a comprehensive examination of the motivational drivers influencing farmers’ behaviours. The application of Maslow’s Hierarchy of Needs as a framework for understanding farmers’ motivations serves to bridge the gap between economic theory and psychological insights into decision-making processes in a conservation context. By focusing on farmers in German NPAs, the thesis provides context-specific insights that are critical for the development of policies tailored to the needs of this key stakeholder group. The research demonstrates that while financial incentives (e.g., subsidies and compensation payments) are a significant factor, they alone are not enough to strengthen long-term biodiversity engagement. Instead, an approach that also considers psychological factors, such as the need for autonomy, social recognition and competence, is essential to drive lasting change.

The thesis represents an innovative contribution in its suggestion that an integrated framework – one that combines economic, psychological, and social elements – will be most effective in

aligning biodiversity goals with agricultural sustainability. By emphasising the importance of stakeholder participation, this research calls for a shift from top-down regulatory approaches to more collaborative, inclusive strategies that engage farmers in the decision-making process. It suggests that participatory environmental management will ultimately lead to more sustainable outcomes for both agriculture and biodiversity.

1.5 Scope of the Work

The work includes the following two publications

- 1) Turck, Angela; Schloemer, Lasse; Terlau, Wiltrud (2023). "Farmers are caught in Tri-Dilemma - Objectives and Challenges for Biodiversity in German Nature-Protected Areas." *Int. J. Food System Dynamics* 14 (2), 2023, 237-250.
DOI: 10.18461/ijfsd.v14i2.F8.
- 2) Turck, Angela; Terlau, Wiltrud (2023). "Hesitations and Aspirations of Farmers in Nature-Protected Areas". *Sustainability* 2023, 15, 3196.
DOI: 10.3390/su15043196

as well as the unpublished article

- 3) entitled "Farmers' Economic Demands and Motivations for Biodiversity in Nature-Protected Areas: A Maslow-based Evaluation".
This chapter integrates a theoretical approach to deepen the analysis of farmers' motivations and is not published so far.

In addition, the following publications contain (co-) authored work, providing valuable insights that contributed to the three main papers forming the core of this dissertation:

Publication 1:

"Institutional Settings Surrounding Agriculture and Biodiversity: Challenges, Potentials and Obstacles of a Contract-based Nature Protection Scheme in the Rhine-Sieg District of Germany".

Darya Hirsch, Angela Turck, Wiltrud Terlau (2022)

Int. J. Food System Dynamics 13 (1), 30-45.

<https://doi.org/10.18461/ijfsd.v13i1.A3>. ISSN 1869-6945

Publication 2:

"Diversity of Insects in Nature Protected Areas (DINA): an interdisciplinary German research project".

Gerlind Lehmann et al. (2021)

*Biodivers Conserv*30, 2605-2614.

<https://doi.org/10.1007/s10531-021-02209-4>

Publication 3:

Improving insect conservation management through insect monitoring and stakeholder involvement”

Sebastian Köthe et al. (2023)

*Biodivers Conserv*32, 691-713.

<https://doi.org/10.1007/s10531-022-02519-1>

Publication 4:

“Recommendations for effective insect conservation in nature-protected areas based on a transdisciplinary project in Germany”

Sebastian Köthe et al. (2023)

*Environ Sci Eur*35, 102

<https://doi.org/10.1186/s12302-023-00813-5>

Publication 5:

“Herausforderungen der Landwirte in Naturschutzgebieten – eine Bewertung im Rahmen des Projektes „Diversität von Insekten in Naturschutz-Arealen (DINA)““

Angela Turck, Wiltrud Terlau (2022)

BfN-Schriften 709/2024, *Insektenschutzmaßnahmen und Potenziale für derartige Maßnahmen in Großschutzgebieten*

<https://doi.org/10.19217/skr709>

As demonstrated in figure 3, a relationship of interconnections exists between the core papers, the theoretical framework and the (co-authored) publications. Each arrow in the figure represents a conceptual or methodological link, labelled with keywords indicating the nature of the connection. For instance, the linkage between Article 1 and Publication 1 emphasises “Institutional Settings”, while Article 3 (chapter 4) is linked to co-authored Publications 3 and 4 through themes like “Conservation Management” and “Effective Conservation”.

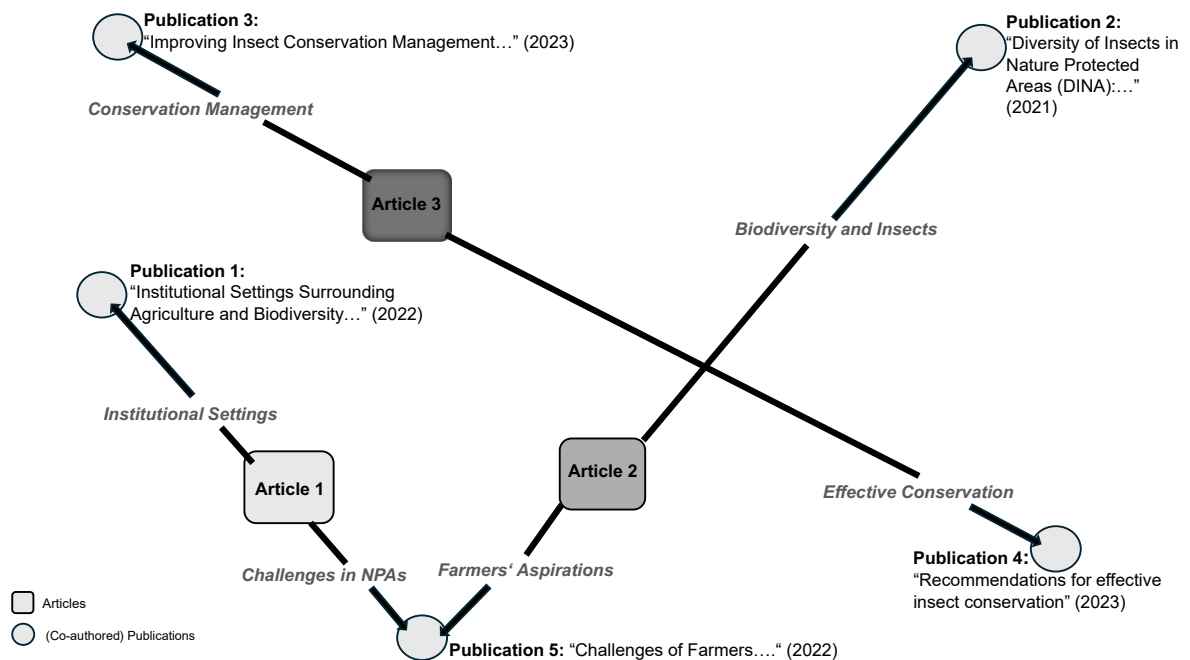


Figure 3: Relationship between Articles and (Co-authored) Publications (own illustration)

2 FARMERS ARE CAUGHT IN TRI-DILEMMA - OBJECTIVES AND CHALLENGES FOR BIODIVERSITY IN GERMAN NATURE-PROTECTED AREAS

2.1 Introduction to the Article

The following publication is based on a timely exploration of the challenges farmers face in their ongoing efforts to enhance biodiversity within the modern agricultural landscape, particularly within the context of NPAs. In recent years, discourses surrounding this topic have increased and have gained unprecedented momentum, driven by a pressing need to address the multifaced demands placed on agricultural land – a complex challenge symbolized by the trilemma of land use (WBGU 2020). While the German context is central to this study, the issues discussed here are embedded within a broader international discourse. Globally, the necessity to reduce agricultural's impact on biodiversity and climate has taken center stage in scientific and political arenas, as reflected in international agreements such as the Convention on Biological Diversity (CBD), the Paris Agreement, and the Kunming-Montreal Global Bioersity Framework (Bakhtary et al. 2024; Federal Ministry of Food, Agriculture and Consumer Protection 2010; Le Roux et al. 2008; Bélanger and Pilling 2019).

According to recent research, greater biodiversity in agroecosystems has been shown to enhance both ecological resilience and natural pest control, which is a key factor in achieving sustainable and economically viable farming practices. Diversified systems, such as crop rotations, intercropping, and flower strips, have been identified as mechanisms that can reduce reliance on chemical inputs and improve yield stability. However, the process of adoption remains limited due to the complexity of procedure, the potential economic risks involved, and the perceived weakness of policy support. The overcoming of these barriers requires policy frameworks that make biodiversity-friendly practices viable, feasible and attractive for farmers (Hatt and Döring 2023).

As awareness of climate change and its profound implications has grown globally, reducing its impact has become a top priority in scientific, political and societal arenas (Rahmstorf and Schellnhuber 2018; European Commission 2023; Neubauer and Repenning 2019). Simultaneously, the demands for securing food production to sustain a growing global population remain undiminished. Preserving biodiversity at the intersections of these concerns is a vital task, as it ensures the health and resilience of ecosystems for the benefit of all life on Earth (IPBES 2019). These are the three corners of the “trilemma” that confronts contemporary agriculture, worldwide, and thus Europe and Germany. However, this confluence of environmental, economic and societal demands has not been without controversy (Grohmann and Feindt 2023; Deutscher Bauernverband 28.06.2023). Farming

methods are currently facing scrutiny due to concerns related to soil contamination, animal welfare and their impact on climate change, among others (Wildkraut and Mergenthaler 2019). Amidst these challenges, farmers have emerged as significant actors tasked with navigating the complex and often conflicting priorities of land use (Zukunftskommission Landwirtschaft 2021; Selhorst 17. März 2020).

On the one hand, consumers and society at large increasingly call for sustainable production practices, demanding not only affordable but also environmentally friendly food products. This call is accentuated by a growing aversion to pesticide residues and an expectation of sufficient food supply for all. On the other hand, farmers struggle with the practical realities of meeting these expectations. They face obstacles arising from an intricate web of consumer preferences shaped by global supply chains, international regulations, various interest groups, and a multitude of direct and indirect factors. Striking the balance between producing sufficient food, protecting biodiversity, and complying with stringent regulatory controls adds further complexity to the situation, as highlighted in international forums and global conferences. In summary, while this article provides an in-depth analysis rooted in a German context and references, the challenges and debates it addresses are part of a broader international discourse. There is an ongoing global conversation regarding the relationship between agricultural productivity with biodiversity conservation and climate action. The experiences of farmers in Germany both reflect and contribute to this global conversation.

2.2 Objective and Message of the Article

The article's primary goal is to generate an understanding of the complexity of demands placed on farmers, especially those working in NPAs or the vicinity of NPAs. These farmers must balance various aspects of land use, including climate change mitigation, ensuring food security, as well as conserving or better enhancing biodiversity. This trilemma is not unique to Germany but is recognized internationally as a key challenge for sustainable agriculture (WBGU - German Advisory Council on Global Change 2021; Shukla et al. 2021; Moran and Lehmann 2007).

The following text emphasizes the critical role that German farmers play in addressing the sustainability challenges while meeting all the demands made to them. These demands include implementing sustainable farming practices to mitigate the environmental impact, the maintenance of productivity to ensure a stable food supply, and the adaptation to regulatory and market pressures aimed at protecting natural resources, all while ensuring their economic viability. The article underscores the importance of recognizing the interdependencies within agricultural land use and its respective management. Furthermore, the article stresses that

policy and society must collaborate with farmers to create conditions that promote biodiversity while acknowledging the economic realities farmers face. This article presents a systematic, empirically informed analysis of the multifaceted challenges encountered by farmers in NPAs. The study focuses on the real-world conditions in Germany, incorporating current societal debates and policy developments. In the context of this research project, a comprehensive mixed-method approach was started, integrating qualitative and quantitative methodologies to provide a throughout understanding of the issues. The initial qualitative component of this study is discussed in this chapter and involves the use of a semi-structured questionnaire to analyse the conflicts and obstacles faced by farmers. The findings of this qualitative analysis provide a robust foundation for the development of recommendations. The findings of this study reflect the specific situation of German farmers and align with international assessments, such as those of the Food and Agriculture Organisation of the United Nations (FAO) and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). These assessments underline the importance of farmers' engagement in advancing biodiversity-friendly agriculture.

These recommendations are used as a basis for the subsequent quantitative survey, which is explained in more detail in further studies (see Chapters 3 and 4) in this context.

2.3 Details of the Publication

The article was accepted by the *Journal on Food System Dynamics*, in December 2022 and published in April 2023, under the title *Farmers are Caught in Tri-Dilemma - Objectives and Challenges for Biodiversity in German Nature-Protected Areas* in Volume 14, No. 2 of the Journal.

The article is available online <https://doi.org/10.18461/ijfsd.v14i2.F8>

This published article is added here.

Farmers are caught in Tri-Dilemma - Objectives and Challenges for Biodiversity in German Nature-Protected Areas

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Received May 2022, accepted December 2022, available online April 2023

ABSTRACT

This paper aims to assess farmers' challenges in enhancing biodiversity. The so-called "trilemma" (WBGU 2021) of land use stems from the multiple demands made on land for the benefit of mitigating climate change, securing food, and maintaining biodiversity. Agriculture is accused of maladministration, causing soil contamination, animal cruelty, bee mortality, and climate change. However, farmers play a key role in overcoming upcoming sustainability challenges. While their supportive role is urgently needed, farmers find themselves caught between a "rock" and a "hard place". Consumers call for sustainable production and affordable food products without pesticide residues, demanding enough for all. Farmers are restricted by the wants and needs of consumers who are influenced by interest groups and exposed to interdependent direct and indirect influencing factors. They need to balance the scrutiny of the critical public as well as the regulatory control. In this paper, we collected and surveyed the data of farmers within or close to the 21 selected nature protected areas of the DINA (Diversity of Insects in Nature protected Areas) Project, using a mixed methods approach with a semi-structured questionnaire considering issues' interdependencies and the complexity of today's problems. The conflicts and obstacles faced by farmers were assessed. The results reflect the farmers' willingness and the importance of receiving appreciation for implementing biodiversity measures. These results, complemented by a following quantitative study, are the basis for recommendations for policymakers and farmers in all German nature protected areas.

Keywords: Biodiversity; farmers' drivers; land use dilemma; land use trilemma; mixed method approach, semi-structured questionnaire.

1 Introduction

Within the last 70 years, the structure of the landscape has changed immensely. Small-scale land management has been replaced by large-scale production-oriented agricultural management (Jongman, 2002). The demand for food increased in line with the growth and prosperity of the population, which in turn caused the agricultural sector to expand in terms of intensification and specialisation (Robinson et al., 2002).

As many publications point out, the decline of biodiversity can also be observed in connection with this changing environment. In recent years, public interest in the loss of biodiversity, particularly with regard to the insect population, has grown, at least since the publication of the "Insect biomass decline" paper by Hallmann et al. (2017). In 2019, German farmers protested for better future conditions, i.e. against the increasing environmental regulations and orders issued by the government. The two ministries concerned (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), and the Federal Ministry of Food and Agriculture (BMEL)) did not work together, but rather against each other (Radtko,

2021). The agricultural package was adopted by the Federal Cabinet in September 2019. With commitments to new animal welfare labelling, restrictions on the use of pesticides, an action programme for the better protection of insects and further restrictions on animal and plant protection products are the subject of strong objections. New government regulations are partly a response to the European Commission's second infringement proceedings brought against Germany on account of the high levels of nitrate measured in groundwater (Steinbach, 2019). The European Commission had taken Germany to the European Court of Justice back in 2016 due to its failure to take action to address the water pollution being caused by nitrates. The European Court of Justice ruled that Berlin had indeed violated the EU Nitrates Directive, which aims to protect water quality across Europe. In particular, it exceeded the limits set out in the directive due to the excessive use of manure as a fertiliser (Maaß, 2021; Fritz, 2018). It was only in January 2022, after the election and formation of the new government, that the Federal Ministries for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV) and BMEL announced that they were in agreement with the European Commission, which does not accept the previous approach to fertiliser regulation in the federal states (Michel-Berger, 2022). This implies that farmers must be prepared to deal with further new and stricter regulations in this regard.

Farmers do, however, have reason to be apprehensive about the future, as the economic base of their income has dropped in recent years. They have also been dismayed by a series of strong price competitions they have been forced to contend with due to the Mercosur trade agreement with South America (European Commission, 2019; Burrell et al., 2011) which intends to lessen trade barriers and facilitate access to the European market. The protests had an effect not only on the public, but also on policymakers and authorities, resulting in the establishment and institution of the German Commission on the Future of Agriculture ("Zukunftskommission Landwirtschaft") by the government (Michel-Berger, 2021).

Against the backdrop of these demanding times being experienced by farmers and in the context of the DINA project (Lehmann et al., 2021) a stakeholder analysis, which identified farmers as key actors in relation to biodiversity, was carried out. The farmers' driving forces were determined by literature (Plieninger et al., 2016) and media research, which allowed us to determine that the direct and indirect driving forces at play behind the scenes at every farm are people facing complex decisions.

The perceptions of this target group revealed insights into land use practices and management approaches concerning biodiversity.

The questionnaire used pursued a qualitative approach, namely investigating the measures taken (or not taken) by farmers to enhance biodiversity and the reasons why they chose to implement or not implement those. The numerous press reports published in relation to the various demonstrations held by farmers within the last few years increased social awareness of the issue considerably. Recent studies and the "Fridays for Future" movement show a high level of engagement towards climate protection and thus nature protection, as climate and nature are intrinsically linked. A recent example of this is the publication of the "Pesticides Atlas" in January 2022 (Chemnitz et al., 2022). This publication presented a survey conducted among young adults in October 2021. The results show that this generation is aware of planetary boundaries, demanding more commitment from politicians to ensure that agricultural production is conducted in an environmentally sustainable way. How production is conducted is of widespread interest.

In the following, dilemma and trilemma of land use is considered. Influencing factors, i.e. framework conditions that farmers have to cope with, are described. This is preceded by the presentation of the first step of the applied mixed method design, the qualitative study. Selected results are discussed providing a more detailed picture of the entanglement.

2 Entanglement of dilemma and trilemma

More than ever, farmers are confronted with the question of whether and how they want to shape their profession and vocation for the future. Increasing social and political demands are threatening the very existence of many farms, especially family farms.

The dilemma faced by farmers is that they have to cope with price erosion and increased production, leaving them little scope to consider environmental aspects (Feindt et al. 2019). The German Advisory Council on Global Change (WBGU) explains that

“the diverse demands made on land for the purposes of climate-change mitigation, food security and the conservation of biological diversity are already in competition with each other....The WBGU calls this the ‘trilemma of land use’ because, at first glance, it appears that any one of these challenges can only be met at the expense of the other two” (WBGU 2021).

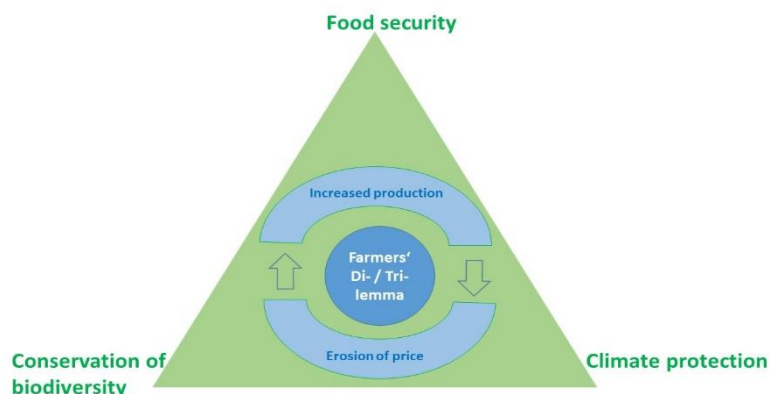


Figure 1. Dilemma - Trilemma problem faced by farmers
Source: Author's elaboration based on WBGU 2021, p. 16.

Combining these framework conditions, farmers move between dilemma and trilemma, which means that they are restricted and are thus influenced by these constraints considerably (Figure 1).

The question does, however, arise as to which factor is the most limiting and which is the least. More research is needed to analyse causes and effects in greater detail.

2.1 Land Use Dilemma

According to figures issued by the Federal Statistical Office of Germany (DESTATIS) in November 2021 (statista, 2021), agricultural land in Germany stood at 16.6 million hectares in 2020, representing a slight decrease compared to the previous year. Most farmland in Germany is used for arable farming, followed by grassland (e.g. pasture farming) and permanent crops (e.g. viticulture). Settlements and transport areas are on the rise. Although about half of Germany's total land area is used for agriculture, the share of agricultural land is slowly declining, while land used for settlements and transport is growing. The loss of agricultural land is particularly noticeable in the areas surrounding urban settlements.

Land use is in the hands of farmers. The intensification of agriculture has strongly increased in recent decades and existing agricultural land is being farmed with higher yields. Farmers achieve this by using pesticides and more resistant crops on the one hand, and less diverse cultivation systems across large areas on the other.

The use of pesticides and monotony of crops is causing biodiversity to suffer and the biological diversity of flora and fauna in the agricultural landscape to disappear. The agricultural land that is cultivated according to conventional methods is mainly criticised for being a cause of the decline in the insect population. The counterpart to conventional farming is organic farming. In 2010, organic farming cultivated an area of 980,851 ha spread across 16,532 farms; by 2013, this had grown to 1,047,000 ha (+6.74 %) across 18,000 farms (+8.88 %), and the trend is increasing.

Society's ideal is that of biological, regional food production and animal welfare, a “wish economy”, a preference for naturalness. Consumers long for naturalness (Zühlsdorf et al., 2012). Farmers, on the other hand, are caught between the ideal and a reality dictated by a price economy (Hauschild, 2018). In short, productivity and naturalness are caught in a “battle” (Kayser et al., 2012).

When focusing on the agricultural production process, farmers are influenced by various direct and indirect factors (Mupepele et al., 2019), which we identified by searching through literature and the media.

2.1.1 Direct Influencing Factors

Figure 2 focuses on the agricultural production process as this is the center of action when it comes to plant protection, fertilisation and crop diversity. Farmers have to strike a balance, taking into account the possibilities offered by site conditions, i.e. habitat occurrence and quality, size, connectivity, soil type and climate.

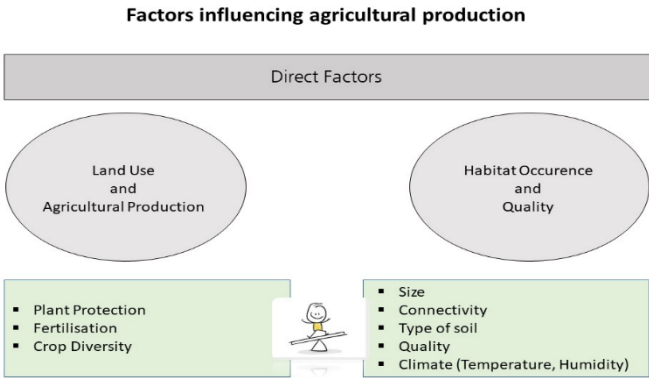


Figure 2. Land Use Dilemma - Direct Factors
(Source: Author's elaboration based on Mupepele et al., 2019, p. 343.)

Farmers have to pay attention to all of these factors each and every day and adjust their day-to-day work accordingly. An example is the recent droughts, which had a direct impact on farming and land use.

2.1.2 Indirect Influencing Factors

Changes in land use need to be framed within a socio-economic, political and legal framework that is beyond the immediate control of individual farmers (Anton et al., 2018). The indirect influencing factors and framework conditions play a non-negligible role. Keywords are economy (i.e. the market), policy and society (Figure 3).

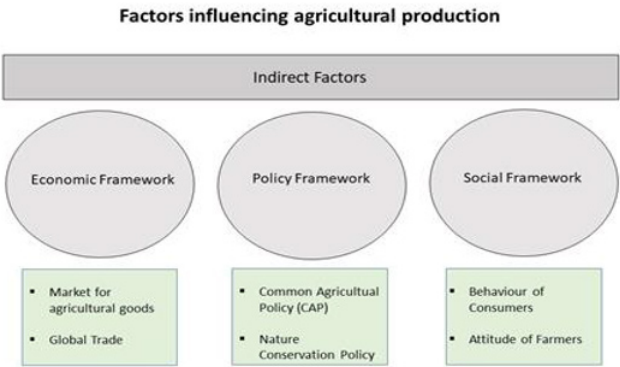


Figure 3. Land Use Dilemma - Indirect Factors
(Source: Author's elaboration based on Mupepele et al., 2019, p. 343.)

The economic framework involves sectoral peculiarities such as the high capital intensity and the need to develop towards stronger market orientation and entrepreneurial orientation in agricultural markets that have been regulated for a long time. This also concerns the increasing regulatory density, i.e. the political framework.

Economic necessities, nature conservation regulations and agricultural policies (at the European Union (EU) and German level) do, of course, also have an influence on the farmers' decisions. Also, a wide range of societal expectations with regard to consumer protection, sustainability, as well as animal welfare and biodiversity pose challenges for farmers. In addition, societal behaviour, the esteem in which farmers are held and public opinion exert an impact on farmers' decisions. Further key issues that farmers have to deal

with are structural change, land pressure, supply chain and food retailing. A lack of planning certainty, changes in policy due to the government elections in September 2021, falling pig prices and the significant rise in input prices are also causing concern among farmers (Deter, 2022).

All in all, a complex system involving active currents and interdependencies. The three indirect factors identified are presented and discussed further below.

2.2 Economic framework

The German agricultural production market has evolved over past decades. Agricultural farms should be able to generate an income through their operations and try to continue farming by adjusting their approaches to farm management and crop cultivation. When marketing their products, however, they often encounter a lack of understanding with regard to the unequal conditions of competition they have to contend with, not only at EU level, but all across the globe. Trade liberalisation, growing price competition and quality requirements are disturbing the market which is regulated by the EU (Canenbley et al., 2004). Farmers perceive increasing globalisation as real threat, as agriculture in Germany and the EU is closely integrated in global supply chains.

The prices that farmers are paid for food is an intensely discussed topic. They are supposed to be fair, ensure an adequate agricultural income, encourage sustainable consumption and regulate supply and demand. However, farmers feel that prices are not fair, as they are a result of a complex situation of quality and mass market, of supply and demand, and of power and powerlessness within the supply chain. Faced with low producer prices and additional requirements related to environmental protection and animal welfare, farmers started to protest in 2019.

2.3 Policy framework

Agricultural policy framework mainly comprises the EU's Common Agricultural Policy (CAP) and its regulatory framework. Many reforms have been implemented since the earlier negotiations concerning the formation of the European Economic Community in the 1950s (Feindt et al., 2019).

The recent 2013 CAP reform (originally planned to be valid until 2020) links the payment of 30% of direct payments to requirements to set aside 5% of a farm's arable area as an "ecological focus area", for crop diversification and to maintain permanent grassland (so called "greening" as part of the first pillar). A close link between agricultural and environmental policy, income policy and environmental integration is the subject of interest. The next reform of the CAP, which will cover the period from 2023, emphasises even more climate and biodiversity topics with its "European Green Deal" programme and "Farm to Fork" strategy. The respective EU countries must present their strategies, but Germany is lagging behind as it has not submitted its strategic plan for the CAP on time.

The transitional regulation, agreed by the European Council and the European Parliament, states that direct payments and support programmes under the second pillar will continue under the current CAP rules until December 2022. This, in turn, has an impact on farmers and the way in which they plan and manage their production.

Farmers are extremely concerned about the constant introduction of new political guidelines for agriculture. Major worries concerning the content of new regulations/conditions are very pronounced and far-reaching, as farmers feel that their very existence is at risk. This is reflected in the protests where concerns, worries and the lack of social recognition by the wider public are expressed (Heinze et al. 2021). Due to the many tightening regulations that have been introduced in the past, farmers have no planning security and are distrustful of policymakers and their institutions (in particular the European Commission and BMEL). The ever-increasing number of requirements scare them.

One example is the Fertiliser Ordinance, which transposes the EU Nitrates Directive into national law. It is part of Cross Compliance (CC). This means that, in the event of infringements, in addition to fines, single farm payments are usually reduced by 3%. Violations of the Fertiliser Ordinance are also considered an administrative offence. Fines are threatened in the event of non-compliance with the regulations (Michel, 2022; Bockholt, 2022).

Another example is the agricultural package presented by BMEL (Julia Klöckner) and BMU (Svenja Schulze) ministers and approved by the Cabinet in 2019. The package comprised an insect protection programme, animal welfare labelling and a restructuring of direct payments for 2020. The insect protection programme, in particular, entails cuts for conventional agriculture. Both ministers left no doubt that insect protection measures are necessary, with Schulze explaining that "*We can use them to turn the tide against insect mortality*". However, Klöckner also stressed that the use of plant protection products must continue to be necessary and possible in principle, stating that "*There will be exceptions, even in protected areas*". The Federal Government intends to provide additional funds for the new special framework plan, with farmers

receiving hardship payments to compensate for additional production requirements and income losses due to plant protection legislation (Insect Protection Act) from January 2022 onwards (LZ Rheinland, 2021). By early February 2022, however, no agreement had been reached by the responsible planning committee. It was expected to be in place by the end of 2021 and is thus inexplicable for the farmers concerned (Awater-Esper, 2022).

2.4 Social framework

People's initiatives have achieved great success, like the "Save the Bees!" campaign in 2019, which became the most successful petition for a referendum in Bavaria's history. More than 1.7 million people signed the petition insisting on the government to take action, and the demands made their way into law (Bayerisches Staatsministerium für Ernährung, Landwirtschaft und Forsten, 2020). In the very same year, similar requests were launched in the federal states of Baden-Württemberg (BW) and North Rhine-Westfalia (NRW). However, in the absence of the support of at least 10% of eligible voters in BW, its 2020 endeavour was not as successful. Something similar happened in NRW and the state parliament rejected the request. Nature conservation associations in Brandenburg (in 2019) and Lower Saxony (in 2020) also launched referendums, and a series of major debates ensued. These proceedings attracted the attention of the press and the general public – a milestone for nature conservation. Farmers did, however, criticise the requests as they threatened to deprive them of the basis for their farming practices.

Farmers are also influenced by consumers' behaviour as the demands is not supported by a willingness to pay/willingness to buy. This is known as the *"attitude-behaviour gap"* (Terlau et al., 2015). The awareness of society is growing, but it is not reflected in consumer spending behaviour. The consumer and the food retailing companies are adding to the dilemma as society has a *"tight is right"* or *"the cheaper the better"* mentality.

The agricultural sector is increasingly being blamed for issues such as pesticide residues in food, farm size structure, monocultures, the use of pesticides, animal husbandry and the distribution of farming premiums. However, the detachment from society combined with the discussions that are taking place internally in both the consumer market and the agricultural sector are presenting farmers with a new set of challenges (Berkes et al., 2019). They also have to grapple with how to go about processing this criticism and try to participate in dialogue with society.

2.5 Land Use Trilemma

In the present, areas of anthropogenic land use are in high demand: both food security and climate protection, not to mention biodiversity, are in strong competition with each other. The impossibility of ensuring these three aspects simultaneously is clear. They all have one thing in common: planetary boundaries. The Earth's surface area is limited! An inescapable "trilemma" of land use exists and agricultural land use is its nucleus.

With their wide-ranging yet vital goals, climate protection, biodiversity conservation and food security are vying for land use. The significant role of land use is demonstrated, among other things, by the scientific analyses presented by the Intergovernmental Panel on Climate Change (IPCC) in the Special Report on Climate Change and Land (Shukla et al., 2020).

The complex interactions between the demand for and use of resources and claims over land use are spiralling: with the growth of the population, the pressure to meet food demands are rising which, in turn, implies the need for higher production and more cultivated land. But land area is finite. Conversion of land (e.g. for wind power) and high-priced land are the results. Although the use of pesticides and fertilisers boosts agricultural production, this leads to further irrevocable loss of biodiversity and contributes to climate change which, in turn, affects productivity and the availability of arable land.

Which aspect of trilemma takes priority – why or when? The controversy of all three aspects has to be considered and we need to think about which issues are competing against one another. Conflicts of goals arise, and the only way out is to scrutinise the respective aspects and their impacts. However, farmers are at the center of this trilemma.

Human nutrition is dependent upon agricultural products. That is why agriculture and the food industry were declared systemically relevant and part of the critical infrastructure during the coronavirus pandemic (Revermann, 2020).

Furthermore, the pressure on the agricultural land market has increased enormously since the financial crisis of 2008. Land has become an object of speculation; the many different interests in land use with non-agricultural capital are driving up prices drastically in many places. Small and medium-sized farms (often family farms) can no longer hold on to their land and the transfer and establishment of farms are failing due to a lack of financing. Less intensive, organic farms, in particular, are increasingly at risk of ceasing to

exist. Besides providing food, these farms fulfil many other important functions for society, such as groundwater and soil protection, structural and species diversity and provide spaces for social interactions and transfer of knowledge.

3 Mixed Method Approach

Due to the current fast pace of economic and political developments, knowledge generation is key.

Because of, in part, the global situation, triggered by the pandemic and situations within the EU and Germany, topics such as the Common Agricultural Policy (CAP), the European Green Deal, the Fertiliser Ordinance and the Agricultural Package (action programme on insect protection, animal welfare labels, redeployment of direct payments) have a dynamic that requires adapted action in the ongoing investigation.

The "mixed-method design" approach used here (Auer-Srnka, 2009) to investigate the complex problematic issues relating to the challenges faced by farmers in relation to nature-protected areas promises such a pragmatic approach. "Mixed-method design" is a method that has recently been met with an increasingly positive response (Becker et al., 2019) because it allows both quantitative and qualitative measures to be taken as a scientific method (Kuckartz, 2014). The use of the qualitative data generated through this approach supports the design of the quantitative study carried out later down the line and helps to refine subsequent questions.

The use of a semi-structured questionnaire initiated the qualitative assessment of the challenges that farmers face in relation to nature-protected areas. According to the mixed-method design, the resulting insight into the concerns of farmers will later be transferred to the quantitative study. Linking together all the information collected will generate practice-oriented knowledge of farmers' aspects with regard to nature-protected areas.

The qualitative study was carried out in 21 selected nature protected areas (NPAs) in Germany. The process for selecting these project areas proceeded as follows. From a total of 8,805 nature-protected areas and 4,544 flora and fauna habitat (FFH) areas in Germany, 5,225 NPA areas were selected in an initial step which overlap with FFH areas. In a further step, the land use classification of the areas adjacent to the NPAs was determined. Taking further criteria (area size, proportion of forest, length to adjacent farmland, etc.) into consideration, the number of NPAs could be reduced to about 200. There was also a desire to ensure that these areas were distributed relatively evenly across the country. The main cause of problems was the inconsistency of demarcations (NPA/FFH), as land use data and federal state-specific NPA demarcations were not always accurate. In another step, a more precise differentiation between arable land and grassland as well as a fine analysis of land use was carried out. Fine selection and problems such as hedges and shrubs as flight barriers for insects and too short distances to the centre of NPAs further reduced the numbers of NPAs to be selected (Eichler et. al 2022).

The survey carried out is not representative as a consequence of the number of selected project areas and hence participants involved.

4 Assessment of Selected Qualitative Research

Evaluations of selected questions of the qualitative study, which describe the entanglement of dilemma and trilemma in more detail, are presented below.

4.1 Farmers' Attitude

A change in agriculture, the so called "Strukturwandel" or structural transformation, is obvious: the number of farms decline steadily in recent years. Small farms with a small area are disappearing, while the number of large farms with an area of over 200 hectares is on the rise. Due to the globalised market, competition is increasing, in which agricultural enterprises are "battling" to keep up with an efficient cultivation of their land (statista, 2021).

This is due to increasing regulations, animal welfare debates, price dumping by food retailers and imports from third countries whose products are produced to much lower standards. In addition, more and more people are concerning themselves with the way in which farmers manage their land. Farmers are facing harsh criticism and are speaking out, expressing that they feel that they are the "scapegoat" for an agricultural policy that has been misguided for years.

One respondent stated the following:

'Our profession is receiving less and less recognition. As a result, the concentration of farms will increase and family farms will be destroyed.'

One objective of the study is to find out how willing farmers are to use more ecological, biodiversity friendly farming methods (i.e. attitude). Other objectives are to analyse preparedness, the related obstacles and the importance of acceptance.

4.1.1 Willingness to collaborate with farmers to provide ecological services

Organic farming is a particular resource-conserving, environmentally sound and sustainable form of agricultural production, and therefore makes an important contribution to preserving biodiversity. It has gained traction as the income prospects of organic farms have increased due to the growing demand for organic, biologically produced food (DESTATIS, 2021). However, organic farming is supposed to be not sufficiently competitive because the sale of organic food alone does not cover the additional costs associated with this farming method. In addition, the revenues generated are not enough to compete with imported products or the high lease prices (German Environment Agency, 2022).

The participants were asked about their willingness to cooperate with other farmers to provide ecological services (Figure 4). Out of 17 respondents, 12 stated that they would be open to collaborating in this field or doing so already. Against the background of the announcement by the new BMEL and BMUV ministers of a strategic alliance (Lemke, 2022) it gives an insight into willingness with the aim of solving the key challenges of farmers – with instead of against each other (as seemed to often be the case in the previous period of government).

4.1.2 Willingness to reduce the use of plant protection products and nutrients

Plant protection is a challenging topic. The need to safeguard yields and produce high-quality and diverse food against a background of population growth, climate change, resistance and the urgency to conserve resources means that plant protection products and high-quality nutrients are an indispensable part of farmers' problematic use of these products and are showing a willingness to reduce their use of them as much as possible. As figure 5 shows, 15 participants would be prepared to reduce the use of plant protection products and nutrients, while only 2 would not.

The reduction in the use of synthetic chemically produced plant protection products is an essential effort towards ecological farming, where the use of these products is prohibited. (Sievers-Langer, 2018).

4.1.3 Willingness to enrich landscapes with small structures such as hedges and field margins

Over the course of several decades, natural and semi-natural habitats such as hedges, orchards, small woods, shrubs and field rows have been removed and converted for arable or grassland use (Feindt et al., 2019). Such landscape features serve as habitats for plant and animal species (Scheper et al., 2013). They vary from region to region and have a positive effect on agricultural land use. They protect farmland from wind and water erosion and delay water loss from the soil during dry periods. Humus is produced by foliage improving soil quality.

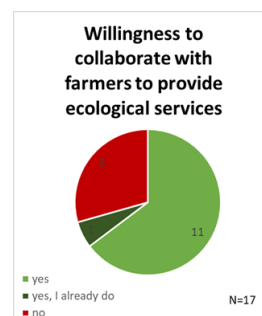


Figure 4. Question: Would you be willing to collaborate with other farmers to provide ecological services?

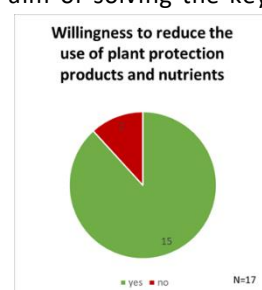


Figure 5. Question: Would you be willing to reduce the use of plant protection products and nutrients?

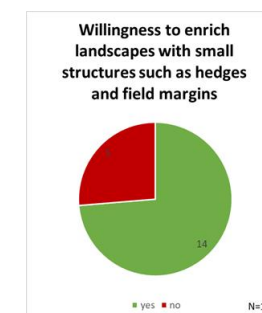


Figure 6. Question: Would you be prepared to enrich the landscape with small structures such as hedges and field margins?

The connection to nature is an influencing factor for conservation efforts as shown by the respondents' answers (Figure 6). Farmers are aware of it and apprehend the importance of it. The vast majority of respondents (14 participants) would be prepared to enrich the landscape with small structures such as hedges and field margins. Only 4 respondents would not be prepared to do so.

4.1.4 Desire to participate in the development and implementation of nature conservation measures

Farmers are resenting about the lack of and incorrect political framework conditions in place. They ask for policymakers to make reliable, consistent and forward-looking decisions in order for them to operate their farms economically and sustainably with consensus to animal welfare and nature protection. Most farmers are willing to play an active part, are open to change and have ideas to realign. The desire to cooperate is evident – see Figure 7. Almost 75% of respondents are eager to be part of the process, they want to be involved, and want their opinions to be heard by policymakers and decision-makers. They demand “to be talked to and about”.

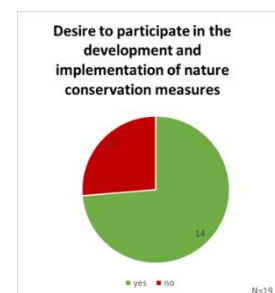


Figure 7. Question: Do you wish to participate in the development and implementation of nature conservation measures?

4.2 Recognition of farmers' work

One central aspect of the social framework as an indirect influencing factor is the recognition that farmers perceive for their work, the appreciation they feel. Consumers certainly become more cognizant when they see convoys of tractors that farmers used for the many protests starting in 2019. The relationship between town and countryside, between man and nature, has become imbalanced. Consumers, i.e. society, have not yet undergone the transformation into today's dominant understanding of agricultural farm management, many still believe in a romantic image of a farm. But not only farmers vanish, so is biodiversity. Society benefits from cheap food but forgets that farmers have a right to exist. Farmers are advocating for consequences and denouncing society for the current system that is hanging nature out to dry. They know that they have to represent and speak up for ecosystems.

4.2.1 Recognition from society of farmers' work in relation to the importance of recognition perceived by the farmers

The bar chart in Figure 8 illustrates the respondents' perceived recognition from society. Not a single farmer in the sample has the feeling that he receives much recognition from society for his work as a farmer. Three participants feel that they get adequate recognition. Of these, two are of the opinion that recognition for their work is important, whereas the other participants think the opposite. However, 14 participants believe to receive only little recognition from society. Of these, twelve are of the opinion that recognition for their work is important.

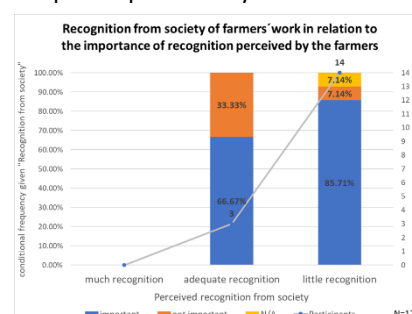


Figure 8. Combined Questions: How important is recognition of your work to you and how much appreciation of your work do you get from society?

4.2.2 Recognition from policymakers of farmers' work in relation to the importance of recognition perceived by the farmers

Farmers feel that environmental and agricultural policies are endangering family farms, they are fighting back against the constant “bashing” of farmers by policymakers and environmental organisations. Due to the fact that this was a very current topic at the time of the survey, the question of appreciation (recognition) arose.

The bar chart in Figure 9 illustrates the respondents' perceptions of recognition by policy makers. Of the farmers who feel that they receive a lot of recognition for their work from policymakers, both consider the recognition of their work to be important. Only one farmer feels to receive enough recognition from policy makers and considers the recognition of work to be very significant. However, of the 16 farmers who believe to receive little recognition for their work from policymakers, only two consider the recognition of their work as not important, while 13 believe the opposite.

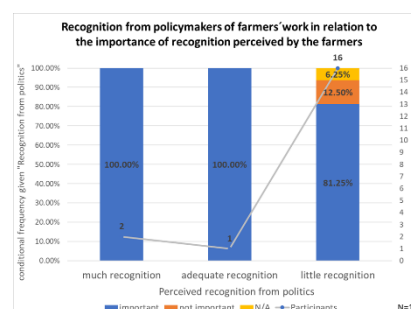


Figure 9. Combined Questions: How important is recognition of your work to you and how much appreciation of your work do you get from politics?

The results show that the respondents believe to receive too little recognition for their work, but this criterion is important to them. Recognition is thus a factor that can influence farmers' attitudes and indirectly affect agricultural production.

4.2.3 Financial recognition of farmers' work in relation to the average total cultivated area

The farmers were asked how they perceive the financial recognition of their work. Not one participant expressed a given high financial recognition for their work. On the other hand, four participants stated that they perceive the financial recognition of their work to be adequate. However, the vast majority, a total of 14 participants, feel that they receive little financial recognition of their work as farmers, which underlines the above statement.

The bar chart (Figure 10) also shows that the average cultivated area of participants who claim to receive adequate financial recognition of their work is significantly larger (934.4 ha on average) than that of those who claim to receive only low financial recognition (601.22 ha on average).

Nonetheless, agriculture, i.e. farmers, do need and ask for recognition of their work, which also implies economic gain. Farmers do not get the recognition they actually think to deserve. The many protests held in front of food retail centres in recent years just show evidence that farmers are troubled by price dumping and unfair trade practices (Federal Ministry of Food and Agriculture, 2019).

4.3 Farmers' Challenges

More animal welfare, more climate protection, more biodiversity – farmers have little to complain about when it comes to policy goals, but they are critical of the path set to be taken to achieve these goals. In recent debates, farmers have expressed that they anticipate and fear incredible challenges. Strict political requirements, lack of planning security and rise in production costs, which are offset by low producer prices, are demanding. If farmers want to go on, they need to invest in their future, which is usually done with the help of loans. Because of the ever-changing regulations and ever-tighter requirements, farmer have no idea what will be valid in ten years' time and are scared of being caught in a debt trap. The half-life of investments is getting shorter and shorter, and the depreciation of invested capital within a given period is significantly challenging. In addition, possible and planned interdictions inhibit key investments. Last but not least, the purchase or lease of land ties up important capital.

In the survey, farmers were asked to describe the challenges they face today and expect to face in five and ten years' time in an open question, multiple answers were possible. With the help of inductive categorisation according to Mayring (Mayring, 2015), the farmers' descriptions of their challenges were grouped into the following categories: Economy, Ecology, Society and Politics/Governance, which describe the causes of the challenges farmers are facing. The "Economy" category includes challenges relating to profitability, producer prices, available manpower and future viability regarding an increasing concentration of farms. The "Ecology" category describes challenges such as drought, water shortages, precipitation, climate change, wolves and the development of plant resistance. The "Politics" category includes challenges such as funding policy, increasing requirements, fertiliser regulations and plant protection product requirements. The "Society" category describes challenges such as young talent, the coronavirus, recognition and tourism. Given the complexity and scale of the challenges, it is not one single aspect that is making the situation difficult, but a variety of levels within the agricultural system that need to be considered.

It is striking that farmers perceive the challenges they face both today and in ten years' time in almost the same way, except for the fact that the ecological aspect, mainly described by climate change, is more present today. This may be due to the fact that the questionnaire was carried out at the time of the protest against the "Aktionsprogramm Insektenschutz" (insect protection programme), and a time when the fertiliser ordinance, animal welfare and the German Commission on the Future of Agriculture were under discussion – not only within the agricultural sector, but in society, too. Figure 11 illustrates the various aspects years to come.

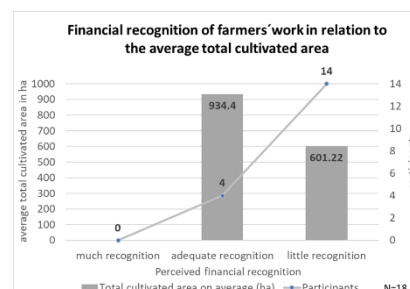


Figure 10. Combined Questions: How much appreciation for your work do you get financially and how many hectares do you cultivate in total?

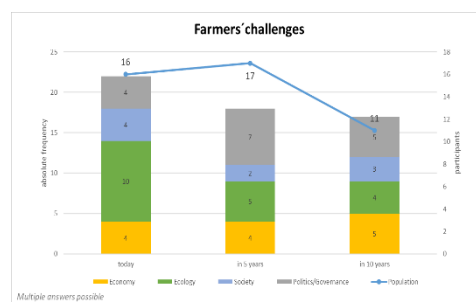


Figure 11. Question: What challenges do you face this year as well as five and ten years from now?

5 Results of assessment

The results of this analysis indicate that indirect driving forces exert pressure on farmers. Driven by work and rising costs, and stigmatised by interest groups, farmers are struggling not only to secure their economic existence, but also to achieve recognition. Farmers lack support, financing strategies and planning security. Increasing regulatory framework has a negative impact on farmers' willingness to enhance biodiversity. As the results of the assessment of farmers' willingness indicate, farmers are ready to participate in biodiversity enhancement measures if framework conditions are acceptable and agreed upon. In concrete terms, this means swiftly implementing the recommendations of the Borchert Commission and the German Commission on the Future of Agriculture for a socially supported agriculture and further developing the German strategic plan for the Common Agricultural Policy (CAP) with regard to social justice, ecology and animal welfare. Farmers are willing to "play their role". Clear framework conditions are necessary and need to be adapted to suit today's time. Demands on politics have been made clear and, above all, must be reliable in the long term in order to resolve the existing conflict of objectives faced by farmers.

6 Conclusion

To answer the introductory question of which factor is the most limiting and which is the least, it is not just a matter of identifying individual factors that need to be improved in order to encourage farmers to increase biodiversity in agriculture. It is about the interconnections between the direct and indirect factors, i.e. the entanglement of dilemma and trilemma, in which farmers find themselves, which must be resolved are essential in this complex subject area.

In order to meet challenges, entrenched behaviours, norms and ways of working need to be altered. This concerns society, policymakers and the regulatory system. The cross-cutting challenges – related to the management practices adopted by farmers both within or around NPAs – need to be addressed urgently if we are to make a concerted effort to enhance biodiversity. Emergency to environmental measures and urgency of human action are needed immediately in order to halt or even reverse the loss of biodiversity.

There is also a loud call for policy action. As the German National Academy of Sciences Leopoldina stated in the summer of 2020, a reliable and long-term framework for agriculture is necessary (Anton et al., 2020). In October 2021, a statement issued by the Sustainable Development Solutions Network Germany (SDSN Germany) read as follows: *"without fundamental, global course correction in politics, society and the economy, global warming of more than three degrees and a dramatic loss of biodiversity and habitats are imminent"* (SDSN Germany, 2021). Sustainable Development Solutions Network (SDSN) Germany also wrote an open letter to the coalition partners in October 2021 (Schnappauf et al., 2021) appealing to make sustainable development the guiding principle of the new legislative period and to approach the necessary modifications with courage. This requires a holistic and multidisciplinary approach to environmental and social sciences, a framework for land use and its resource use. Society must also be prepared to play its part. The long-term challenge is to build and maintain trust between all levels of stakeholders (farmers, consumers, policy makers, public authorities). Conducting this study, it has become increasingly clear that much more dialogue is required, not only about the subsidy landscape in general, but also about the complexity of the subject itself.

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3 HESITATIONS AND ASPIRATIONS OF FARMERS IN NATURE-PROTECTED AREAS

3.1 Introduction to the Article

German farmers are currently facing complex and multi-layered challenges that need to be overcome if they want to promote biodiversity in the modern agricultural landscape. This is a challenge that is made difficult by numerous interests and objectives that often compete and conflict with one another. Farmers are tasked with counteracting climate change, ensuring food security, securing their income, and enhancing biodiversity on their farmland, while at the same time navigating a network of EU, national as well as regional legislation. The need to secure their income adds a layer of complexity, as economic viability is essential for the sustainability of their agricultural practices. These complicated interrelationships often lead to growing discontentment among agricultural practitioners.

Moreover, the expectations of society regarding farmers' land management practices and society's reluctance to shoulder additional costs related to environmental services have increased complexity. This conflict is another challenge that needs to be resolved and balanced in a consensual manner by all stakeholders involved.

Farmers operate within their perceived economic feasibility. They are receptive and respond to expert recommendations, particularly regarding pest control and fertiliser use. Furthermore, some of this may be influenced by industry lobbying. Agricultural input companies, such as those producing pesticides, fertilizers, and genetically modified seeds, often engage in lobbying efforts to promote their products and influence agricultural policies and practices (Institut Arbeit und Wissenschaft, iaw, Universität Bremen 2019). However, it is important to recognise that long-term environmental consequences of practices are not always readily apparent to farmers or communicated to them understandably and transparently, which may affect the decision-making process where appropriate. In addition, limited access to comprehensible information and alternative approaches may further limit their ability to make informed decisions. Moreover, the situation of farmers operating in NPAs is marked by stringent conservation regulations, limited land use options, and the need to strike a balance between agricultural productivity with environmental conservation and climate protection. They must navigate the complex interplay of maintaining productive agricultural practices while adhering to regulations aimed at preserving biodiversity, protecting natural resources, and mitigating climate change impacts. Despite following the regulatory framework, these farmers often find themselves in opposition to society's perception that they are responsible for the rise in food prices, pollution and biodiversity loss as well as being viewed as the main contributors to deteriorating land conditions. This societal perception contrasts with the multi-faceted

factors influencing farming methods (Hannus and Sauer 2021). While these perceptions and realities are often at odds, this is not always the case. There are instances where societal expectations align with sustainable practices adopted by farmers, especially when supported by appropriate policies and incentives. However, consumer demand and market dynamics often prioritize productivity over sustainability, indirectly placing pressure on farmers to adopt practices that may have detrimental ecological consequences. In addition, societal expectations and reluctance to pay additional costs related to environmental services further complicate the situation, creating a conflict that requires a balanced solution by all stakeholders involved. In this context, the role of society and politics in promoting awareness and responsible consumption is instrumental in steering farming methods towards sustainability. Monetary compensation, such as payments for environmental responsibility gives stronger consideration to biodiversity-friendly approaches. Thus, farmers are under increasing pressure to move towards more sustainable practices, reduce their ecological footprint, adapt to climate change and maintain or even enhance biodiversity. At the same time, economic strains, such as low product prices and rising input costs impose additional burdens (see article above). A major concern for the farmers is the financial impact of switching to more sustainable practices, as many farmers are already facing financial difficulties (Sponagel et al. 2021). They fear that changing their farming practices or investing in new technologies will further drive up their costs, potentially affecting yields or profitability.

Despite these challenges, German farmers have hopeful expectations for the future. They agree with the need for transformation; however, a key objective is to secure domestic agriculture to ensure food sovereignty. This commitment includes preventing drastic structural changes that could disrupt the agricultural sector and compromise its sustainability (Deutscher Bauernverband e.V. 2021). I.e., the farmers are committed to sustainable food production and are taking an active role in seeking ways to reduce their environmental impact and diversify their farms. The role of the German government, politicians and other stakeholders can play a part. They can support farmers in their transition to a more sustainable, biodiversity-friendly and profitable future. Mutual understanding of interests and regionally coordinated measures that facilitate diverse flora and fauna, with the active participation of all stakeholders involved, need to be promoted. This approach, as advocated for example by Wolf (Wolf 2023), will play an important part in coping with the pressing challenge.

Having highlighted the importance of mutual acceptance, trust and changing established behaviours and norms in the previous article, the focus shifts to the area of quandary faced by farmers in their efforts to improve biodiversity. This transfer accentuates the nexus of various factors reflected in the “dilemma” and “trilemma” that continues to shape the landscape of

sustainable agriculture. The findings from the qualitative study offer valuable insights into the complex dynamics of incentives, constraints and the role of indirect factors influencing farmers' commitment to biodiversity. While financial incentives certainly are important in addressing these environmental challenges, the analysis serves to emphasise the need for a more holistic approach.

3.2 Objective and Message of the Article

The paper ahead, consisting of a **quantitative** study and a subsequent **qualitative** study, conducts a closer examination of incentive systems, bureaucratic hurdles, and the perspectives of farmers, the key stakeholder group, involved in shaping the agricultural landscape within and around NPAs. Based on these findings, the objective is to understand how and why German farmers cope with the perceived complications of cross-compliance, which ties financial support to compliance with regulatory standards, direct payments, and the broader European Common Agricultural Policy (CAP) in the context of biodiversity enhancement.

As this examination explores the subject, its objective is to reveal farmers' desires and scepticism, offering insights into the dynamic interplay between economics, policy, society, and environmental sustainability. The study of these multiple elements aims to create a holistic understanding of how German farmers perceive and address the challenges of promoting biodiversity in their farming practices in NPAs. Building on the qualitative study in the previous chapter, which provided in-depth insights into farmers' experiences, attitudes, perceptions and further issues, this chapter focuses on the quantitative study. The mixed-method approach used continues to play a central part in gaining a deeper and more nuanced understanding of the intricacies of this many-faceted setting. This approach aids in improving comprehension of these complex interrelationships.

3.3 Details of the Publication

The article was accepted by the MDPI Special Issue *Sustainability via Biodiverse Agri-Food Value Chains*, in February 2023, under the title *Hesitations and Aspirations of Farmers in Nature-Protected Areas*.

The article is available online <https://www.mdpi.com/2071-1050/15/4/3196>

A copy of the published article is printed in the following.



Article

Hesitations and Aspirations of Farmers in Nature-Protected Areas

Angela Turck and Wiltrud Terlau

Special Issue

Sustainability via Biodiverse Agri-Food Value Chains

Edited by

Prof. Dr. Konstadinos Mattas, Dr. George Baourakis and Dr. Stefanos A. Nastis



Article

Hesitations and Aspirations of Farmers in Nature-Protected Areas

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Abstract: Pursuant to Sustainable Development Goal (SDG) 15 of the 2030 Agenda for Sustainable Development of the United Nations, one pivotal target is to halt biodiversity loss. This paper's objective is to analyze why and how German farmers hesitate to implement more than the prescriptive measures with regard to cross compliance and direct payments under the European Common Agricultural Policy (CAP) and what their aspirations are for possible incentives to bring biodiversity into focus. By applying a mixed methods approach, we investigate the experience of individual farmers by means of a qualitative approach followed by a quantitative study. This analysis sheds light on how farmers perceive indirect influencing factors and how these factors play a non-negligible role in farmers' commitment to biodiversity. Economy, policy and society are intertwined and need to be considered from a multi-faceted perspective. In addition, an in-depth analysis is conducted based on online focus group discussions to determine whether farmers accept financial support, focusing on both action- and success-oriented payments. Our results highlight the importance of paying attention to the heterogeneity of farmers, their locations and, consequently, farmers' different views on indirect drivers influencing agricultural processes, showing the complexity of the problem. Although farmers' expectations can be met with financial allocations, other aspects must also be taken into account.

Keywords: biodiversity; farmers' heterogeneity; incentives; Sustainable Development Goals (SDGs); mixed methods approach



Citation: Turck, A.; Terlau, W.
Hesitations and Aspirations of
Farmers in Nature-Protected Areas.
Sustainability **2023**, *15*, 3196.
<https://doi.org/10.3390/su15043196>

Academic Editors:
Konstadinos Mattas,
George Baourakis and Stefanos
A. Nastis

Received: 10 January 2023
Revised: 6 February 2023
Accepted: 7 February 2023
Published: 9 February 2023



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1. Introduction

One of the 17 Sustainable Development Goals (SDGs) set by the United Nations (UN) in 2016 is SDG 15 (Life on Land) [1]. Target 15.5 states that there is a need for “urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species” [2]. Insects, the most species-rich class of animals, and thus an essential component of biological diversity, can be found in almost every habitat on land and water. Insects contribute to the nutrition of other animals and humans as part of our world's food production, notably through pollination. Furthermore, many insects themselves serve as food for other animals and are helpful for pest control [3]. In 2017, a publication on the “Insect biomass decline” by Hallmann et al. displayed data on a worrying drop in insects [4]. This also applies to insects in nature-protected areas [5–7]. An indicator of extinction of threatened species is the IUCN (International Union for Conservation of Nature) Red List of Threatened Species, which is also known as the IUCN Red List [8]. This list displays an inventory list of the global conservation status of different species, including insects. The latest Red List of the German Federal Agency for Nature Conservation was published in 2021/2022, which confirmed advanced decline in insects. Almost 30% of insects are classified as endangered, critically endangered or endangered to an unknown extent [9].

Nature-protected areas are legally binding areas in Germany where the special protection of nature and landscape is required. A regulation for such areas can be found in the

German Federal Nature Conservation Act in § 23 (1) [10], and within these nature-protected areas, owners must accept restrictions that come with the declaration of protection, pursuant to § 14 (2) of the German Basic Law [11]. Since this is a perceived encroachment on the rights of third parties, disputes may arise between owners and nature conservation authorities, especially with regard to said restrictions. As farming is practiced in nature-protected areas, the Common Agricultural Policy (CAP) of the European Union (EU) also affects farmers working on arable land within nature-protected areas [12]. The CAP has been one of the most important political areas of European policy since the establishment of the European Community in 1957 and has been repeatedly adjusted to the living situations in Europe over the past decades [13,14]. Globalization, climate change and the strengthening of rural areas are central regulatory aspects of the CAP [14]. In this context, agriculture is caught between social and ecological responsibility as well as the economic necessity for sustainable entrepreneurial action.

Farmers receive direct and indirect payments. These subsidies are bound to conditions such as food safety, animal welfare and environmental protection. In addition to EU funds, German farmers receive federal and state subsidies, such as payments from agri-environmental programs. The EU agricultural support is divided into the first and second pillars based on binding and voluntary measures, respectively. The direct payments outlined by the CAP are found in the first pillar. They are the core element of EU agricultural support. This instrument supports the income and protects agricultural enterprises from risk, regardless of production. These payments are granted per hectare of agricultural land—if the respective conditions are met. The linking of agricultural payments to obligations concerning environmental, human, animal and plant health as well as animal welfare is known as “cross compliance”. Another payment outlined in this first pillar goes towards climate and environmentally friendly land management practices, which is defined as “greening”. “Greening” promotes agricultural services for climate protection, species conservation, diverse cultural landscapes and sustainable production [15]. The second pillar comprises targeted support programs for sustainable and environmentally sound management, as well as for rural development. Especially for farmers, the focus is on voluntary agri-environmental and climate protection measures (AECM) in agriculture, in addition to payments for organic farming and for “Natura 2000” sites [16].

Having implemented these regulations, farmers in Germany feel trapped in the so-called “trilemma” [17]. Farmers are not only obligated to counteract climate change and provide food security, but legislation also requires farmers to enhance the biodiversity of their farmed land. The farmers’ ability to think economically is disturbed by political framework conditions set by the EU (“Green Deal” [18] and “Farm to Fork Strategy” [19]) and Germany. Multiple regulatory requirements exist [20]; some of them are incomprehensible to farmers, which leads to growing discontent among these farmers. In addition, the diverse societal expectations towards farmers’ management of land use and society’s eagerness not to pay the additional cost of such “services to environment” come into conflict. An important keyword here is “consumer behavior” [21], which resonates poorly with farmers. The farmers have clearly expressed their discontent through their demonstrations in 2019. In this context, the German Diversity of Insects in Nature-protected Areas (DINA) project, a trans- and interdisciplinary research study, was started [22]. The DINA project is based on an interactive approach to integrate scientific findings with socio-ecological aspects and stakeholder perspectives. The socio-ecological aspects of the project includes a stakeholder analysis to identify farmers working on arable land within nature-protected areas as key stakeholders [23]. Nowadays, farmers face a variety of challenges such as drought, energy shortages, and restrictions on fertilization due to the Plant Protection Act and Plant Protection Application Ordinance. They are components of the Insect Diversity Protection Act introduced in September 2021 [24]. Farmers have to manage all this and more. In order to gain insight into the hesitations and aspirations of farmers, we conducted a qualitative study [23] followed by a quantitative survey using previous findings that again will later be complemented by a further qualitative study. This research centers on

the question of how farmers cope with the conservation of biodiversity on arable land within nature-protected areas. Obstacles and possible financial incentives, inter alia, are examined. The focus on arable land in such protected areas is chosen because the protection of this land is not anchored in the current German Arable Farming Strategy 2035 (Ackerbaustrategie 2035) [25]. With our chosen approach we gain an understanding of farmers' commitment to promoting biodiversity by examining constraints on and aspirations of farmers in nature-protected areas. We aim to determine whether financial incentives are sufficient to motivate farmers to enhance biodiversity in nature-protected areas. As in the past, the world political situation was different from the one we find today.

2. Methodology and Research Findings

The combination of qualitative and quantitative research methods, the so-called “mixed methods design” approach, is a method that has received more attention in the past several years [26–28]. The used data collection tools were applied in three consecutive steps [29]. Firstly, our data were generated with a qualitative study [30] which supported the subsequent design of the quantitative (second) study that, in turn, led to a later qualitative (third) study [31]. This kind of triangulation promises a deeper insight into farmers' obstacles in promoting biodiversity. Because of the dynamic momentum of the changing political and economic situations, generating knowledge is essential.

The collected data were consistently anonymized.

2.1. Qualitative Study (First Stage)

With the help of a qualitative study that targeted and identified key stakeholders, i.e., participating farmers who work in 21 nature-protected areas within our DINA project, 33 farmers were asked to participate in a semi-structured questionnaire [30]. One goal was to learn about their concerns and to understand their scope of action, i.e., their decision-making framework. Our evaluation shows that agricultural production is influenced by factors and direct and indirect drivers, which confront farmers with complex decision-making situations [32]. Direct drivers include land use and agricultural production as well as habitat condition and quality. In contrast, indirect drivers (i.e., economy, policy and social frameworks) are beyond the immediate control of individual farmers [7]. Farmers are required to make decisions on a daily basis, and they have to find a balance between these factors [23]. Economically, they are confronted with the erosion of price and increased production demands, leaving little space for considering ecological aspects such as the environment and biodiversity. This is what we call the “dilemma of farmers” [23]. Moreover, the land use stems from multiple demands made on the land: for the benefit of climate change, securing food and enhancing biodiversity. The German Advisory Council on Global Change (WBGU) defines this as the “trilemma” of land use [17]. In the middle of the trilemma are the farmers, as demonstrated in Figure 1.

Therefore, it can be determined that the indirect influencing factors, the framework conditions, are a nuisance to farmers. This led us to focus on indirect drivers in the later quantitative study.

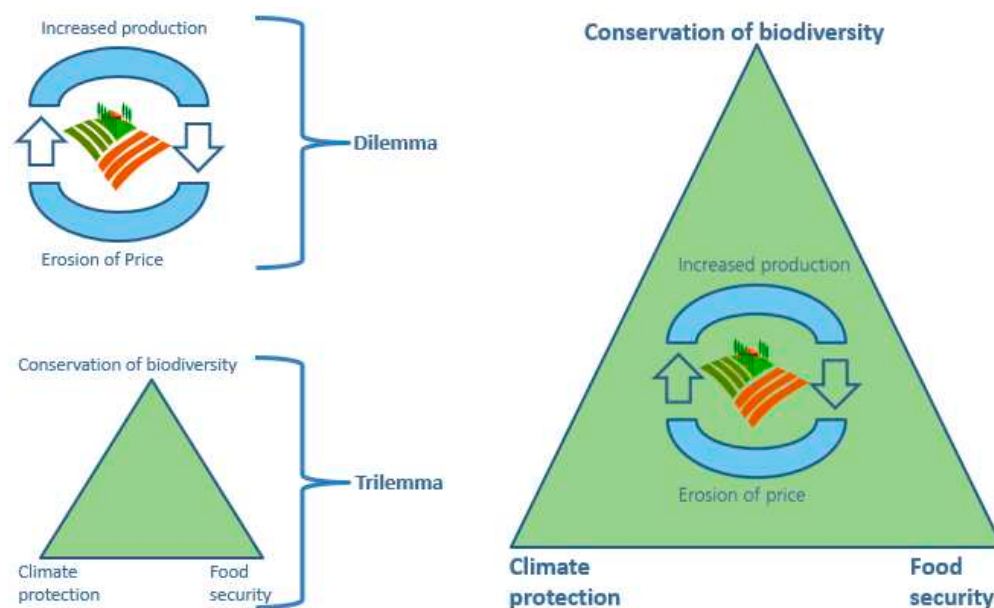


Figure 1. Farmers' dilemma and trilemma—a schematic illustration (source: author's elaboration based on [17]).

2.2. Quantitative Study (Second Stage)

The gained insights obtained by the qualitative study were used to further refine our findings. The quantitative survey (second stage) which followed consisted of a computer-assisted telephone interview (CATI) and an in-depth and subsequent qualitative study, the latter being an online focus group study (third stage). This methodology of using a three-stage approach promises a deeper understanding of farmer's concerns. The German polling institute dimap was commissioned to carry out both steps [33].

2.2.1. Computer-Assisted Telephone Interviews (CATI) and the Research Findings

CATI Study: The Basic Population of the Study Comprised Farmers Who Cultivate Arable Land or Grow Wine or Fruit in Nature-Protected Areas. The sample was selected via pre-selection of the areas by the project partners. From the 100 nature-protected areas in Question that were of interest to the DINA Project, 97 farmers were interviewed. The duration of an interview was about 20 min, and the survey period was from 27 December 2021 to 2 February 2022.

An interview in its various forms remains the main method of practical social science [34]. However, an interview can only guarantee a sufficiently thorough amount of knowledge if it is conducted in a controllable form [35]. The technology of computer-assisted telephone interviews enables the efficient handling of telephone surveys [36]. The ability to target calls by geographic regions, the possibility that the respondent can ask to clarify questions and the substantially low attrition rate ensure these aspects [33]. The selected telephone survey method is a reliable instrument of social research, and the interviewer-assisted survey provides quality assurances during the survey process. The telephone interview was conducted using the questionnaire displayed on the screen of the computer. The questionnaire was developed to achieve coherent and comparable interviews [37]. The interviewer recorded the given answers of the interviewee by using the keyboard or mouse, which matched with the pre-coded answers displayed on the screen. In our study, farmers were notified and informed about the objectives of the survey beforehand by means of a letter and informative brochure. The data of farmers operating in 100 selected German nature-protected areas were included. The areas were selected in consultation with project partners, and according to the same method, were used for selecting the 21 DINA project areas [22,38]. The response rate was 97% ($n = 97$).

Based on previously obtained knowledge, 35 questions in a sensible order as well as 5 mandatory statistical questions for possible later evaluation were developed.

The following observations are selected results from the telephone survey. Figure 2 shows that 96% of the surveyed farmers indicated restrictions on their land use within nature-protected areas. The respondents named these restrictions in an open question as requirements for plant protection, fertilizers, growth regulators, herbicides and a period of non-cultivation (fallow). Rarely mentioned conditions, on the other hand, included leaving stubble cereals standing, double seed row spacing, the use of regional seed and crop rotation requirements or harvest waiting periods, such as partially leaving crops or alternating crops left standing. For the query about receiving compensation, 59% of the respondents do not receive any payment, whereas almost 41 % receive compensation.

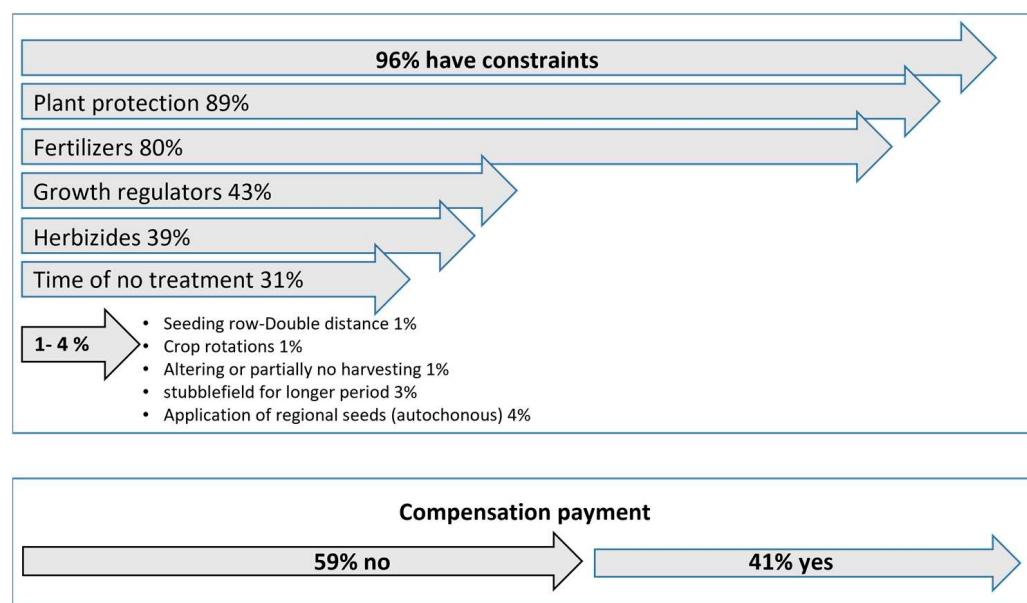


Figure 2. CATI-selected results: restrictions and received compensation payment ($n = 97$).

Table 1 gives an overview of payments received, which vary considerably. The mean value is EUR 450 per hectare and per financial year, and the median is EUR 300; additionally, the minimum value is EUR 40 and the maximum is EUR 1.600.

Table 1. CATI-selected results: amount of payment. Data in absolute and relative frequencies ($n = 39$).

Received Payments (EUR/ha)	Absolute Frequencies (Relative Frequencies)	Received Payments (EUR/ha)	Absolute Frequencies (Relative Frequencies)	Received Payments (EUR/ha)	Absolute Frequencies (Relative Frequencies)
<100	2 (5.1%)	250–299	5 (12.8%)	500–599	2 (5.1%)
100–149	2 (5.1%)	300–349	4 (10.3%)	600–699	4 (10.3%)
150–199	4 (10.3%)	350–399	1 (2.6%)	≥700	7 (18.0%)
200–249	4 (10.3%)	400–499	3 (7.6%)	Do not know	1 (2.6%)

In the case of farmers working in nature-protected areas, monetary needs are a vital factor. Farmers were invited to state their assessment of lost profits or perceived losses due to restrictions on land use. The question aimed to understand the subjectively felt reduction in acquisition opportunities due to existing usage requirements. Overall, more than 80% of the participants complained about a loss of profit. The perceived average loss is EUR 895 per hectare, whereas the median is EUR 400 per hectare, with a range from EUR 100 to EUR 8000 per hectare (Table 2).

Table 2. CATI-selected results: perceived losses and estimation of monetary loss per hectare per financial year of respondents. Data in absolute and relative frequencies ($n = 49$).

Estimated Monetary Loss (EUR/ha)	Absolute Frequencies (Relative Frequencies)	Estimated Monetary Loss (EUR/ha)	Absolute Frequencies (Relative Frequencies)	Estimated Monetary Loss (EUR/ha)	Absolute Frequencies (Relative Frequencies)
<200	6 (12.2%)	400 < 499	7 (14.3%)	≥3000	4 (8.2%)
200–299	7 (14.3%)	500 < 999	10 (20.4%)	Do not know	3 (6.1%)
300 < 399	7 (14.3%)	1000 < 2999	5 (10.2%)		

This scenario is followed by a question on whether farmers can imagine biodiversity having absolute priority in their land management, provided they receive monetary compensation. This was answered positively by 65% of respondents (Figure 3).

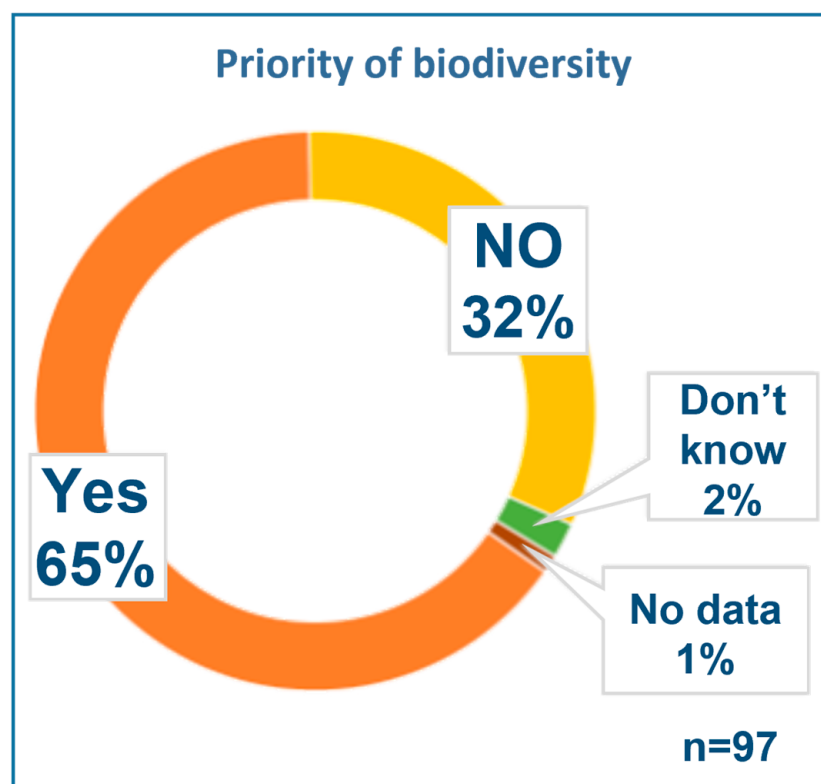
**Figure 3.** CATI-selected results: biodiversity is a priority provided monetary compensation is received. Data in relative frequencies ($n = 97$).

Table 3 shows farmers' monetary wishes for prioritizing biodiversity. The desired necessary financial incentive component, i.e., amount, ranges from EUR 300 to EUR 7500 per ha per financial year. It is remarkable that more than 25% of the respondents could not or did not want to give any information related to this topic.

Table 3. CATI-selected results: desired monetary incentives per hectare for prioritizing biodiversity. Data in absolute and relative frequencies ($n = 97$).

≤EUR 500	9 (9.3%)	EUR 2000–EUR 2999	5 (5.2%)	Do Not Know	16 (16.5%)
EUR 500–EUR 999	26 (26.8%)	≥EUR 3000	5 (5.2%)	No data	12 (12.4%)
EUR 1000–EUR 1999	24 (24.7%)				

Monetary incentives are a crucial factor in motivating farmers to increase biodiversity. Moreover, the literature distinguishes and discusses how payments that reward not only action, but also success (outcome-based agri-environmental measures), may be an additional suitable approach [39–42]. As Figure 4 shows this question was answered in the affirmative by around 75% of the farmers surveyed.

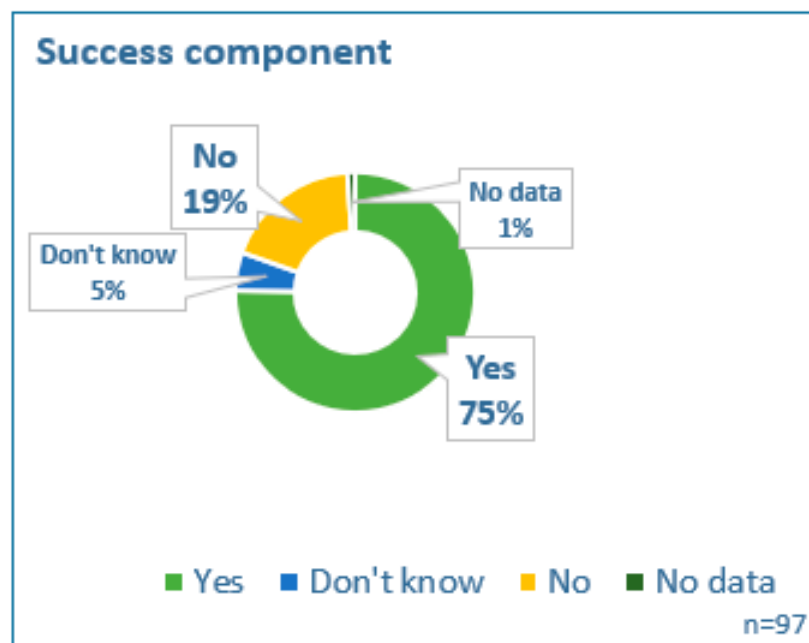


Figure 4. CATI-selected results: acceptance of outcome-based payments. Data in relative frequencies ($n = 97$).

For the sake of completeness, it is to be mentioned here that other questions in the telephone survey included facts about hourly wages, time spent working in nature-protected areas and the farmers' assessment of the effort they put into biodiversity measures at their desks.

In order to take a closer look at the option of a success fee, online focus group interviews, the third stage of the study, were carried out.

2.2.2. Qualitative Study of Online Focus Groups (Third Stage) and the Research Findings

Generated from the aforementioned quantitative study, we continued the survey of farmers in greater depth with the help of a qualitative focus group study. The methodological approach of focus groups (here, online focus groups) is a diagnostic tool that reveals the emotional and rational anchored attitudes of the target group (i.e., farmers working on arable land in nature-protected areas). The results are not meant to be representative in a statistical sense. Instead, focus group studies collect a wide spectrum of different experiences, perspectives, feelings, ways of thinking and evaluations with regard to a transparent topic to identify typical attitudes. An interview guideline was developed.

A total of 15 of the former 97 participants of the previous CATI study, who are farmers who manage land in nature-protected areas in Germany, discussed, among other things, how they currently manage their land in the protected areas. The online focus group interviews took place on 6, 7 and 12 April 2022. Each discussion round had three to five participants and a duration of about 120 minutes. The participants were divided into four online focus groups and allocated a time based on their time preference; no other criteria were applied.

As in the preceding telephone interviews, we commissioned the opinion research institute dimap to lead the focus groups [33]. The aim of the online dialogues was to capture the interpretation, views and attitudes of the respondent farmers in discussion.

They were recorded and subsequently transcribed. Using a content analysis, an often practiced form of qualitative data analysis working with categories and the categorization of the material [43,44], we focused on monetary incentives for encouraging biodiversity in nature-protected areas, as well as on the potential acceptance of success-oriented payments. Statements were coded into categories. As the coding process was carried out and the participants were promised anonymity, a summary of statements are presented rather than word-by-word quotations.

The current financial compensation for participation in biodiversity-enhancing measures based on action was mostly described by farmers as inadequate and was criticized for not reflecting the high value placed on biodiversity. Additionally, the payment of lump sums (flat rates) was predominantly viewed by the respondents in a negative light, and they believe that location and yield quality, as well as additional expenses and cost increases, are not accounted for. Furthermore, farmers advocated minimizing administrative expenses, as they state that their perceived burden is immense. With regard to conceivable models for creating monetary incentives for biodiversity-friendly management, the farmers unanimously advocated for a reward system. However, unlike the responses from the farmers during the telephone interviews, the farmers participating in the online focus groups had a critical view of the additional payment of result-based (success) fees or bonuses. They affirmed this by calling into doubt the practical design of targets and performance controls. They believe that it would be challenging to implement in view of the work in and with nature. The farmers state that effectiveness would be difficult to measure, as other environmental influences are relevant and, in addition, a singular consideration of small areas is not possible and not comparable.

Irrespective of financial aspects, most farmers agreed that measures to promote biodiversity can and will be implemented by them, provided that they are not linked to economic losses for the farm.

Ultimately, they asked for full financial compensation for labor and administrative expenses, yield and profit losses, and material and leasing costs.

3. Discussion

Our research aimed to explore farmers' hesitations and aspirations regarding their commitment to biodiversity within nature-protected areas and to elicit their motivation for implementing these measures. In our studies that used CATIs and online focus groups, the views of individual farmers were collected and analyzed together as the studies complemented each other.

The CATI evaluation of respondents' answers from an economical point of view is challenging: many factors that have to be taken into account are not known and are applied differently by each farmer, not to mention fluctuating production prices and costs (this refers to direct as well as indirect drivers). The items and their amounts, e.g., in the calculation of contribution margins or in full-cost or partial-cost calculations, are not known. However, the task of this study was not to determine the extent to which farmers have "priced in" fixed costs in their answers. Moreover, the willingness of farmers to make their calculations transparent needs to be questioned. The fact that 25% of the farmers avoided this question feeds into this aspect. Furthermore, the farmers advocated for minimizing administrative expenses, as their perceived burden is immense. With regard to conceivable models for creating a financial incentive for biodiversity-friendly management, the farmers who participated in the CATIs unanimously advocated for a reward system. On the other hand, unlike the telephone-interviewed farmers, the farmers who participated in the online focus groups viewed the additional payment of success fees or bonuses critically. This is because they doubt the practical design of targets and performance controls, and they believe it would be challenging to implement these payments in view of the work in and with nature. The farmers stated that effectiveness would be difficult to measure, as other environmental influences are also relevant and a singular consideration of small areas is not possible, and not comparable.

In addition to purely financial incentives, the farmers named a number of other aspects that could motivate them to act in a more biodiversity-friendly way and which are almost entirely related to questions around the design of the agri-environmental measures and their cooperation with the administrative authorities. Three central, interwoven strands of action were identified.

1. The need for the stronger appreciation of farmers' contribution of agriculture to biodiversity, especially through monetary incentives.
2. Flexibility and freedom in the implementation of measures in order to obtain the possibility of biodiversity-friendly land management.
3. The recognition of farmers as partners in nature conservation through dialogue at eye level.

The in-depth online focus group study also revealed that the success fee favored by CATI participants was viewed questionably and skeptically in terms of implementation, as these participants could not envision a practical approach to evaluating success based on their experience of implementing existing measures. The current financial compensation for participation in biodiversity-enhancing measures based on action was mostly described by farmers as inadequate and was criticized for not reflecting the high value placed on biodiversity. In any case, there is currently no consideration of location and yield quality, or of additional expenses and increases of costs.

Our findings show that the issues faced by farmers practicing on arable land within nature-protected areas are many and varied. This is reflected in the heterogeneity and associated divergent viewpoints of farmers and is evident from both the CATI- and on-line focus group studies. The respondents' answers regarding monetary issues, such as perceived monetary loss due to constraints in agricultural management, i.e., land use and perceived necessary monetary incentives, show that there is not only a large range within respondents' answers, but there is also a wide gap in the expectations around monetary incentives.

The aggregation of these studies show that our respondents are basically open-minded towards biodiversity-friendly measures and are willing to implement them, but expect sufficient financial support for these actions. They often stated that they would do more if they were financially rewarded. They also pointed out that promoting biodiversity must not be their sole responsibility. Various studies on farmers' willingness to act in a biodiversity-friendly manner have shown that farmers have a receptivity to change, but that acceptance of their work performance significantly affects them [45,46]. Furthermore, monetary incentives are not the only factor that plays a role. Other indirect influencing factors, such as policy and social frameworks, need to be considered.

The combination of qualitative and quantitative methods to investigate farmers' motivation towards enhancing biodiversity on arable land within nature-protected areas was suitable for our study. It enabled us to understand attitudes as well as motives, and we learned about farmers' individual thoughts and behaviors. In this way, our analysis helps to gain a deeper insight into this area of study. However, the study is not representative as it only focused on farmers of existing nature-protection areas in Germany that were chosen through a project partner selection.

4. Conclusions

This study reveals that the individual farmer is deprived of determining their scope of action with regard to biodiversity, as the CAP mainly determines payments for agri-environmental measures in nature-protected areas, i.e., in the EU and the Federal States of Germany. This indirect driver (CAP regulations) has a high impact on farmers' motivation to mitigate biodiversity loss. Monetary incentives are particularly important when we talk about agricultural land use within nature-protected areas. Especially in this study, incentives were found to be significant for achieving a high acceptance of well-considered measures, as farmers are willing to actively participate in agri-environmental measures aimed at effecting biodiversity, but their willingness would be increased by raising pay-

ments for desired public services [47]. To this end, it was demonstrated, that it is important to define comprehensible criteria that represents viable options for farms taking into account individual farm habitats. Offers made by regional contractual nature protection schemes are one approach to solving this problem [48].

Further scientific evaluations using the study methods should be carried out. Existing interdependencies and mutual dependencies of economy, ecology and society need to be further investigated to achieve the vital conservation of biodiversity.

Author Contributions: Conceptualization, A.T.; methodology, A.T.; validation, A.T. and W.T.; formal analysis, A.T.; investigation, A.T.; resources, W.T.; data curation, A.T.; writing—original draft preparation, A.T.; writing—review and editing, A.T. and W.T.; visualization, A.T.; supervision, W.T.; project administration, W.T.; funding acquisition, W.T. All authors have read and agreed to the published version of the manuscript.

Funding: The research for this article was funded by the German Federal Ministry of Education and Research (BMBF) as part of the project “Diversity of Insects in Nature-protected Areas (DINA)” and was handled by the VDI Project Management Agency (Grant Number FKZ 01LC1901).

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The generated dataset can be made available for research purposes upon request to the corresponding author.

Acknowledgments: We would like to thank Nicolas Fuchshofen for his valuable and appreciated contribution to the development of the sub-project of our work package “Institutional Framework and Stakeholder-Analysis”, as part of the overall “Diversity of Insects in Nature-Protected Areas (DINA)—Project”.

Conflicts of Interest: The authors declare no conflict of interest.

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4 FARMERS' ECONOMIC DEMANDS AND MOTIVATIONS FOR BIODIVERSITY IN NATURE-PROTECTED AREAS: A MASLOW-BASED EVALUATION

4.1 Introduction to the Article

Building on the insights gained from previous studies, this article shifts the focus to the economic and motivational dimensions that influence farmers' commitment to biodiversity-enhancing practices. While earlier articles provide a foundational understanding of the external challenges shaping farmers' decisions, this article narrows the path by diving into the individual-level factors. Using Maslow's Hierarchy of Needs as a guiding framework, the study offers a structured approach to understanding how financial and non-financial incentives align with farmers' priorities.

The following article highlights the challenges farmers face in balancing ecological obligations with economic viability. This requires a thorough examination of the policies in place but in particular how these relate to farmers' experiences. By incorporating findings from focus groups and interviews, the study reveals insight into practical and psychological factors that either encourage or hinder engagement in biodiversity measures.

This study's key element is its emphasis on exploring beyond economic concerns. Farmers' motivations are influenced by a variety of factors, including their sense of autonomy, opportunities for recognition, and their ability to deal with bureaucratic structures. By including these elements in the broader narrative, the article demonstrates how an integrated understanding of needs and motivations can result in more effective and sustainable policies.

4.2 Objective and Message of the Article

The primary objective of this chapter is to uncover and analyse the economic, psychological and structural factors that shape farmers' commitment to biodiversity conservation in NPAs. Specifically, it aims to evaluate how financial incentives - structured as basic subsidies, action-based and result-based payments - interact with farmers' hierarchical needs, ranging from economic security to social recognition and personal fulfilment as defined by Maslow's model. The article seeks to provide a deeper understanding of how these incentives align with or fall short of farmers' expectations, offering insights into designing more impactful policy interventions.

The message of the article highlights the necessity of developing incentive systems that address both immediate and long-term needs. Financial incentives are essential, but they are insufficient to encourage long-term engagement. They must be paired with strategies that strengthen trust, reduce administrative complexity and recognise the vital role of farmers as

biodiversity stewards. This approach involves policies that meet the economic demands of farmers and resonate with the farmers' aspirations for autonomy, social connection and esteem within their communities.

By focussing on the motivations behind farmers actions, the article advocates a participatory approach to biodiversity conservation. By empowering farmers through practical support and inclusive governance, biodiversity efforts can be transformed from regulatory impositions into collaborative activities, ensuring both ecological and agricultural sustainability.

4.3 Details of the Article

This article, entitled *"Farmers' Economic Demands and Motivations for Biodiversity in Nature-Protected Areas: A Maslow-based Evaluation"*, serves as an integral part of the cumulative dissertation. Unlike the preceding articles, it is not published but is developed as a core component of this dissertation.

Integration with the Dissertation

While Article 1 analysed the macro-level constraints and Article 2 the micro-level hesitations and aspirations, this chapter provides a focused analysis of farmers' motivations. It synthesises the results and explores the intersection of economic incentives and psychological motivations for farmers operating in or near NPAs.

Including this article in the dissertation ensures a comprehensive examination of the issues faced by farmers in NPAs. The article is complementary to the publications as it bridges the gap between structural and individual-level analysis. It focusses primarily on motivational theory, which is an essential component of the dissertation aim to balance biodiversity goals with agricultural realities. Its inclusion enriches the dissertation's contribution.

Farmers' Economic Demands and Motivations for Biodiversity in Nature-Protected Areas: A Maslow-based Evaluation

1 Introduction

1.1 Background and Problem Statement

Biodiversity loss is one of the most pressing environmental challenges of our time, especially in Nature Protected Areas (NPAs), where human activities intersect with fragile ecosystems. Agricultural landscapes are both a cause and consequence of biodiversity degradation and preservation of biodiversity. Farmers are key actors as well as in key players in land management and significantly influence ecological outcomes through their agricultural practices (Turck et al. 2023). Despite the widespread acknowledgement of agricultural impact on biodiversity, participation in conservation efforts remains inconsistent and the level of commitment is often far from sufficient.

It is essential to understand how economic incentives, regulatory frameworks and personal motivations shape farmers' engagement with biodiversity-friendly practices. While some farmers actively adopt sustainable measures, many perceive conservation efforts as economically unfeasible, bureaucratically challenging, or misaligned with their professional identity. This study bridges this gap by analysing farmers' motivations and constraints, using Maslow's Hierarchy of Needs as psychological framework. Understanding how financial security, social recognition and self-fulfilment influence farmers' willingness to engage in biodiversity conservation is the key to designing effective agricultural policies.

The research is particularly relevant in the context of the European Common Agricultural Policy (CAP), which shapes the financial landscape of European agriculture. While CAP incentives exist for biodiversity conservation, their effectiveness depends on how they align with farmers' economic realities and psychological motivations. This study provides a structured analysis of what drives or hinders farmers participation in biodiversity-friendly land management by systematically applying Maslow's Hierarchy of Needs.

1.2 Research Aim and Objectives

The study examines the economic, social, and psychological drivers that shape farmers' engagement in biodiversity conservation within NPAs. Using Maslow's Hierarchy of Needs as an analytical framework, the research will:

- Examine the financial constraints and economic incentives influencing farmers' decisions regarding biodiversity conservation.
- Assess how social drivers, such as community belonging and societal recognition, affect farmers willingness to engage in biodiversity-friendly practices.

- Identify the psychological motivations that lead farmers to adopt (or reject) conservation measures.
- Evaluate the effectiveness of financial incentive models, including basic subsidies, action-based payments and result-based payments, in encouraging biodiversity-enhancing agricultural practices.
- Provide recommendations for policy recognition to maximise alignment between farmers' needs and biodiversity objectives.

By addressing these objectives, the study contributes to the academic understanding of farmers' motivations and provides valuable insights for policymakers aiming to design more effective biodiversity incentives.

1.3 Theoretical Foundation: Why Maslow's Hierarchy?

Maslow's Hierarchy of Needs (Maslow 1954) is an accepted psychological framework for understanding human motivation. The theory explains that humans progress from fulfilling basic psychological and safety needs to addressing higher-level needs, such as social recognition and self-actualization. The study applies Maslow's model to the agricultural sector, conceptualising farmers' engagement in biodiversity conservation through the following adapted hierarchy:

1. **Basic Needs** (Economic Security): Farmers need financial stability to sustain their livelihoods before considering biodiversity investments.
2. **Safety Needs** (Regulatory and Policy Stability): Farmers need predictable agricultural policies and reliable financial support.
3. **Belonging Needs** (Community and Social Networks): Farmers are influenced by their relationships with peers, institutions, and local communities.
4. **Esteem Needs** (Recognition and Respect): Farmers seek social validation for their environmental contributions.
5. **Self-Actualization** (Sustainability Leadership): Farmers engage in biodiversity efforts as a personal or ethical commitment beyond economic incentives.

This framework allows for a structured, systematic examination of the drivers and inhibitors of biodiversity-friendly practices among farmers in German NPAs. By integrating Maslow's psychological insights with economic and policy perspectives, the study provides a multi-dimensional understanding of farmers' motivations. In addressing this, the factors influencing farmers' willingness to participate in result-based agri-environmental measures are analysed. This investigation explores the rationale behind farmers' reservations, which can be tracked back to practical concerns and past experiences with bureaucratic processes.

2 Theoretical Framework: Maslow's Hierarchy in Agriculture

2.1 Understanding Maslow's Hierarchy of Needs

2.1.1 Origin and Core Principle of Maslow's Model

In 1943, Maslow published his paper "A Theory of Human Motivation" in which he set out his motivational theory. This was later expanded upon "Motivation and Personality" (Maslow 1943; Maslow 1954). The theory is based on the idea that human needs are structured in a hierarchical order, with individuals seeking to satisfy basic needs before advancing to higher psychological and self-actualization needs. This framework was developed in response to behaviourist and psychoanalytic approaches, providing a humanistic perspective on motivation (Maslow 1954).

Maslow's Hierarchy of Needs proposes a five-stage model of human needs, typically represented as hierarchical levels within a pyramid. The needs range from basic (psychological) needs at the base to self-actualization needs at the top. According to Maslow, individuals are motivated to fulfil basic needs before moving on to higher levels of needs. Maslow's model is commonly portrayed as a pyramid (Fig. 1), thereby emphasising that individuals must first address lower-tier needs before seeking fulfilment at higher levels.

The five levels are:

1. **Basic needs:** These are basic survival requirements, including food, water and shelter.
2. **Safety needs:** Personal security, financial stability and predictability in one's environment.
3. **Belonging needs:** Social integration, strong interpersonal relationships and community acceptance.
4. **Esteem needs:** Recognition, status and respect from peers in society.
5. **Self-Actualization:** The pursuit of personal growth, creativity and realisation once full potential.

It is widely acknowledged and not subject to discussion here that Maslow did not create the pyramid in its entirety as it is commonly portrayed. The pyramid shape was later developed by others based on Maslow's ideas to visually represent the Hierarchy of Needs (Bridgman et al. 2019). Maslow's theory is widely applied across disciplines, from psychology and sociology to business and policy studies, due to its adaptability in explaining human motivation. However, while the model provides a useful conceptual framework, it has been subject to critique. The argument is that human motivation is non-linear, and individuals may pursue multiple needs a mysteriously, depending on context and individual differences (Bridgman et al. 2019).

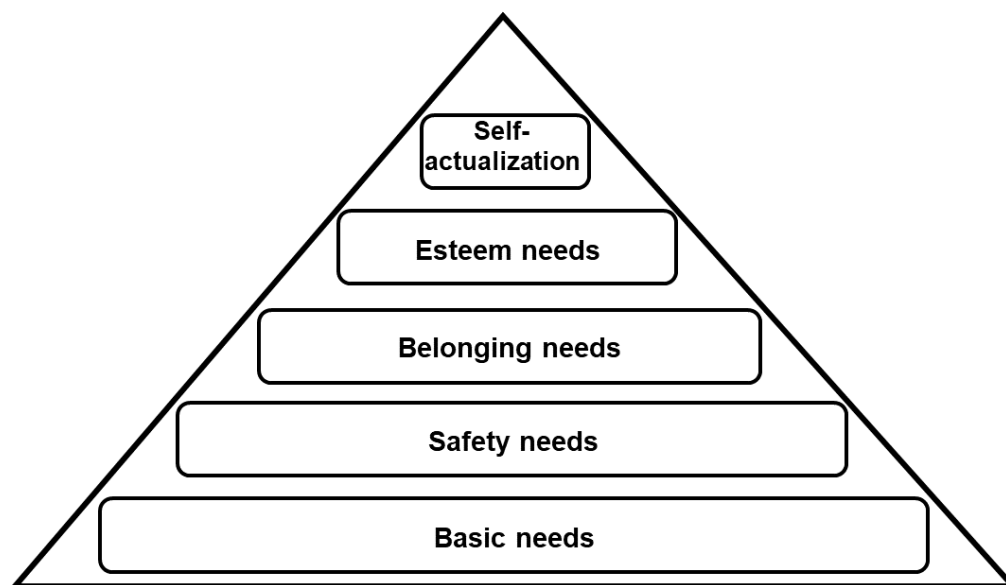


Figure 1: A Simplified Two-Dimensional Visual Representation of Maslow's Hierarchy of Needs
(Navy 2020)

2.1.2 The Application of Maslow's Hierarchy in Agricultural Study

The pyramid's popularity lies in its simplicity and the easily accepted psychological examples it conveys. Consequently, applying Maslow's basic concept of the Hierarchy of Needs is valuable for investigating the challenges and perspectives of farmers, who are the principal stakeholders in this context. In particular, this approach can assist in identifying and addressing issues such as financial insecurity, lack of social recognition, regulatory constraints, and the need for personal and professional development. The application of this theory to the motivation of farmers for biodiversity conservation enables such a structured opportunity for systematically analysing the multifaceted motivations influencing farmers' engagement in biodiversity-friendly practices. It considers their needs, ranging from fundamental economic security to higher-level motivations like self-fulfilment and contributing to environmental protection. Farmers operate in a complex environment where economic stability, regulatory frameworks, social structures, and personal aspirations interact dynamically. The application of Maslow's model to this sector provides a nuanced understanding of how hierarchical needs drive decision-making processes, especially in the context of biodiversity conservation.

Hierarchical Structure of Farmers' Needs in Biodiversity conservation

Maslow's Theory postulates that individuals prioritise the fulfilment of basic needs before progressing towards higher-order motivations such as personal growth and self-actualization. Within agricultural practise, this principle is reflected in a layered structure, in which economic

security, policy stability, and social belonging serve as prerequisites for higher engagement in sustainability efforts. Adapting Maslow's model to the agricultural sector thus provides a systematic framework for assessing how farmers balance economic demands with environmental responsibility.

The adoption of biodiversity-friendly practices is influenced by a complex interplay of economic, social and psychological factors within an uncertain and highly regulated environment. Economic pressure, policy incentives, and community expectations shape their farming decision-making. The adaptation of Maslow's model to agriculture provides a contextual framework for understanding farmers' motivations concerning biodiversity, revealing a layered structure of economic, regulatory, and personal incentives.

1. Basic Needs in Agriculture (Economic Viability and Resource Access):

At the base of Maslow's hierarchy, psychological needs are critical for farmers' survival and economic sustainability. Farmers require access to arable land, water, and financial security. Without secure income streams, derived either from market activities or subsidy programmes, their engagement in biodiversity conservation is challenging (Turck et al. 2023).

2. Safety Needs (Regulatory and Policy Stability):

Financial security through agricultural subsidies and stable regulatory frameworks is essential. The unpredictability of agricultural markets, combined with climate change-related risks, underscores the need for security measures (European Parliament 2014; Matzdorf 2004).

3. Social Belonging and Community:

Farmers' willingness to participate in biodiversity programmes often depend on their sense of belonging within agricultural communities, cooperative networks and community integration. Social recognition and peer influence play essential roles in shaping their engagement (Schneider et al. 2021).

4. Esteem and Recognition (Societal Valuation of Agricultural Contributions):

The perception of farming as a valued profession is a critical driver of engagement in biodiversity-friendly measures. Many farmers express frustration with negative public narratives that frame farming as a source of ecological degradation while overlooking the sector's potential for conservation leadership. Policy frameworks that enhance public recognition and reward sustainability efforts can improve motivation (Newbold et al. 2015).

5. Self-Actualization (Intrinsic Motivation):

Farmers who are intrinsically motivated to engage in sustainable agriculture view their work as personal mission. Enabling autonomy in decision-making and providing

platforms for knowledge exchange supports their self-actualization (Ryan and Deci 2000).

As shown in figure 2, this adapted version of Maslow's model, aligns each hierarchical level with key agricultural concerns, thereby illustrating how farmers' needs - ranging from economic stability and regulatory compliance to social acceptance and personal fulfilment - shape their decision-making regarding biodiversity-friendly practices. This adaptation of the framework facilitates the integration of biodiversity measures into farming practices and identifies policy interventions to address participation barriers.

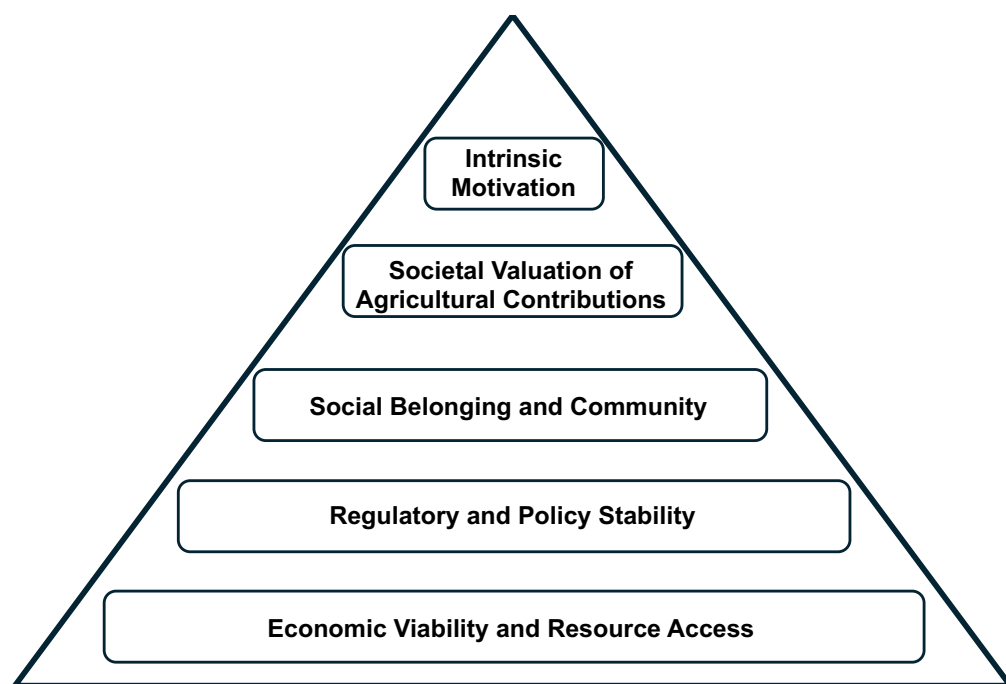


Figure 2: Maslow's Hierarchy of Needs Adapted for Agricultural Context (own illustration)

Analysing farmers' motivations through this model demonstrates that conservation efforts are most effective when they align with the immediate economic and social realities of farmers. This perspective emphasises the necessity of targeted policy approaches, ensuring that biodiversity programmes are not only ecologically beneficial but also economically and socially viable.

2.2 Adapting Maslow's Model to the Agricultural Context

The economic survival, regulatory constraints, social recognition, and intrinsic motivation shape farmers' engagement with biodiversity. These factors align with Maslow's Hierarchy of Needs, reflecting the complex interplay of economic, regulatory, social, and psychological

influences on farmers' decision-making. Applying this framework provides a structured approach for understanding how farmers navigate within NPAs.

2.2.1 From Industrialisation to Biodiversity Challenges

The process of industrialisation in the 19th and 20th centuries, and especially after the Second World War, transformed society and economy. During the period of agro-industrialisation in Europe, which was characterised by the extensive application of technological innovations in the agricultural sector, led to a fundamental structural change in farming practices (Statistisches Bundesamt 2023; Hemmerling and Pascher 2022). Farms expanded in size, while the number of individual farms declined (Jongman 2002). This consolidating shift was driven by a combination of economic growth, a rising population, and the increasing demand for a diverse and plentiful food supply (Hemmerling and Pascher 2022). In response, agriculture underwent further intensification and specialisation to meet the evolving societal needs. Changing in dietary habits reinforced this trend, impacting German farming, international trade and the environment (Robinson and Sutherland 2002). In addition, the technical progress in agricultural development was marked by a multitude of consequential problems associated with terms such as “agri-factory”, “agri-industry” or “agri-business” (Rösener 1993). Several studies document that one result is the decline of insect diversity and biomass loss in different habitats, even in nature-protected areas (Cardoso et al. 2020; Seibold et al. 2019).

While these changes in agriculture have contributed to biodiversity loss and ecosystem degradation, farmers, who are at the forefront of food production, paradoxically depend on an intact natural environment. Agricultural areas are responsible for the environmental impacts of humans on natural systems (Kastner et al. 2012). The widespread loss and degradation of ecosystems and biodiversity are the responsibility of farmers (Newbold et al. 2015). Cultivated land, typically of high quality, plays a central role in food supply through the production of feed and food. In modern, machine-based agriculture, the dominance of monocultures has become established, in which only one single genotype of crop is cultivated over vast areas, optimised for high yields and often lacking natural plant defence substances (Schuman et al. 2015). Large-scale monocultures featuring identical plants have harmful effects, leaving ecological deserts and causing long-lasting damage to ecosystems, especially when fertilisers and synthetic pesticides are used on a large scale (Gottfried 2022).

The structural dependencies created by the post-war agricultural model, primarily through the European Common Agricultural Policy (CAP), have placed German farmers in a vulnerable position regarding policy shifts, price fluctuations, and regulatory changes. CAP subsidies initially prioritised yield maximisation over environmental sustainability, reinforcing short-term

economic decision-making rather than long-term ecological resilience. Farmers' potential to engage with biodiversity conservation is significantly influenced by the CAP regulations, which have a noteworthy impact on their motivation to participate in such practices. To effectively incentivise participation in agri-environmental measures (AEMs), it is important that these regulations contain transparent and well-defined criteria, along with higher compensation. The implementation of regional nature conservation measures has been identified as a promising approach to address biodiversity loss in agricultural landscapes (Hirsch et al. 2022).

In contemporary times, this situation leads to an inherent contradiction, placing farmers in a challenging and ambivalent position. On the one hand, farmers are contributing to biodiversity loss (being key actors), yet on the other, they play an important role in the process of biodiversity restoration (being key players). Addressing these challenges requires the development of a framework that acknowledges the need to achieve a balance between economic viability and ecological responsibility, social incentives, as well as intrinsic motivations and conservation efforts.

Maslow's Hierarchy of Needs demonstrates the importance of ensuring farmers' financial and operational stability prior to expecting an increased commitment to biodiversity-friendly practices. By establishing a correlation between economic security and environmental responsibility, policy can promote the development of a more sustainable agricultural system that achieves a balance between productivity and long-term ecological stewardship.

2.2.2 Needs in Biodiversity Conservation

Maslow's five-tiered hierarchy offers a useful structure to analyse how farmers engage with biodiversity-friendly measures. Their level of commitment depends on how well their basic economic, regulatory, social, and self-actualization needs are met.

To better illustrate this hierarchical progression, the Staircase Model (Fig. 3) demonstrates the sequential advancement of farmers through various levels of motivation.

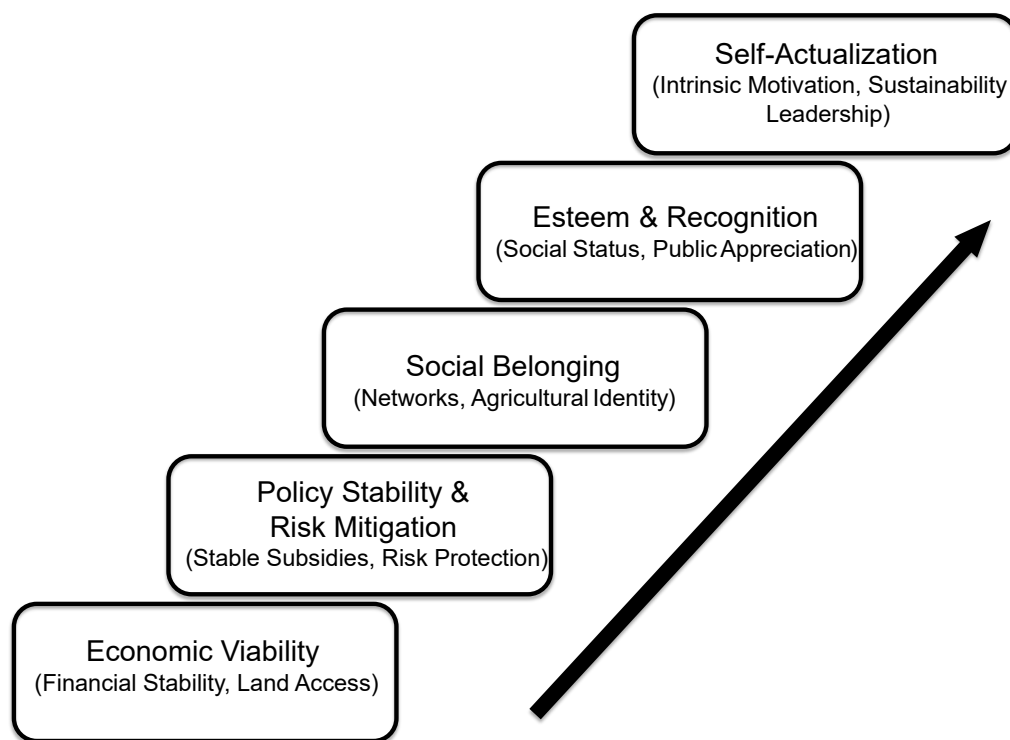


Figure 3: Staircase Model of Biodiversity Conservation Needs (own illustration)

Each step builds upon the preceding one, with economic viability forming the foundation, leading up to self-actualization within biodiversity conservation. In this model, the challenges and policy mechanisms that influence farmers' engagement are presented, with both potential barriers and enabling conditions for conservation participation.

1. Basic Needs: Economic Viability as a Prerequisite for Biodiversity Engagement

Farmers' primary concern at the foundational level is economic survival.

Key factors include:

- Access to financial resources, including farm subsidies, fair market prices, and stable income.
- Secure land tenure, ensuring the ability to sustain agricultural operations.
- Availability of essential inputs, such as water, soil fertility, and farming equipment.

CAPs direct payments (Pillar I) provide economic security; however, they are not directly linked to biodiversity and do not incentivise long-term engagement. CAPs indirect payments, the so called Agri-environmental schemes (Pillar II) offer biodiversity incentives but are perceived by farmers as complex, rigid, and administratively burdensome, reducing attractiveness to farmers. Market pressure (e.g. rising input costs, price fluctuations) further constrains farmers'

ability to prioritise biodiversity conservation initiatives.

Without economic stability, biodiversity conservation remains a secondary priority. Financially vulnerable farmers are unlikely to engage voluntarily without economic support. Economic stability thus remains the base upon which all other conservation motivations are built – if this need is not met, engagement remains unlikely.

2. Safety Needs: The Role of Policy Stability and Risk Mitigation

Once economic survival is secured, predictability and stability in agricultural policies become key drivers of engagement. Farmers are risk-averse due to their dependence on external factors such as climate conditions, market volatility and CAP policy fluctuations.

Essential safety concerns include:

- Stable agricultural policies providing long-term security for conservation incentives.
- Clear and predictable subsidy structures reducing uncertainty in financial planning.
- Climate resilient strategies to protect against environmental risks.

Farmers ask for clear, long-term commitments from policymakers to avoid the uncertainty associated with short-term, fluctuating CAP-reforms. Moreover, farmers' dependence on, for example, the local food trade and its market power further impacts their sense of security (dpa-Newskanal 08.12.2020). The transition from fixed subsidy models to performance-based incentives, i.e. like result-based payments, introduces financial uncertainty, which many farmers are not willing to accept without risk-mitigation programmes. The perceived bureaucratic burden complexity in biodiversity conservation programmes discourages participation as farmers feel the requirements as barriers rather than incentives. Hence, farmers' trust in policy frameworks is key for their participation in biodiversity programmes. Conservation initiatives are only effective if they are not perceived as financially or administratively risky.

3. Social Belonging Needs: Networks and Agricultural Identity

Farming is embedded in community structures, traditions, and professional identities, with social relationships and a sense of belonging within the agricultural community impacting farmers' decisions. Those, who feel disconnected or perceive biodiversity conservation as a threat to their traditional role are less likely to participate in biodiversity-friendly measures.

Social belonging key aspects include:

- Peer influence and knowledge exchange within farming networks.
- Community-based conservation initiatives integrating local identity with environmental stewardship.

- Collaboration between farmers, policymakers, and environmental groups to strengthen trust.

Farmers engaged in strong cooperative networks tend to adopt biodiversity-friendly practices more readily as peer influence and knowledge exchange have an impact on participation. The Ostrom's Common Theory highlights the importance of participatory governance, in which farmers play an active role in conservation decision-making rather than being passive recipients of top-down policies (Ostrom 2005; Hamlin et al. 1995). Furthermore, the perceived exclusion from biodiversity policymaking can strengthen resentment, reducing engagement.

For these reasons, a lack of social integration in conservation planning is a barrier to biodiversity adoption.

4. Esteem Needs: Recognition and Status in Farming Community

Farmers seek recognition for their expertise and contributions beyond economic success, including acknowledgement of their role as environmental stewards.

Esteem-driven motivations include:

- Public recognition and certification schemes for biodiversity-friendly farming.
- Positive media representation of sustainable agriculture.
- Integration of conservation achievements into professional identity.

Public discourse frequently frames farmers as contributors to environmental degradation. Moreover, lack of public recognition for biodiversity efforts leads to disengagement as farmers feel that their environmental contributions are unnoticed.

5. Self-Actualization: Biodiversity as a Higher Agricultural Value

At the highest level of the adapted hierarchy, self-actualization represents farmers who actively engage in biodiversity conservation, not solely for economic or social incentive, but because it aligns with their intrinsic values and long-term vision for sustainable farming.

Key drivers include:

- Strong environmental commitment aligned with personal values.
- Desire for long-term land stewardship and intergenerational sustainability.
- Recognition as a leader in sustainable agriculture.

Farmers who view biodiversity as part of their identity and legacy are more likely to pursue biodiversity-friendly measures beyond financial incentives.

2.3 Economic, Psychological and Social Drivers Affecting Farmers' Motivations

Farmers' commitment to biodiversity-friendly practices is not determined by economics factors alone, it is shaped by the complex interplay of economic constraints, psychological perceptions

and social influences. These interact within a broad context of regulatory frameworks, market structure, and cultural expectations. While financial incentives, such as those provided by the CAP, play an important role in ensuring economic viability, they are insufficient on their own to promote widespread adoption of biodiversity-friendly farming practices (Zukunftskommission Landwirtschaft 2021). Beyond economic considerations, behavioural and social factors shape conservation decisions.

The previous section outlined how Maslow's Hierarchy of Needs provides a structured framework for understanding these dynamics. This chapter extends the analysis by exploring the economic, psychological, and social mechanism that influence farmers decision-making processes. The challenges they face are further compounded by market pressure, shifting policies and evolving societal expectations. These conflicting demands, as outlined in earlier chapter article, *"Farmers are caught in Tri-Dilemma - Objectives and Challenges for Biodiversity in German Nature-Protected Areas"*, are illustrated by the concept of "tri-dilemma" of land use, which involves the competing objectives of climate change mitigation, food security and biodiversity conservation (Turck et al. 2023).

To address these challenges, it is essential to understand how these multi-dimensional factors interact to either encourage or discourage engagement with biodiversity. This chapter provides an exploratory frame to assess farmers' motivations and structural constraints they encounter.

2.3.1 Economics Factors: The Foundation of Decision-Making

The economic factors influencing agricultural production have a considerable impact on the engagement with biodiversity (Schmitz et al. 2019; CBD 2022). The prevailing agricultural model in Europe, shaped by the CAP and global trade pressures, prioritises maximising yield over ecological sustainability. Industrialised farming, characterised by specialisation, mechanisation and intensification, has been a contributing factor to biodiversity loss (Pe'er et al. 2022). However, biodiversity conservation itself presents economic challenges as the implementation of agri-environmental measures often required increased labour, financial investment, and long-term planning with no immediate market returns (Ducos et al. 2009) .

The financial incentives offered to farmers for conducting biodiversity-friendly practices are principally governed by the CAP subsidy structures, which provide a combination of basic subsidies (Pillar I) and targeted environmental payments (Pillar II). Nevertheless, the effectiveness of these schemes is constrained by administrative complexity, perceived inadequacy of financial compensation, and regulatory unpredictability (Hirsch et al. 2022). The recent shift towards eco-schemes and result-based payments under the CAP seeks to strengthen the alignment of economic incentives with conservation outcomes (Navarro and López-Bao 2019; Pe'er et al. 2019; Pe'er et al. 2021). Yet, concerns regarding long-term

financial security remains a key barrier (European Commission 2023). While these challenges affect all farmers, their impact is not evenly distributed. Large-scale agricultural enterprises benefit from greater financial reserves, access to services and economies of scale, allowing them to absorb conservation related costs more effectively. In contrast, smaller farms often face greater financial vulnerability and are less equipped to manage biodiversity-friendly practices. This economic asymmetry necessitates policy instruments that are tailored to account for differences in farm size, financial resilience and production systems (Brown et al. 2019).

2.3.2 Psychological Factors: Autonomy, Risk Perception and Professional Identity

While economic considerations form the basis of farming decision-making, psychological factors determine how farmers perceive, evaluate, and respond to biodiversity conservation measures. A key issue influencing motivation is the perceived degree of autonomy and control over decision-making.

Research indicates that highly prescriptive, top-down conservation policies often trigger resistance, as they conflict with farmers' desire for self-determination and regionally adapted land management strategies. Many farmers view top-down environmental regulations as overly prescriptive, restricting the ability to manage land according to their expertise and experience (Burton et al. 2008).

In this context, the design of agri-environmental incentives is essential:

- Action-based payments require farmers to implement defined conservation measures.
- Result-based payments offer financial rewards based on measurable biodiversity improvements. They provide farmers with greater autonomy in deciding how to achieve conservation goals.

The adoption of biodiversity measures by farmers is influenced by a number of factors, including autonomy, perceptions of risk and regulatory stability. Farming is inherently high-risk profession, which is exposed to economic, climatic as well as regulatory fluctuations. The adoption of biodiversity-friendly practices introduces additional uncertainties, especially when financial compensation is delayed or conditional on long-term biodiversity improvements. Many farmers are reluctant to invest in conservation efforts unless multi-year financial guarantees, risk-sharing mechanisms, or combined financial financing models mitigate these uncertainties (Burton and Schwarz 2013).

The professional identity of farmers also has a significant impact on their engagement in biodiversity conservation. Farmers primarily define themselves as food producers and therefore engage with biodiversity issues only secondary (Dannenberg and Follmann 2023;

Matzdorf and Lorenz 2010). This perception can lead to a reluctance to embrace biodiversity conservation efforts, which are often viewed as imposing additional burdens on farming practices. The dominant agricultural narrative, which has historically placed emphasis on productivity, efficiency, and technological advancement, has contributed to the widespread perception that conservation efforts that impose additional burdens rather than complementing agricultural goals. Consequently, conservation engagement tends to increase when biodiversity is framed as integral to modern, resilient agricultural systems rather than as an external requirement imposed by policymakers.

2.3.3 Social Factors: Peer Influence, Public Recognition, and Policy Trust

Also, social belonging plays a significant role in shaping farmers' engagement in biodiversity conservation. Farmers embedded in strong social networks are most likely to adopt biodiversity-friendly practices, as peer endorsement and knowledge exchange facilitates behavioural change (Burton and Paragahawewa 2011). Conversely, when biodiversity initiatives are perceived as unpopular by farmers, engagement rates decline.

Public recognition also affects farmers' willingness to participate in conservation measures. Farmers frequently reported a lack of societal appreciation for their role in maintaining ecological landscapes, coupled with negative public discourse portraying agriculture as a primary driver of environment degradation. This disconnect strengthens resentment towards biodiversity policies, particularly, when farmers perceive themselves as unfairly blamed for the broader ecological changes (Süddeutsche Zeitung 2020). Therefore, social acceptance also plays significant role in farmers' commitment to conservation measures (Burton and Paragahawewa 2011).

Policy trust is another crucial social determinant. Farmers expressed scepticism towards conservation regulations, particularly when past experiences with bureaucratic inefficiencies, inconsistent policies, or inadequate financial compensation have led to frustrations (Feindt 2004).

2.3.4 Summary: Integrating Economics, Psychological and Social Considerations

Farmers engage in biodiversity-friendly measures when they are economically stable, psychologically motivated and socially accepted. Financial incentives are important, but they alone are not enough. They need to be structured in such a way that aligns with farmers' risk tolerance and operational flexibility. If conservation policies fail to account for these broader dimensions, they will not be adopted, participation rates are likely to fall, and to face resistance. Economic drivers alone do not address the concerns related to autonomy, regulatory uncertainty, and social acceptance.

It is economically, psychologically and socially necessary to integrate these considerations into biodiversity policies to ensure sustainable, long-term engagement. To understand these factors a comprehensive understanding requires an extension beyond Maslow's framework, incorporating contemporary motivation theories that account for self-determination, risk behaviour, and social influence. The following chapter explores these theories, offering a refined perspective on the complex decision-making processes underlying farmers' participation in biodiversity conservation.

2.4 Complementary Motivation Theories

While Maslow's hierarchy offers a structured framework for understanding motivation, it has notable limitations when applied to complex decision-making in biodiversity conservation within the agricultural sector. One major limitation of Maslow's model is its rigid, linear structure, which assumes that individuals must fully satisfy lower-tier needs before progressing to higher levels. In contrast, farmers often navigate multiple levels simultaneously. Balancing economic security while considering social belonging and ecological responsibility. Moreover, Maslow's framework does not adequately account for intrinsic motivation, which plays a pivotal role in sustainable agricultural practices, nor does it address the external regulatory pressures and socio-political contexts that influence decision-making.

To bridge these gaps requires an integration of additional psychological and behavioural theories that acknowledge non-linear motivation, external influences, and the dynamic interplay between economics, psychological, and social factors. Three major contemporary motivational theories - Self-Determination Theory (SDT), Consistency Theory and the SCOAP-Model - have been selected to offer valuable extensions to Maslow's approach, allowing for a more comprehensive understanding of farmers' motivations in biodiversity-friendly efforts within German NPAs. The selection of these theories over others was driven by several critical factors including comprehensive coverage of psychological needs, relevance to the agricultural context, applicability to policy and intervention design, and the integration of intrinsic and extrinsic factors. These theories offer useful frameworks for understanding the complex interplay of motivations that drive farmers' behaviours moving beyond the hierarchical structure proposed by Maslow, recognizing that human motivation is not strictly linear but rather a dynamic interplay of multiple factors.

For instance, **the Self-Determination Theory (SDT)**, developed by **Deci and Ryan**, expands on Maslow's framework by emphasizing autonomy, competence, and relatedness as core psychological needs (Deci and Ryan 1985). It assumes that people are strongly influenced by the needs for **competence**, **autonomy**, and **relatedness**, in addition to the psychological and safety needs described by Maslow's Hierarchy. These dimensions can be seen as

differentiated extensions of Maslow's esteem and self-actualization as they relate to the quality of motivation and well-being. Individuals seek to fulfil their intrinsic needs for competence, autonomy and relatedness, and these needs are not merely hierarchical but integral to self-motivation and personality development.

Competence refers to an individual perceived ability to effectively perform a task or activity. It involves feeling capable, skilled, and successful in carrying out actions or achieving goals within a given context. Competence plays an important role in intrinsic motivation, as experiences that promote feelings of competence during an activity can enhance one's intrinsic motivation for that activity (Deci 1975). This means that when individuals believe they are competent at what they are doing, they are more likely to feel motivated to engage in that activity for its own sake, rather than relying on external rewards or pressures (Vallerand and Reid 1984). It is important to providing optimal challenges and supportive feedback to foster feelings of competence, which in turn can contribute to sustained intrinsic motivation (Fisher and Pritchard 1978; Ryan 1982).

Autonomy involves the ability to act in a self-determined way and having the freedom to make choices. Autonomy is described as the individual's action after careful consideration (Dworkin 2015). Intrinsic motivation is an example of autonomous motivation, where the individual pursues an activity because they find it appealing or enjoyable by nature (e.g. "I work because I enjoy it").

In the framework of SDT, *relatedness* refers to the psychological need to feel connected to others, to love and care, and to be loved and cared for in return. According to SDT, satisfying this need is essential for psychological growth, intrinsic motivation, and personal well-being. Relatedness emphasises the importance of social relationships and the sense of belonging and connection individuals seek with other people. Fulfilling the need for relatedness, along with the needs for competence and autonomy, is critical for fostering intrinsic motivation and self-determination. When individuals feel connected and valued by others, their motivation to engage in activities and pursue personal growth is enhanced because these activities are seen as more meaningful and satisfying (Ryan and Deci 2000).

In the settings of NPAs, this suggests that initiatives and policies must not only ensure that farmers' basic needs are met but also nurture their intrinsic motivation. For instance, competence can be enhanced by providing farmers with training and resources to implement biodiversity-friendly practices. Autonomy can be respected by involving them in policy-making processes, and relatedness can be strengthened by community-building initiatives that connect farmers and conservation groups. For farmers in NPAs, competence manifests itself in the skill and effectiveness of biodiversity-friendly farming practices, autonomy is reflected in their freedom to make decisions within the often-restrictive framework of environmental

regulations, and relatedness in the sense of connection and belonging they seek within the farming community and with other stakeholders.

Consistency Theory, developed by Klaus **Grawe**, in the early 2000s, offers a different perspective by highlighting the human desire for internal consistency as a primary motivational force, psychological congruence and the avoidance of internal conflict (Grawe 2004). Individuals are motivated by the need to achieve coherence between their needs, goals, perceptions, and the feedback from their environment and thus maintain a sense of consistency in their lives.

The theory is based on four main psychological needs that determine human behaviour: the need for *attachment*, the need for *control and orientation*, the need to increase and maintain *self-esteem*, and the need for *pleasure* while avoiding pain. These needs are seen as dynamic and in constant interaction with the environment to achieve a state of consistency. When experiences match these fundamental needs, a person feels congruent and psychologically balanced. However, if there is a discrepancy between the needs and reality – e.g. if the need for control is threatened by external circumstances – psychological incongruence occurs, leading to stress and maladaptive behaviour. The theory highlights not only the desire for inner balance but also an active and responsive adaptation of one's mental constructs in response to changing external and internal experiences. It is about achieving a harmonious state (a state of equilibrium) in which personal needs, perceptions and the environment are in alignment. This is a process, whereby each individual continually balances their responses in order to ensure their psychological well-being. This theory states that individuals are motivated to look for experiences that confirm their self-concept and avoid those that do not. Grawe's Consistency Theory introduces the idea of cognitive and emotional congruence as a key motivator, which is not explicitly detailed in Maslow's Hierarchy.

In the setting of NPAs, where the interplay between environmental regulations and a farmer's capacity to act can be complicated, Grawe's theory offers insightful perspectives. As farmers may face complex challenges and regulations that could threaten their sense of control or self-esteem, this theory provides an entry point for understanding how they might respond when their environmental reality conflicts with their psychological needs and goals. For example, too restrictive policies could lead to a perceived loss of control, causing stress and resistance to such policies. On the other hand, policies that recognise and reinforce farmers' competence, expertise and self-understanding could create a greater sense of congruence and encourage more adaptive and cooperative behaviour. Grawe's theory suggests that interventions and policies should be designed with an understanding of these internal dynamics to ensure that they are congruent with the farmers' self-understanding and goals. This approach could lead to higher levels of engagement and well-being as farmers have a greater sense of alignment

between their internal drivers and external actions, particularly in their role as protectors of biodiversity and stewards of the environment.

Consistency Theory thus provides a more elaborate framework for understanding farmers' behaviour and motivation. By ensuring that the management and policies of NPAs are designed to meet the psychological needs of farmers, it becomes possible to develop strategic approaches that not only minimise psychological incongruence but also harness the motivation that comes from achieving greater consistency. Farmers in NPAs may thus be driven to adopt behaviours that align with their self-identity as custodians of the land. Policies that acknowledge and reinforce farmers' identity, and which help resolve conflicts between economic pressure and environmental responsibilities, could be particularly motivating.

Furthermore, **Peters and Ghadiri** present the **S C O A P-Model**, a framework that integrates multiple human motivational factors: **Security**, **Control**, **Orientation**, **Attachment**, and **Pleasure** (Peters and Ghadiri 2013). Although initially developed for the working environment, it is suited to exploring farmers' motivation as it presents a comprehensive view of human motivational drivers that are relevant to the context in which farmers operate. The SCOAP-Model encompasses Maslow's safety needs but extends to a broader spectrum of motivational drivers, providing a nuanced understanding of what motivates farmers in their daily operations. It extends the motivational theories of Klaus Grawe's Consistency Theory and Ryan and Deci's Self-Determination Theory by integrating elements from both frameworks and expanding on them.

In the model, *security* corresponds to Maslow's safety needs and emphasises the psychological aspect of feeling secure that favours a predictable and secure socio-economic environment. For farmers in NPAs, this could mean not only the assurance of personal safety but also economic stability and political predictability, which together provide a secure basis for their livelihoods. Security could include guarantees of subsidies from the EU's CAP and protection against volatile price fluctuations in the market as well as facing the unpredictability of climate change. Additionally, long-term leases or ownership rights provide a secure operational foundation, allowing farmers to plan with confidence. Thus, security could include not only the physical security of farmers but also the security of their livelihoods.

Control is identified as a key aspect of motivation that involves the desire to influence one's path and environment. It extends beyond mere influence, as suggested in Maslow's higher-order needs, and includes a more comprehensive sense of control over one's environment and life circumstances. It reflects the autonomy that farmers need in their regulated environment to make meaningful decisions and to feel confirmed in their role as farmers and conservationists. However, within NPAs, regulations may impose restrictions that challenge this sense of control. Therefore, control could mean that farmers have a say in the regulations

that affect their work. Farmers might seek control through participative decision-making in local agricultural policies. This could involve having a voice in discussions about land use regulations, organic farming standards, or the implementation of new agricultural technologies that are environmentally friendly.

Orientation within this model is particularly important as it is about understanding one's place and function in complex systems. Orientation is a cognitive need that could be seen as part of Maslow's esteem needs, where understanding one's place in the world contributes to self-confidence and self-worth. For farmers, it is about managing the often-complicated balance between agricultural productivity and environmental protection, manoeuvring through the complex regulatory system and adapting to ever-changing market demands. For farmers, clear orientation could come from understanding the regulations they must adhere to, the ecological impact of their practices, and the market forces at play. Orientation for farmers could, for example, involve training and guiding farmers to understand and master the complexities of biodiversity-friendly farming. Also providing clear guidelines and continuous training on the EU's complex regulations might help farmers navigate compliance while still maximising their yield. Orientation could also be facilitated through advisory services that help farmers adapt to the demands of biodiversity-friendly farming within NPAs.

In the SCOAP-Model, *attachment* goes beyond emotional connections and mere social connections. It refers to the depth of relationships and the sense of belonging to a community. It represents the social fabric that holds individuals together. It evolves from Maslow's social needs and implies deeper emotional connections that are vital for mental health. Through attachment, farmers find solidarity and shared purpose with fellow stakeholders. For them, this could mean a network of support and collaboration that promotes their social well-being and ties their individual efforts into a collective undertaking. A strong sense of community is fostered through local cooperatives and trade associations, in which knowledge, resources as well as support can be shared. Attachment is also strengthened through participation in regional farming conventions and local markets that emphasise the importance of local produce and community ties. Attachment relates to the development of strong community networks. Lastly, *pleasure* according to the SCOAP-Model speaks to the enjoyment and intrinsic satisfaction derived from one's actions. This Maslow did not explicitly define, speaks to the intrinsic joy and satisfaction derived from engaging in fulfilling activities, which for farmers can mean a connection to their land, the joy of harvest or the satisfaction of contributing to the food supply or the act of cultivation itself. For those working the land in NPAs, it could mean the pleasure derived from seeing crops flourish, the fulfilment of contributing to the community's well-being, and the personal satisfaction that comes from being stewards of the land. Pleasure derives from the joy of working with land in a way that feels personally and culturally meaningful.

Integrating these theories into agricultural biodiversity policy provides a more adaptable and behaviourally informed approach. Instead of relying solely on financial incentives, policymakers must consider intrinsic motivational factors, social dynamics, and the need for policy consistency to ensure sustained farmer participation in NPAs. For instance, participatory governance models that involve farmers in conservation planning enhance their sense of autonomy and relatedness, leading to greater commitment. Likewise, conservation training programs can bolster competence, and well-structured incentive schemes that align with farmers' financial security concerns enhance consistency and reduce resistance.

By addressing Maslow's limitations through these complementary theories, a more holistic framework emerges, capturing the multi-faceted motivations driving farmers' decision-making in biodiversity conservation. This expanded approach ensures that policies not only target economic survival and financial incentives but also nurture intrinsic commitment, social cohesion, and psychological well-being, ultimately leading to more effective and enduring conservation outcomes in NPAs.

2.5 Summary and Research Implications

This chapter integrates Maslow's Hierarchy of Needs into the agricultural context, allowing for a fundamental, structured and systematic analysis of farmers' motivations and economic demands, especially in German NPAs. By applying an adapted Maslow's model to agricultural decision-making processes, a deeper understanding of the multiple factors influencing farmers' participation in biodiversity-friendly measures is achieved. Farmers' motivations are shaped by financial security, regulatory stability, social belonging, and professional recognition. While economic viability remains a fundamental necessity, long-term commitment is driven by non-economic factors such as social acceptance, policy trust, and professional identity.

A notable aspect that strengthens farmers' engagement in biodiversity-friendly practices is the role of digitalization and social innovation in addressing psychological needs. To illustrate this, the following example presents the manner in which digital technologies stimulate competence and social belonging, thereby contributing to farmers motivation for biodiversity conservation.

Example:**Digitalisation and Social Innovation: A Future-Oriented Framework for Motivating Biodiversity***How digital technologies strengthens psychological needs in farming*

The digitisation has transformed modern agriculture, equipping farmers with innovative tools that promote knowledge-sharing, decision-making, and social engagement. Precision farming techniques, such as GPS and IoT-based monitoring, enable farmers to optimise soil health, crop conditions, and field management, thereby enhancing their competence and expertise.

Social media platforms such as Instagram, YouTube, and Facebook, have emerged as vital forums for farmers to share knowledge, connect with peers, and obtain social recognition. In contrast to traditional farming communities, these digital networks offer farmers the opportunity to extend their visibility beyond local markets, allowing them to showcase their work, exchange best practices, and receive immediate feedback, with the result that their sense of relatedness and esteem is strengthened.

Success stories:

- “Gertrudenhof”, located in Hürth, Germany. It utilises social media to do more than just display routines of farm life. The account has attracted 65,000 followers, demonstrating the potential for social media to engage with a wider audience than traditional farming communities. This engagement not only satisfies the psychological need for connection and belonging but also serves as a platform for identity formation and advocacy.
- “philippswagyu”, a Wagyu breeder from Neukirchen-Vluyn, Germany, with around 3,300 followers, leverages digital platforms to market his product directly to consumers. This direct engagement with the audience helps achieve recognition and validate his craftship, fulfilling the need for esteem and recognition.
- Heinrich Trippen from Rommerskirchen, Germany, known online as „Kartoffelkult“, showcases not just conventional potato varieties but also rare potato varieties that astonish in shape, colour, and taste, engaging with 4,900 followers.

These digital initiatives under discussion highlight how technology can satisfy the psychological needs of farmers for competence, autonomy, and recognition, while also providing economic opportunities. By enabling farmers to connect with broader audiences, these platforms facilitate the acquisition of validation and appreciation that extend beyond the confines of traditional local markets. This validation serves to reinforce intrinsic motivation, harmonising the personal aspirations of farmers with the objective of conserving biodiversity. This creates a positive feedback loop whereby biodiversity-friendly farming practices that are supportive of biodiversity can simultaneously be experienced as personally fulfilling and economic viable. In the context of digitally connected agriculture, farmers are able to engage in commercial activities, express themselves, and develop their professional skills, thereby finding pathways to self-actualization. In addition to their function as marketing tools, social media platforms serve as spaces for formation of identities, the acquisition of knowledge, and the dissemination of innovative practices. These interactions promote social engagement and the development of a shared vision for sustainable farming, encouraging farmers to adopt biodiversity-friendly practices through enhanced knowledge and community support. Incorporating digital and social innovations into agricultural policymaking offers significant potential to address both external incentives and internal motivations. By integrating these tools with the psychological framework, comprehensive strategies can be developed that address holistically address farmers’ needs. This future-oriented approach not only addresses the immediate challenges faced by farmers but also positions them as stewards of biodiversity as well as leaders in the global transition to sustainable agriculture. Thus, digital platforms serve as critical enablers, strengthening growth, social collaboration, and environmental stewardship in a way that ensures long-term sustainability.

Thus, the contemporary motivational theories add further, more nuanced context to these findings, each contributing unique insights into farmers’ decision-making: The Self-Determination Theory (SDT) emphasises empowerment through autonomy, competence and relatedness, suggesting that engaging farmers in decision-making strengthens investment and

personal relevance. Competence can be strengthened by specialized training in ecological farming techniques, while recognition of expertise and environmental stewardship reinforces motivation beyond external rewards. The Consistency Theory indicates that aligning conservation incentives with farmers' values and self-image, reducing internal resistance and increasing sustainability accordingly. Policy frameworks that affirm farmers' identities as environmental caretakers can reinforce motivation, for instance, by recognizing habitat-preserving practices essential for insect diversity. The SCOAP-Model (Security, Control, Orientation, Attachment, and Pleasure) also underscores the need for financial security, professional decision-making autonomy and personal satisfaction to promote participation. Simplifying bureaucratic processes and strengthening participatory governance play key roles in improving policy acceptance and reducing resistance.

Synthesising these insights informs policy design, ensuring that interventions address farmers' intrinsic and extrinsic motivations. Hence, economic incentives need to be structured to accommodate various motivational levels, with basic subsidies providing financial stability, action-based payments rewarding conservation efforts, and result-based incentives strengthening long-term engagement.

Continued research is recommended to examine the long-term effectiveness of these models and to refine strategies for integrating economic, psychological and social dimensions into biodiversity conservation policies by aligning incentives with farmers intrinsic and extrinsic motivations.

The following analysis therefore extends beyond financial incentives but validates conceptual findings. The next chapter describes the methodological approach of this study and explains in detail the research design, data collection, and methods used to analyse the economic and psychological drivers behind farmers' engagement in biodiversity conservation in NPAs.

3 Methodology

3.1 Research Design

This study is built on earlier research within the framework of the project "Diversity of Insects in Nature-Protected Areas (DINA)". The study is conducted using a multiple-step approach, integrating qualitative and quantitative approaches to comprehensively analyse the economic demands and motivations of farmers concerning biodiversity conservation in NPAs, as elaborated in the articles "Farmers are Caught in Tri-Dilemma – Objectives and Challenges for Biodiversity in German Nature-Protected Areas" and "Hesitations and Aspirations of Farmers in Nature-Protected areas" (Turck et al. 2023; Turck and Terlau 2023). The integration of both qualitative and quantitative research methods in this study allows a thorough investigation of

the factors affecting biodiversity within NPAs. One primary objective was to gain demographic insights to determine the optimal level of funding required for - ultimately - the provision of public goods services, with the overarching goal of motivating farmers to alter their farming practices and, consequently, contributing to the conservation and, if possible, the enhancement of biodiversity on arable land in NPAs. This approach aligns with the Commons concept, emphasising the need for shared management and conservation of natural resources (Ostrom 2015). This design is grounded in Maslow's Hierarchy of Needs, adapted for an agricultural context.

3.2 Mixed-Method Approach

The integration of qualitative and quantitative methods provides a holistic understanding of farmers' motivations. A significant additional asset of this study is the further developed concept emphasising the multi-stage, mixed-method approach. This methodology was chosen to comprehensively understand the complexities of farmers' motivation and needs in the context of promoting biodiversity in NPAs.

Stage One: Qualitative Survey

The initial stage involved a qualitative survey to assess farmers' challenges in enhancing biodiversity as described in "Farmers are Caught in Tri-Dilemma – Objectives and Challenges for Biodiversity in German Nature-Protected Areas" (Turck et al. 2023). This survey explored the "trilemma" of land use, which includes mitigating climate change, securing food, and maintaining biodiversity (WBGU 2020). Farmers are made responsible for environmental issues, but they are also important players in overcoming sustainability challenges.

Stage Two: Quantitative Survey

Following the qualitative survey, a quantitative survey was conducted as outlined in "Hesitations and Aspirations of Farmers in Nature-Protected Areas" (Turck and Terlau 2023). This stage aimed to capture the diverse experiences and challenges, the hesitations and aspirations faced by farmers regarding biodiversity-friendly practices (Turck and Terlau 2023). The results of this survey provided a foundation for understanding the extent and prevalence of the issues identified in the qualitative stage.

Stage Three: Further Development with Mixed-Method Approach

The third stage of this study represents a significant advancement by integrating and validating the findings from the previous stages through an additional qualitative analysis. This further development employed the mixed-method approach again, combining the depth of the qualitative insights with the breadth of the quantitative data. By involving farmers in four online focus group discussions, this stage provided an additional platform to pursue specific topics in more depth. The discussions facilitated a comprehensive exploration of farmers' needs,

motivations and desires concerning biodiversity-friendly land use in German NPAs. This iterative process of combining qualitative and quantitative methods is particularly powerful. This multi-staged approach not only validates and enriches the findings from each stage but also enhances the overall reliability and validity of the research.

By employing a qualitative content analysis approach based on Mayring's theory, this stage involves the participation of farmers in online focus group interviews, as outlined in Chapter 3.4. The results are then assigned to the five categories of Maslow's Hierarchy of Needs to understand farmers' needs providing a spectrum of motivations and demands associated with the pursuit of biodiversity-friendly agriculture.

3.3 Data Collection and Processing

The third stage of the research process is centered on these online focus group discussions, which provided in-depth insights into farmers' economic and social motivations regarding biodiversity-friendly measures in NPAs. Four online focus group discussions were conducted, each comprising participants with diverse agricultural backgrounds. The objective of these discussions was to validate themes identified in previous research phases, uncover additional complexities in farmers' perspectives, and generate policy recommendations tailored to enhance biodiversity-friendly measures in NPAs.

The methodological rigor of the focus groups was ensured through systematic data collection and analysis: Each discussion was recorded and transcribed, followed by an in-depth thematic analysis using ATLAS.ti software. The coding process involved an interactive approach, beginning with the identification of recurring themes, followed by thematic clustering into overarching categories related to financial incentives, regulatory frameworks, and societal recognition. These findings were then cross validated with results from qualitative and quantitative research phases to enhance reliability and coherence. The study was conducted ethically and to highest scientific standards. All participants provided informed consent, and anonymity was maintained to ensure confidentiality. The discussions took place in an online environment that encouraged open and honest dialogue, and minimised potential distortions. By employing this rigorous focus group methodology, the study provides a well-contextualised understanding of farmers' insights, their motivations and the challenges they face related to biodiversity in NPAs. The insights generated are integrated into the policy recommendations discussed later in chapter 4, which contributes to a more effective and adaptive approach to biodiversity aspects adopted by farmers in NPAs.

3.4 Qualitative Content Analysis – Categorisation

The evaluation of the online focus group interviews is based on the method of Philipp Mayring, the qualitative content analysis (Mayring, 2010a). This method is chosen as the aim of the

analysis is to work systematically with the material of the online focus group interviews. The analysis was carried out with the help of two application processes offered by Mayring: inductive and deductive category-building (Mayring 2014). In this pragmatic approach, it is straightforward to merge the perspective that there is only one (rather than many) world that each person has an own individual interpretation of this world. Thus, intersubjectivity is a fundamental element of all social life (Kuckartz 2014).

3.4.1 Seamless Integration into the Multi-stage Concept

The research and refinement process are an integral component and fits seamlessly into the multi-stage approach, forming a crucial component of the iterative cycle of data collection and analysis. The results of both the qualitative and quantitative surveys contribute to this process. The use of focus groups generates a more nuanced understanding of farmers' motivations and challenges. By applying Mayring's content analysis, the study gains deeper qualitative insights that complement the existing data. This methodological triangulation increases the robustness of the findings.

The nature of Mayring's content analysis corresponds with the overall aim of the study, which is to uncover underlying factors and motivations that determine farmers' behaviour. This method categorises the data into meaningful themes, which is essential for developing targeted interventions.

By mapping the results to Maslow's Pyramid of Needs, a structured framework is set for understanding the different motivational levels of farmers. This theoretical approach enables the identification of specific needs that must be addressed in order to promote biodiversity-friendly practices. Furthermore, this stage allows for the refinement of concepts based on direct feedback from farmers. The iterative process ensures that the proposed solutions are feasible and oriented towards the target group's circumstances.

By incorporating this detailed, methodical analysis into the multi-stage approach, the study not only provides a comprehensive understanding of the issue but also increases the practical applicability of recommendations. This phase is of critical importance for the translation of research findings into actionable strategies that can effectively motivate farmers to adopt biodiversity-friendly practices.

3.4.2 Application of the Multi-stage Structure

This structure is applied to better understand the interplay of incentives for farmers who are responsible for promoting biodiversity in agriculture. The multi-stage methodology incorporates several initial methods, which were conducted. With the help of literature research, daily press information and a series of expert interviews, a concept for biodiversity-friendly financial

motivation was derived. All experts were representatives of interest groups (stakeholders) in the field of biodiversity, nature conservation and agriculture. The proposed concept incorporates a Three-Stage Payment Model (fig. 5, chapter 3.5) to financially motivate farmers at each respective stage to act on biodiversity.

To investigate and refine this concept, data from the four online focus group interviews were extracted. Subsequently, the results are then analysed using Philipp Mayring's Content Analysis (Mayring, 2010a). This explorative method assigns the results to the five categories of Maslow's pyramid of needs. The aim is to identify the potential to motivate farmers towards more biodiverse-friendly behaviour.

By applying this structured approach, the study integrates theoretical and practical insights to develop targeted interventions for strengthening biodiversity in agricultural practices. This alignment ensures that the findings from the multi-stage methodology are directly applicable to actual challenges and support the broader aim of sustainable biodiversity management.

3.4.3 Inductive Approach

Firstly, the interview material was subjected to analysis, with the formation of categories based on the text. The categories that have been defined include "compensation", "design of measures" and "biodiversity-friendly management". The process of generating categories developed from data is called inductive category formation as the categories are generated based on this interview material. Mayring calls this procedure "summarising content analysis" (Mayring, 2010a). For objectivity and reliability control, a second person verified the construction of categories adhering to strict requirements (Mayring, 2010a).

Inductive category formation based on an example:

During the initial screening of the online focus group interviews, it became apparent that the farmers interviewed had different encounters with bureaucracy in their work. At the beginning of the categorisation process, various codes were generated for bureaucratic challenges concerning differing support measures and the related authorities. For instance, farmers have identified several issues, including challenges in accessing support measures, uncertainties in authorisation procedures, and complex paperwork requirements. To make the evaluation process leaner and comprehensible, all codes for the multiple bureaucratic challenges were combined in the category "Other" with the code "Bureaucracy". The codes help to have a better understanding of farmers and their opinions in further analysis. The insights obtained through coding will be incorporated into action recommendations and can be included in subsequent studies. Thus, the understanding of this critical and influential stakeholder group is essential, as they are key actors and significant key players making them valuable key informants.

Moreover, the findings from the coding help to identify new questions and assumptions in future studies to maximise the efficiency of new knowledge generation.

3.4.4 Deductive Approach

In the next step, the category construct obtained was revised with findings from the previous telephone study as detailed in “Hesitations and Aspirations of Farmers in Nature-Protected Areas” and literature research into a confirmed system of thematic categories (Turck and Terlau 2023). This type of category building is called deductive (Mayring 2010). This deductive category application is another variant to select within qualitative content analysis. It is suitable for the evaluation of data collected in interviews. Mayring calls this “structuring content analysis”.

Deductive category building based on an example:

The evaluation of interviews with stakeholder groups from nature conservation and agriculture as well as literature research reveals that farmers express a strong preference for increased financial support and incentives to enhance their engagement in biodiversity efforts (Matzdorf 2004; Bayerische Landesanstalt für Landwirtschaft Juli 2019). Consequently, it is evident that greater financial incentives significantly increase their motivation to participate.

The combination of the inductive approach followed by the deductive approach promises to mitigate the disadvantages of either method: The pure induction approach tends to be subjective making it challenging to derive conclusions about an objective reality. The pure deduction process, on the other hand, operates within a given theoretical framework, thus limiting the ability to explore beyond its confines. It restricts the possibility of encountering unexpected results that may not be consistent with existing knowledge. Nevertheless, such unexpected findings are most valuable and make the investigation attractive. Therefore, mixing the two processes is a good choice for qualitative content analysis (Kuckartz 2014).

Thus, the entire text of the online focus group interviews was revised and coded again. The categories and sub-categories have an objective and structural character and are intended to reflect the content of the respective text passage.

The methodological synthesis of Maslow’s Hierarchy of Needs with Mayring’s qualitative content analysis is visualised in figure 4. This analytical framework underlies the study.

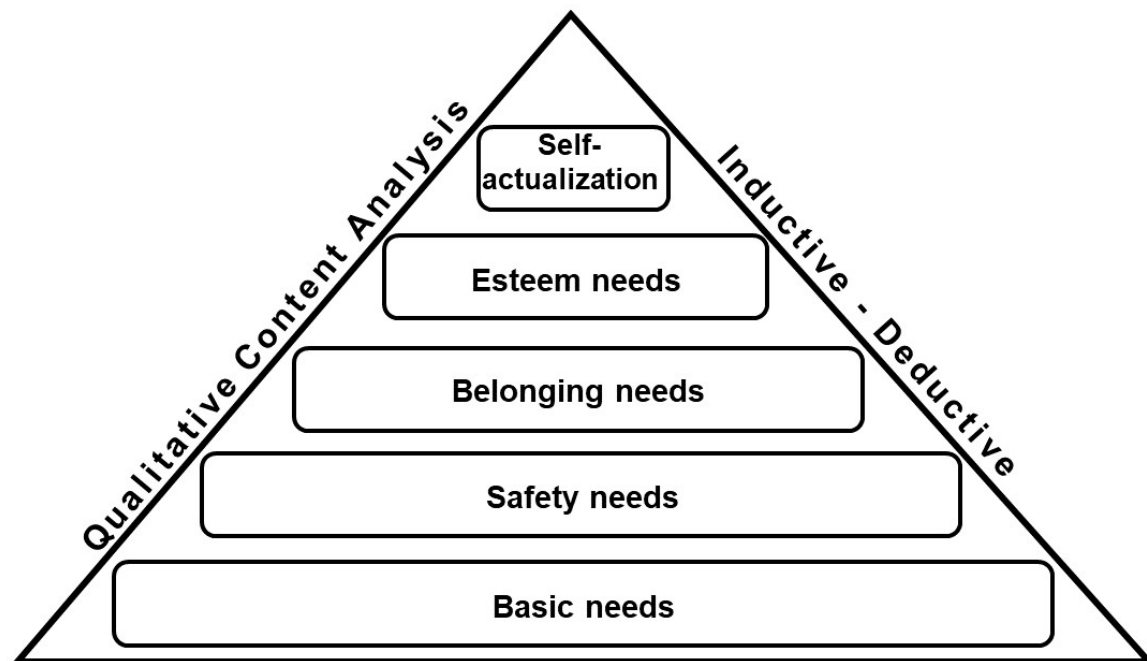


Figure 4: Method of Proceeding: Synthesised Framework Integrating Maslow's and Mayring's Theories (own illustration)

The final coding was done with twenty-three codes, which are assigned to seven categories. The recommended computer program used for qualitative content analysis is ATLAS.ti, which was recommended by Mayring and developed by an interdisciplinary working group at the Technical University Berlin (Mayring, 2010a).

3.5 Development of the Three-Stage Payment Model

The development of the Three-Stage Payment Model is grounded in an integrated understanding of farmers' economic realities, psychological motivations, and policy frameworks that influence biodiversity efforts. Drawing on Maslow's Hierarchy of Needs, the hierarchical model structures financial incentives to ensure economic stability while promoting long-term engagement in biodiversity-friendly practices in NPAs. Developed in response to the identified motivations and barriers expressed by farmers in the qualitative and quantitative studies, it aligns financial support with varying levels of commitment to conservation.

3.5.1 Categorisation of Financial Incentives

A detailed analysis of financial incentives was conducted to better understand needs and motivations of farmers regarding biodiversity. The resulting categorisations of monetary incentives, inspired by the structure of Maslow's pyramid, reflect the progression from economic security to conservation-driven engagement, i.e. to achieve higher ecological and sustainable goals. Each layer addresses different facets of farmers' motivation, ensuring a

balanced approach that accounts for economic necessities and aspirational incentives. The classification comprises Three sub- categories:

1. Sub-category: Basic subsidy payments

Providing foundational financial stability, mitigating market volatility, and ensuring farmers' viability to facilitate in biodiversity conservation.

2. Sub-category: Action-based payments

Incentivising specific biodiversity-enhancing measures by compensating direct conservation efforts and addressing financial barriers to implementation.

3. Sub-category: Result-based payments

Linking financial rewards to measurable conservation outcomes, strengthening long-term commitment, promoting innovation and best-practices for biodiversity enhancement.

To evaluate the effectiveness of these incentives, qualitative analysis was conducted, applying assigned codes to each sub-category. The respective codes capture positive and negative remarks, as well as improvement, especially in relation to administrative efficiency, funding security, and policy stability.

3.5.1 Structure of the Three-Stage Payment Model

As displayed in figure 5, the model progresses through three distinct stages to facilitate biodiversity engagement among farmers.

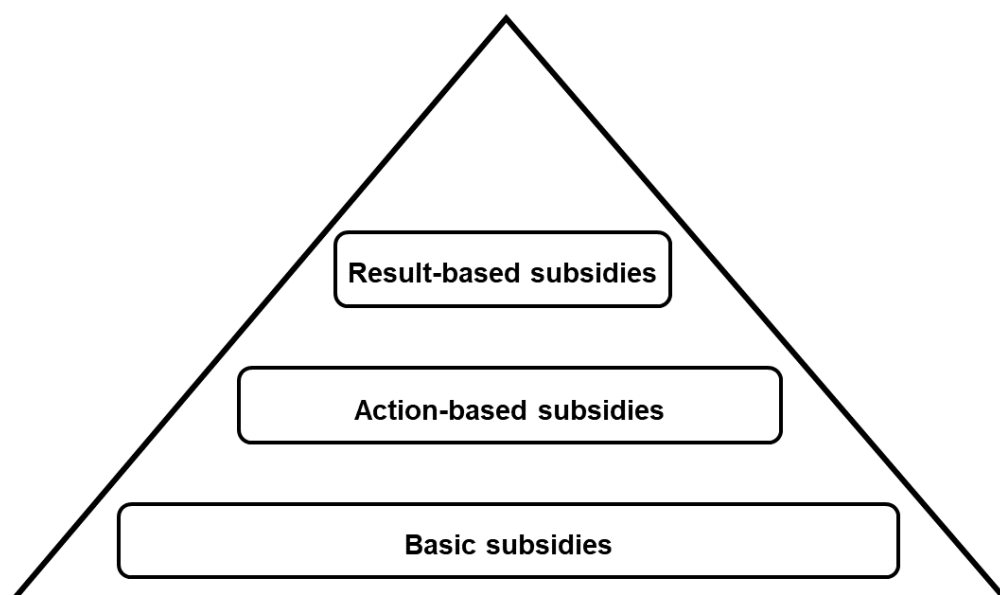


Figure 5: A Three-Stage Payment Model for Biodiversity Conservation (own illustration)

1. Basic subsidies (Ensuring Financial Stability)

The first stage of the model is designed to secure the financial foundation required for biodiversity engagement. The provision of basic subsidies serve as an effective measure to mitigate financial challenges for farmers operating within NPAs. These payments address farmers' psychological and safety needs, as identified in Maslow's model, by stabilising income streams and mitigating financial risk associated with reduced agricultural intensification. The provision of basic subsidies acknowledges the economic constraints faced by farmers and establish a secure foundation upon which further engagement with biodiversity-friendly measures can be built. They are equivalent to the basic subsidy payments, which constitute the first pillar of the EU's Common Agricultural Policy (European Parliament 2014).

2. Action-Based Payments (Encouraging Biodiversity Practices)

The second stage of the model introduces action-based payments, which compensate farmers for the direct implementation of biodiversity-friendly farming practices. The measures include a range of approaches, such as habitat restoration, reduced pesticide usage, crop diversification, introduction of buffer zones. This stage addresses farmers' social belonging and esteem needs, providing external validation for their environmental efforts. The structure of action-based payments acknowledges that financial compensation alone is insufficient to ensure long-term engagement and, therefore, incorporates social incentives such as public recognition, corporative networks, and knowledge-sharing platforms. These subsidies provide a sound supporting incentive to motivate farmers to engage in biodiversity-friendly practices. Measures often include specifications regarding periods of land use and livestock numbers, as well as regulations concerning partial or complete abandonment of fertilisers and pesticides, alongside other regulations tailored to the requirements of habitat and species protection.

3. Result-Based Payments (Rewarding Conservation Outcomes - Performance-Driven Incentives)

The final stage of the model consists of result-based payments, which link financial rewards directly to measurable improvements in biodiversity indicators. This component aligns with self-actualization needs, as it offers farmers the autonomy to choose their own conservation strategies while strengthening a sense of accomplishment through tangible environmental contributions. This flexibility embedded in result-based payments allows farmers to innovate and optimise conservation practices according to their specific farm conditions. However, given the complexities of objectivity measuring biodiversity outcomes, this stage necessitates robust monitoring frameworks and risk mitigation missions are needed to ensure fairness and reliability. These payments function as an alternative approach to creating economic incentives

by tying payments to outcomes, i.e. results, following a model similar to that of a free-market economy. This result-based bonus would be granted to farmers who successfully achieve or improve the pre-agreed biodiversity targets. Importantly, the farmer is given the target, while having the flexibility to determine how to reach and even to surpass it.

The Three-Stage Payment Model, with its hierarchical structure, is designed to recognise the complexity of farmers' motivations by bringing together economic constraints with intrinsic drivers for engagement to biodiversity-friendly practices. This three-level arrangement is intended to assure that financial support is not only targeted and effective, but also able to encourage authentic commitment to biodiversity conservation.

3.5.2 Justification for a Three-Stage Approach

The rationale behind a tiered payment structure is rooted in the necessity for an adaptable and context-sensitive as well as targeted incentive system. The focus group discussions and survey data revealed that farmers exhibit varying levels of motivation and readiness to engage in biodiversity conservation. While some farmers prioritise financial security and regulatory clarity, others expressed greater interest in long-term ecological stewardship. The Three-Stage Payment Model accommodates this diversity by providing an entry-level financial safeguard while creating pathways for progressive engagement.

Economic theory suggests that incentive structures must account for both extrinsic and intrinsic motivational factors (Benabou and Tirole 2003). The integration of action-based and result-based payments serves to transition farmers' motivations from financial dependencies to more autonomous, goal-orientated engagement with conservation practices. This transition aligns with contemporary motivation theories, including Self-Determination Theory (SDT), which emphasises the role of competence, autonomy, and relatedness in shaping behavioural persistence.

4 Findings and Discussions

The findings of this study are in alignment with a number of international research papers that highlight the multifaceted nature of farmers' motivations to engage in biodiversity-friendly measures. Studies from various European contexts have identified perceived excessive bureaucracy, financial uncertainty, and a lack of social recognition as a key barrier to engagement in conservation measures (Prager et al. 2012; Mills et al. 2017; Sutherland et al. 2012). Prager et al. emphasise that rigid administrative frameworks and high transition costs can deter farmers from participating, even when they support the environmental objectives in principle. Similarly, Mills et al. show that farmers are less likely to engage meaningfully if schemes are overly complex or if the compensation does not match the economic risks involved. Moreover, their research underlines the importance of social identity and public

recognition. Such factors are often overlooked in policy design. Sutherland et al. further strengthen that major behavioural changes typically follow “trigger events” such as economic shocks or regulatory changes, but these lead only to lasting adoption when they are accompanied by trust, social support, and a perceived fit with farmers’ values and long-term goals.

Building on these international insights, the present study investigates how such factors manifest in the specific context of farmers operating within German NPAs. The findings presented in this chapter are based on a qualitative content analysis of four online focus group interviews with farmers operating in German NPAs. In line with Mayring’s methodology, thematic categories were developed both inductively and deductively, allowing for nuanced and theory guided interpretation (see Chapter 3.4). As the study follows a purely qualitative research design, as such, no statistical methods such as regression analysis were applied. In order to support conclusions, direct quotes are included where appropriate. The anonymised transcripts, codebooks, and the coding synthesis (structured according to Maslow’s hierarchy) have been published as open data for transparency and reproducibility via Zenodo (<https://zenodo.org/records/15599651>) (Turck 2025).

4.1 Economic Incentives and Farmers’ Participation

4.1.1 Understanding Farmers’ Needs Through Maslow’s Hierarchy

This analysis of farmers’ needs, conducted using Mayring’s content analysis method, provides a comprehensive and structured understanding of the different levels of needs as described through the lens of Maslow’s Hierarchy. The results from the content analysis reveal how each level of need is addressed within the context of farmers working within NPAs. Figure 6 offers a detailed illustration of these needs, incorporating both positive and negative feedback from the farmers.

This connection is reflected in statements from the farmers who participated in the focus groups, such as repeated emphasis on the lack of participation in decision-making processes (belonging needs), the uncertainty caused by perceived constantly changing regulations (safety needs), or concerns about restrictions on herbicide use potentially threatening their livelihoods (basic needs).

The Basic needs: These needs are primarily satisfied by the interviewed farmers. Working in NPAs, farmers secure their basic needs through income derived from their agricultural practices, bolstered by subsidy payments from CAP. These payments ensure that farmers have the financial resources necessary to meet their physiological (basic) needs. However, as illustrated in figure 6, some farmers perceived restrictions on fertiliser and herbicide use as a

threat to their livelihood, indicating that the fulfilment of basic needs is not entirely unproblematic. One farmer explained: "Wir sind nicht dafür eingerichtet, um ohne Herbizide den Ackerbau zu betreiben. Auf einer kleinen Fläche, die uns betrifft, macht es keinen Sinn sich maschinell anders zu orientieren. (We are not equipped to practise arable farming without herbicides. On a small area that concerns us, it makes no sense to orientate ourselves differently by machine)"; Farmer A1, interview. Another farmer illustrates the challenge faced by farmers, stating: "Und das große Problem ist, dass wir aber auf der Fläche Geld verdienen müssen und das gelingt uns nicht. (And the big problem is that we have to earn money on the ground and we're not succeeding.)"; Farmer C 4, interview (Turck 2025).

The Safety needs: While financial stability is partially secured through EU CAP subsidies, there is a sense of uncertainty. Farmers regularly navigate regulations issued by the EU, Germany or its Federal States, which include environmental and nature conservation requirements. This regulatory setting and its adaptations, which are perceived as turbulent, often leaves farmers feeling uncertain and uneasy. As one farmer described it: "Wir werden ständig mit wechselnden Neuerungen im Pflanzenschutz, Düngung, Tierhaltung konfrontiert und müssen uns permanent anpassen. (We are constantly confronted with changing innovations in plant protection, fertilisation, animal husbandry and must constantly adapt.)"; Farmer C1, interview (Turck 2025).

The constantly evolving regulations create difficulties in long-term planning. Moreover, farmers' dependence on, for example, the local food trade and its market power further impacts their sense of security (dpa-Newskanal 08.12.2020). As shown in figure 6, while long-term contracts and stable framework conditions contributed positively, concerns about legal uncertainties and rigid requirements remain major barriers.

In summary, the fundamental subsidy payments offered by the CAP address the farmers' primary and, to some extent, safety needs, particularly in terms of economic aspects, i.e. economic driver, which relates to financial incentives. It is obvious that this basic funding primarily covers the basic needs. However, the participants in online interviews have viewed those critically.

The Belonging needs (i.e. social relationship): Farmers participating in the online focus groups reported feeling excluded from key discussions and lacking opportunities to participate in decision-making processes. Many expressed the need for stronger relationship, improved exchanges, and better cooperations with other stakeholder groups. These sentiments were echoed in the interviews. As one farmer remarked: "Ich finde es konträr, wenn ich mit Verbrauchern spreche und merke, wie wenig sie die Komplexität der Landwirtschaft begreifen. (I find it contrarian when I talk to consumers and realise how little they understand the complexity of agriculture.)"; Farmer C1, interview. Another interviewee reflected in the same

context: “Wir Landwirte haben das Problem, dass wir 30 Jahre lang es nicht geschafft haben, dem Verbraucher diese Komplexität zu vermitteln. (We farmers have the problem that for 30 years we have not managed to communicate this complexity to the consumer.)”; Farmer E1, interview. A third farmer highlighted the value of exchange: “Ich finde den Austausch sehr interessant und auch ganz wichtig. Ich bin anderweitig auch landwirtschaftspolitisch unterwegs und immer hoch erfreut, wenn ich mit Kollegen aus anderen Bundesländern Gespräche führen darf und versuche daraus zu lernen (I find the exchange very interesting and also very important. I am also involved in other agricultural policy and I am always delighted when I am able to have discussions with colleagues from other federal states and try to learn from them)”; Farmer C4, interview (Turck 2025).

As illustrated in figure 6 positive interactions with authorities and NGOs are valued, yet challenges persist. Farmers feel marginalised and perceive a lack of recognition for their contributions, highlighting that their social needs remain unmet.

The following farmers’ statements illustrate this point: “Bei uns ist es gerade so, dass ich dann mal zufällig gerade mitbekomme, dass wieder ein Biologe im Gebiet unterwegs war. Und ich bekomme dann da auch gar kein Feedback, was die denn da herausbekommen. Man muss so viel aktiv nachfragen, wenn man was wissen will. Das ist schade. Da ist so wenig Feedback und Kommunikation. (In our case, I only learnt by chance that a biologist was in the area. And I don't get any feedback on what they're finding out. You have to actively ask if you want to know something. That's regrettable. There's so little feedback and communication.)”; Farmer A3; interview. In addition, the statement is supported by the opinion of another farmer: “Jede Behörde hackt auf uns rum. (We are picked on by every authority)”; Farmer C 3, interview (Turck 2025).

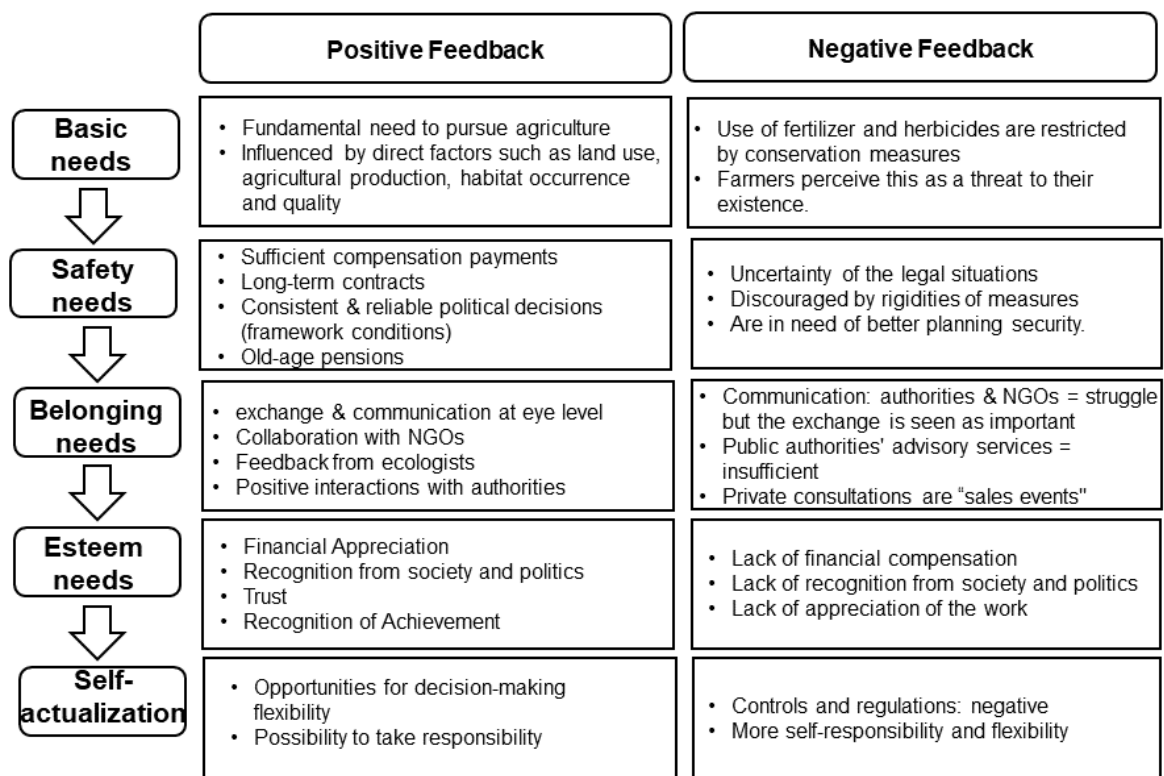


Figure 6: Farmers' Motivations and Barriers in Biodiversity Conservation: Hierarchical Needs-Based Perspective (own illustration)

The Esteem needs: There is a notable discrepancy between the esteem needs of farmers and the extent to which they are fulfilled. As seen in figure 6, the interviewed farmers report a sense of social unacceptance and a lack of social recognition, which in turn leads to feelings of being undervalued and blamed by society. This perceived lack of appreciation is articulated in interview statements such as: "Im Kreise meiner Kollegen werde ich belächelt. (Among my colleagues, I am laughed at)"; Farmer B1, interview; and "Landwirte haben mittlerweile so Angst vor diesen Kontrollen, dass sie nicht mehr bereit sind, solche Maßnahmen zu machen (Farmers are now so afraid of these controls that they are no longer prepared to take such measures)"; Farmer C1, interview (Turck 2025).

These expressions of dissatisfaction stem from a social disconnection between consumers' perceptions and the acknowledgement of the crucial role that farmers play in food production and maintaining agricultural landscapes. Protest actions and expressions of frustration during the interviews reflect farmers' need for their contributions to be recognised and respected. One farmer strongly criticised the existing regulatory and institutional environment: "Die Naturschutzbehörde sieht ihre Interessen. Mir fehlt das gesamtheitliche Denken. Beispiel Insektizide. Ich kann keine Schadinsekten mehr bekämpfen. Ob das in der Summe Sinn

macht, wenn kein Raps mehr angebaut wird. Wenn es keine blühenden Kulturen mehr gibt. Es hat dann nichts mehr mit einer Bewirtschaftung zu tun sondern mit einer Stilllegung der Flächen, die entschädigt werden muss. Sonst Stichwort Enteignung. Von den Landwirtschaftsbehörden, Ämtern, sehe ich nur noch eine Kontrollfunktion. Aus der Beratung haben sie sich komplett zurückgezogen. Der Kontakt beschränkt sich auf ein Minimum. (The nature conservation authority sees its interests. I miss holistic thinking. For example insecticides. I can no longer control insect pests. Whether that makes sense in total if oilseed rape is no longer grown. If there are no more flowering crops. It then no longer has anything to do with cultivation but with the set-aside of the land, for which must be compensated. Otherwise, the keyword is expropriation. From the agricultural authorities, I only see a control function. They have withdrawn completely from counselling. Contact is limited to a minimum.)"; Farmer C1, interview (Turck 2025).

These gaps serve to illustrate the complexity of addressing the needs of farmers, who also operate within NPAs. They also highlight the necessity for comprehensive strategies that not only address the financial aspects of farming but also take into account the regulatory environment, farmers' participation in decision-making processes, and the social recognition of their essential role in food production and environmental stewardship.

The discussion on the preceding two needs, the belonging needs and the esteem needs, emphasises the importance of social integration (societal involvement). At this level, the lack of esteem from society that farmers deeply feel becomes prominent. Those needs, which are essential for human well-being, are perceived by farmers as not being met. The farmers' view is consistent with Maslow's framework, which stresses that the lack of recognition and appreciation from society contributes to a sense of non-fulfilment of these needs. This realisation becomes particularly relevant when examining the motivations and challenges farmers face about biodiversity-friendly practices. The desire to belong and be valued, combined with the realisation that their social needs are not being answered, sheds light on the complexity and nuances of farmers' experiences and aspirations within the broader agricultural landscape.

The four previously identified needs, categorized as **deficiency needs** by Maslow, are all integral aspects of a farmer's life and work. These needs are considered "deficiencies" because they arise from a lack or deficit, and they are centered on addressing immediate shortcomings. Farmers rely on secure monetary income and regulatory safety in order to sustain their livelihood, both in the present and for the benefit of future generations. Additionally, societal acceptance plays a significant role. Farmers value meaningful dialogue over being merely subjects of discussions. As more farmers leave the profession, initiating

conversations with the remaining population becomes increasingly challenging due to their decreasing number.

The need for Self-actualization: At its highest level of Maslow's hierarchy, self-actualization, also known as the **growth need**, represents the pursuit of one's full potential and the desire to achieve personal goals. The farmers interviewed for this study, who are identified as key stakeholders as outlined in "Farmers are Caught in Tri-Dilemma – Objectives and Challenges for Biodiversity in German Nature-Protected Areas", indicate that legal framework conditions and imposed requirements often hinder their ability to achieve self-realization (Turck et al. 2023). This suggests that the opportunity for self-determined work in biodiversity is only feasible if farmers are provided with the respective scope. A significant proportion of farmers express reservations about this possibility, citing their experiences with bureaucratic processes and stringent controls imposed by supervisory authorities. One farmer framed this very clearly: "Ich plädiere dafür, dass man das freier machen muss. Es muss mehr Flexibilität rein, dann wird das auch gemacht (I am in favour of making this more liberal. There has to be more flexibility, then it will be done)"; Farmer B1, interview. Another said: "Wenn es da ein Angebot gebe, dass man da ohne Bürokratieauflagen, ohne Pflegezeitpunktauflagen reinschnuppern könnte, ansonsten viele Sachen sind einfach abschreckend. (If there was an offer, that you could get a taste of it without bureaucratic constraints, without care time constraints, otherwise many things are simply off-putting.)"; Farmer D1, interview (Turck 2025).

In light of these perceived challenges, the capacity for perseverance and trust is an essential characteristic for farmers. The process of navigating the apparent complexity of bureaucratic hurdles and stringent controls, requires determination. This is particularly important given that farmers are striving to achieve laudable objectives and are aware of the intricate interdependencies that characterise their interactions with regulatory and supervisory authorities as illustrated in figure 6.

The ability to endure and overcome setbacks becomes a key factor in removing obstacles and promoting sustainable agriculture practices. Farmers expressed a desire for greater autonomy and decision-making flexibility. The ability to take responsibility for conservation measures is seen as motivating.

4.1.2 Economic Incentives as Key Drivers

Farmers' participation in biodiversity conservation measures is strongly affected by economic factors, as evidenced by the findings of the focus group discussions. The focus group discussions underscore the importance of financial stability for agricultural decision-making. Participants have repeatedly stressed the necessity of reliable and consistent economic support for their efforts in preserving the commons, to counterbalance the risks involved in

biodiversity-friendly practices. This economic dependency is reflected in the three key forms of financial incentives: basic subsidies, action-based payments and result-based payments, each of these offering distinct motivational dynamics and structural implications.

Recent developments in German agricultural policy serve to illustrate the relevance of financial stability and institutional trust as criteria for farmers' engagement. The subsequent three case examples serve to demonstrate the systemic challenges that prevent long-term commitment to sustainability objectives.

This sentiment is illustrated by the following three examples:

First example:

In the fall and winter of 2020, farmers protest outside various food retailers. Their discontent results in a culmination of factors: Despite playing a major role in food production and facing economic challenges such as falling producer prices, they question the adequacy of consumer prices, and farmers feel undervalued and blamed by society (Süddeutsche Zeitung 2020). A so-called „agricultural dialogue“ (Agrardialog), constructive talks between farmers and retailers at eye level, was initiated. In addition to the Aldi, Lidl and Edeka, belonging to the leading food retail companies in Germany (Ahrens 2023), the Federal Association of German Food Trade (Bundesverband des Deutschen Lebensmittelhandels) and smaller organisations of the agricultural sector are involved. The latter include „Land schaft Verbindung“, „Freie Bauern“, „Arbeitsgemeinschaft bäuerliche Landwirtschaft“, and the Federal Association of German Dairy Farmers (Bundesverband Deutscher Milchviehhalter). The German Farmers' Association (Deutscher Bauernverband) has chosen not to engage in the dialogue format, leaving the designated space for participation vacant (Schneider et al. 2021). Instead, and almost simultaneously, the German Retail Association (Deutscher Handelsverband), the German Raiffeisen Association and the German Farmers' Association agreed to establish a coordination center in March 2021. Just half a year later, in September 2021, it was announced that the agricultural dialogue would come to an end, stating that the „Agrardialog“ would be transformed into a „Zentrale Koordination Handel Landwirtschaft“ (central coordination of trade and agriculture) in which smaller agricultural interest groups have little impact (Michel 20.09.2021). The representatives of „Agrardialog“ viewed the establishment of this central coordination as creating a parallel dialogue platform, primarily intended to diminish the influence and effectiveness of the original „Agrardialog“.

Second example:

In 2019, the former Federal Minister of Agriculture, Julia Klöckner, set up the „Competence Network for Livestock Farming“ also known as the „Borchert Commission“. It developed perspectives for animal husbandry until 2040 representing results in 2020. Frustrated by the lack of political will to implement the strategy, it discontinued its work in the summer of 2023 (Huber 2023).

Third example:

Despite efforts prompted by protests of farmers in 2019 and involving the former German Chancellor Angela Merkel and the then Federal Minister of Food and Agriculture Julia Klöckner, who summoned approximately thirty agricultural associations and farmers to a summit, advancements towards effective implementations were not achieved. The summit resulted in the formation of the „Future Commission for Agriculture“ (Zukunftskommission Landwirtschaft), which included stakeholders from diverse sectors. The objective was to formulate sustainable recommendations for German agriculture. The commission issued its final report in the summer of 2021 (BMEL 2021). However, several members expressed their dissatisfaction with the German government's policies. Although the commission itself remains optimistic about its work and values its diverse representation with different interests, disappointment persists due to slow and inadequate implementation of its proposals by policymakers, there is recognition of the Commission's continuing importance. The head of the German Agricultural Society (Deutsche Landwirtschaftsgesellschaft) emphasises the urgency of preserving the Commission's valuable contributions for the future (DLG e.V. 22.02.2023)

These examples highlight the critical role of financial stability in farmers' willingness to engage in biodiversity conservation and agricultural policy dialogues. They illustrate how uncertainties

in policy implementation and economic incentives impact farmers' participation and trust in institutional frameworks. To better understand how farmers' financial mechanisms influence farmers' decision making processes, the following section categorises different types of financial incentives and examines their respective implications.

4.1.3 Categorisation of Financial Incentives

Behavioural patterns observed in the analysis reveal the extent to which financial structures influence biodiversity conservation decisions.

As seen in table 1, a comparison of these payment categories show that they differ in terms of their objectives, farmers' perceptions and impact on biodiversity conservation. The table provides a structured comparison of these incentives, summarising their core functions, advantages, and limitations based on policy frameworks and empirical survey data.

Table 1: Comparative Analysis of Three-Stage Payment Model in Biodiversity Conservation

Incentive Type	Objective	Farmers' Perception	Strengths	Limitations
Basic subsidies	Provide financial security, independent of conservation efforts	- Essential for economic security - Not perceived as direct biodiversity incentive	- Provides income stability, reducing financial stress - Supports farm viability	No direct link to biodiversity
Action-based Payments	Reward farmers for implementing biodiversity-friendly practices	- Viewed as supportive - Rigid regulations - Administrative workload	- Provides direct compensation - Encourages adoption of biodiversity measures	- Rigid compliance requirements limit flexibility - High bureaucratic complexity
Result-based payments	Link financial compensation to actual biodiversity improvements	- Appreciation of greater autonomy - Concerns over financial uncertainty due to unpredictable ecological conditions	- Rewards successful biodiversity efforts - Allows regional and farm-specific adaptation	- Outcome variability poses financial risk - Require long-term monitoring and stable policy frameworks

(i) Farmers' Perspective on Basic Subsidies

The findings indicate that while subsidies provide essential financial security, their effectiveness is often compromised by rigid administrative structures and the perceived inequities in distribution criteria. Farmers expressed concerns that the one-size-fits-all nature of such subsidies fails to account for regional ecological variations and differing economic pressures from across farm types. As one farmer explained: "Das müsste länderspezifisch oder regional sein, dann wären verschiedene Ertragsniveaus abgebildet. Es müsste Pauschalen für Standardmaßnahmen und besondere Aufwände geben, Ertragsverluste müssten aber auch berücksichtigt werden. Es gibt ja keine Standardmaßnahmen, die überall zum tollen Erfolg führen. Die müssten auch regional angepasst werden und unterschiedlich dann vergütet werden. (This would have to be country-specific or regional, in which case different yield levels would be accounted for. There would have to be flat rates for standard measures and special efforts, but yield losses would also have to be taken into account. There are no standard measures that lead to great success everywhere. They would also have to be adapted and then remunerated differently.)"; Farmer A4, interview (Turck 2025). This point of view indicates the requirement for flexible, regionally differentiated support mechanisms that acknowledge the diverse conditions of agricultural production and environmental contexts across Germany NPAs.

Furthermore, focus group discussions revealed that reliance on basic subsidies, without additional targeted incentives, may inadvertently discourage proactive biodiversity engagement by strengthening dependency rather than initiative.

On the positive side, farmers acknowledge that these payments play an important role in transforming unprofitable farming sites into profitable and economically robust ones. Farmers assume ease of implementation of monetary compensation as they are allocated fixed amounts. Many consider the combination of basic subsidies with bonus payments to be a beneficial approach.

However, there are also sceptic comments regarding these subsidies. Farmers point out the challenges of setting comparable standards, as agricultural areas are highly diverse and cannot and should not be uniformly assessed due to their heterogeneity. Determining an appropriate monetary amount is seen as a complex task. This concern is exemplified by the following statement made by one farmer: "In den Gunststandorten, da kommt man nicht mit Agrar-Umweltmaßnahmen. Wenn man in solchen intensiven Regionen Maßnahmen umsetzen will, muss man die dort finanziell unterfüttern, sonst wird es nicht funktionieren. (In favourable farming areas, you can't get there with agri-environmental measures. If you want to implement measures in such intensive regions, you have to support them financially, otherwise it won't work.)"; Farmer D1, interview (Turck 2025). This statement draws attention to the need for

differentiated and regional adapted funding mechanisms that take into account local agricultural intensity and production potential in order to ensure fairness and effectiveness in the context of biodiversity conservation.

Additionally, concerns were raised that monetary compensation may disadvantage successful farmers, as it may result in lower payments for those who consistently achieve above-average results.

Overall, while farmers appreciate the stability provided by basic subsidy system, they emphasise the need for greater flexibility in their design. Adjustment should account for regional differences and fluctuations in input costs, such as fuels and fertilizers, to ensure a fair and adaptive subsidy system. This statement of farmer B4: “Die Pauschale wird nicht an tatsächliche Preise gekoppelt, die wir derzeit sehen, für Dünger, Diesel und so weiter. Das wird irgendwann festgelegt und die Entwicklungen auf dem Markt werden nicht berücksichtigt, man bindet sich auf viele Jahre egal was kommt. Man kommt nicht raus. Das muss einem regionalen und zeitlichen Wert auch entsprechen, sowie den Unkosten, die tatsächlich entstehen. Und jedes Jahr ändern sich ja die Preise, wie wir jetzt sehen. (The flat payment is not linked to actual prices that we currently see for fertiliser, diesel and so on. and so on. This will be fixed at some point and the developments on the market will not be taken into account, you are tied in for many years no matter what. You can't get out. That must also correspond to a regional and temporal value, as well as the expenses that actually incurred. And prices change every year, as we are now seeing.)”; Farmer B4, interview(Turck 2025).

(ii) Farmers' Perspective on Action-Based Payments

Action-based payments are structured to financially support farmers who actively implement biodiversity conservation measures, such as reducing pesticide use, maintaining buffer strips or adjusting grazing intensity. These payments serve as a bridge between traditional farming practices and conservation-oriented land management, offering farmers a direct incentive to adopt environmentally beneficial practices.

While many farmers appreciate the variety of available measures - stating that “there is something for everyone – they also highlight significant challenges. As one farmer puts it: “da ist für jeden was dabei. Es ist viel dabei. (There's something for everyone. There is a lot on offer.)”; Farmer C3, interview (Turck 2025). A major concern is the bureaucratic complexity associated with these schemes, including rigid administrative processes, delayed payments, and a lack of flexibility to accommodate regional ecological variations. Standardized conservation requirements are often perceived as too inflexible, failing to account for the specific conditions of individual farmers. Despite these concerns, many of the interviewed farmers consider measure-oriented programmes as farmer-friendly and effective, particularly

when they incorporate adaptable and regionally tailored conservation measures. However, there is a strong emphasis on the need for fair and sufficient financial compensation. As one farmer notes: “Man muss die Landwirte überzeugen, dass es Sinn macht Zeit und Arbeit zu investieren und es muss vergütet werden (You have to convince farmers that it makes sense to invest time and labour and it must be rewarded.)”; Farmer A1, interview (Turck 2025). This perspective is further elaborated upon by another interviewee, who emphasises the economic challenges confronting the farming sector: “Ich bin auch Betriebswirtin. Ich muss meine Familie ernähren und mache das nicht nur aus Liebhaberei. (I am also a business economist. I have to feed my family and I don't just do this as a hobby.)”; Farmer C1, interview (Turck 2025). The financial risk is further accentuated when biodiversity measures result in products that are unsellable, as described by another participant: “Wenn ich mit dem Ernteerzeugnis, mit dem Heu oder mit dem Getreide, auch keinen Abnehmer mehr habe und es nicht mal als Einstreu verkaufen kann, kann ich selbst mit viel Fördermitteln den monetären Verlust nicht richtig ausgleichen. Ich habe die Arbeit, ich ernte Schrott, muss es noch entsorgen...(If I no longer have a buyer for the harvested product, hay or grain, and can't even sell it as bedding, I can't really compensate for the monetary loss, even with a lot of subsidies. I have the labour, I harvest scrap, and still have to dispose of it.)”; Farmer A4, interview (Turck 2025). These statements draw attention to the fact that, in addition to ecological ideals, conservation programmes have to be financially sustainable, i.e. attractive. It is essential that compensation is determined by factors other than the time and effort invested, but also by the potential market losses that farmers may face. Without these aspects, the likelihood of long-term engagement is considered minimal.

Many farmers stress that without adequate monetary incentives, participation in action-based measures remains uncertain. Additionally, while some farmers find visibility-based payment assessments satisfactory, others express ambivalence, questioning whether the current evaluation methods accurately reflect real biodiversity improvements.

Overall, while action-based payments are widely regarded as a valuable tool for promoting biodiversity-friendly farming, their success depends on reducing administrative burdens, ensuring timely payments, and enhancing the flexibility of conservation measures to align with the realities of diverse farming systems.

(iii) Farmers' Perspectives on Result-Based Payments

Result-based payments offer an alternative model where financial compensation is directly linked to biodiversity performance. This model allows farmers greater autonomy in choosing how to achieve ecological improvements, strengthening innovation and long-term commitment. However, while many farmers view this with cautious optimism, they also express concerns regarding its risk and implementation challenges. A primary concern is the uncertainty in

biodiversity outcomes, which are influenced by external ecological and climatic factors beyond farmers' control. The lack of guarantee financial returns is a significant barrier to adoption particularly among small and medium sized farms with limited financial buffers. Farmers express optimistic views regarding the introduction of a result-based payment system. They argue that such a system, when combined with a reliable financial foundation through monetary compensation, could possibly set new impulses in their practices towards biodiversity. They point out that for result-based payments to be widely accepted, they have to be integrated with a reliable financial foundation - such as basic subsidies - to provide economic security. In this context, they view result-based payments as an additional benefit rather than a sole source of financial support.

Focus group discussions highlight that the farmers appreciate the autonomy and self-responsibility given by the result-based model. Many express a preference for outcome-driven biodiversity programmes, believing that such schemes would provide new incentives for sustainable farming practices. However, concerns persist regarding the complexity of assessing biodiversity goals objectively. Farmers stressed their needs for transparent, well-communicated evaluation criteria, making sure that performance assessments are fair and aligned with practical agricultural realities. To mitigate these concerns, farmers propose a structured yet flexible approach to implementation. A suggested strategy involves an initial trial period, allowing for experimentation in gradual adaptation. This would include baseline documentation of current conditions, followed by comparative evaluations after a designated period which is typically five years. Additionally, continuous monitoring and follow-up assessments are seen as essential for maintaining credibility and ensuring that farmers are not unfairly penalised due to external environmental factors. Finally, farmers emphasised the importance of minimising bureaucratic complexity. They advocate for a straightforward, transparent and seamlessly integrated process which is required to support participation, rather than hinder it. The distinction between fixed subsidies and result-based bonuses is considered to be of key importance in maintaining trust and engagement in biodiversity conservation initiatives. This perspective is illustrated by the following statement: "Das würde ich als interessante Kombination finden. Dann habe ich zumindest eine Grundabsicherung, dann nehme ich an diesem Programm teil, da kann ich dann fest mit kalkulieren. Denn was nicht geht, das habe ich in Niedersachsen gesehen, ist ich schreibe das Programm einmal maßnahmenorientiert und einmal erfolgsorientiert aus und bei beiden Programmen steht die gleiche Prämie. Da weiß ich im Vorfeld, was der Landwirt wählt. Nämlich dann maßnahmenorientiert, weil ihnen das Risiko viel zu hoch ist, wenn sie meinen, dass sie das nicht umgesetzt bekommen. Was sie vorgeschlagen haben, ist aber ein interessanter Ansatz, wenn man es richtig messen kann. Das muss dann aber auch wieder richtig kommuniziert

werden, was wird gemessen, wie wird gemessen und kann ich es eventuell auch selber messen? (I would find that an interesting combination. Then I have at least basic cover, so I'll take part in this programme, so I can make a firm commitment. What doesn't work, as I saw in Lower Saxony, is offering the same premium for both action-based and result-based schemes. It's obvious which option farmers will choose, namely action-based, because the risk is far too high otherwise. But what you suggested is an interesting approach if you can measure it properly. That needs to be communicated clearly: what is measured, how is it measured and whether I can perhaps measure it myself.); Farmer A3, interview (Turck 2025). This quote underlines the significance of integrating guaranteed action-based payments with result (performance)-based incentives to ensure not only financial security but motivation, too. Farmers have indicated to favour models that keep risk remains calculable, and success is measured fairly and comprehensibly. It thus follows that transparency, risk mitigation and clear measurement criteria are crucial to strengthen participation and trust.

In consequence, the empirical findings indicate that farmers prefer a hybrid approach, where economic security is provided through basic subsidies, direct incentives encourage conservation behaviour, and additional financial result-rewards support long-term biodiversity success. The implementation of a combined incentive system, combining the stability of fixed payments with the flexibility of performance-based bonuses is seen as the most effective strategy for balancing financial security and ecological sustainability.

4.2 Psychological and Social Motivations

Beyond economic considerations, psychological and social factors play an essential role in shaping farmers' engagement in biodiversity initiatives. The financial models do not consider the autonomy of farmers, their perception of risk, social influences, and the potential of impact on their professional identity. This oversight can lead to limited engagement or strategic compliance rather than the adoption of meaningful measures. The findings presented in this section highlight the interaction between financial mechanisms and behavioural decision-making, with direct implications for policy design. Rather than regarding financial incentives in isolation, these findings must be considered within a broader framework of motivation theories, including Maslow's Hierarchy of Needs to understand their impact.

A key determinant of farmers participation in biodiversity measures is their perceived level of influence over conservation decisions. The qualitative interviews indicates that farmers often perceive prescriptive, action-based payments as bureaucratically restrictive, while result-based payments are regarded as offering greater autonomy in achieving ecological goals. However, despite the appeal of autonomy, the financial unpredictability of result-based payments introduces risk, making them less attractive to many farmers. Consequently, a

preference has emerged for hybrid models that combine guaranteed base payments with flexible, outcome-oriented incentives. These structures provide financial security while allowing adaptive management strategies in biodiversity conservation measures.

Farmers willingness to engage in conservation programmes is also influenced by their perception of risk. Concerns that external environmental factors, such as weather variability, could undermine the conservation success, thereby reducing or eliminating financial compensation, often motivates farmers to favour predictable, fixed payment structures. Furthermore, trusting policy institutions play a critical role in participation. Farmers who have experienced frequent policy shifts, delayed payments or inconsistent subsidy structures exhibit greater scepticism towards new financial incentives. It is therefore essential for the establishment of a reliable, transparent and stable policy framework for the promotion of long-term engagement.

The observation of successful implementation of biodiversity efforts by peers strengthens trust in these measures, thereby encouraging participation through the principal of social proof. The important role of peer exchange within their professional community in determining their willingness to implement measures related to biodiversity are emphasised by several farmers. The findings of the interviews indicate that individuals who are actively engaged in networks with fellow practitioners tend to exhibit a greater openness to adopt biodiversity-friendly practices. One farmer described the value of this in the following terms: “Ich finde den Austausch sehr interessant und auch ganz wichtig. Ich bin anderweitig auch landwirtschaftspolitisch unterwegs und immer hoch erfreut, wenn ich mit Kollegen aus anderen Bundesländern Gespräche führen darf und versuche daraus zu lernen. (I find the exchange very interesting and also very important. I am also involved in other agricultural policy and I am always delighted when I am able to have discussions with colleagues from other federal states and try to learn from them.)”; Farmer C4, interview (Turck 2025). This statement illustrates how dialogue and collaboration among peers strengthens learning and motivation, which can positively influence the adoption of biodiversity measures in farming practice.

The findings also suggests that financial incentive structures should be designed to incorporate mechanisms for social reinforcement, such as peer learning network or public acknowledgment programmes. Farmers’ professional identity and public recognition have been identified as factors in encouraging engagement. Farmers have expressed their discontent with the prevailing societal narrative that portrays agriculture as a primary driver of environmental degradation, arguing that such voices neglect to acknowledge their contribution to food security and ecological stewardship. The survey results indicate that farmers are more willing to adopt biodiversity-friendly practices when they receive public and market recognition

for their efforts. The strengthening of positive discourse, coupled with targeted social incentives enhances full entry participation.

4.3 Integration of Maslow's Theory in Financial Model

An essential aspect of this discussion involves examining how financial incentives align with Maslow's motivational framework. The findings demonstrate that basic subsidies satisfy the basic, i.e. psychological and safety, needs by ensuring financial stability. Action-based payments correspond to belonging and esteem needs, providing recognition for farmers conservation efforts and thereby strengthening a sense of inclusion within environmental policy frameworks. Result-based payments, by rewarding tangible conservation achievements, align with self-actualization needs, allowing farmers to derive personal and professional fulfilment from the biodiversity initiatives.

By mapping the Three-Stage Payment Model onto Maslow's Hierarchy, the section conceptualises a progressive model of economic motivation. This demonstrates how farmers can transition from basic financial security to conservation engagement. Figure 7 visually represents this alignment, illustrating the parallel structure between Maslow's Pyramid of Needs and the Three-Stage Payment Model. The alignment shows how financial incentives must first secure the basic needs of farmers before they contribute towards autonomy, self-actualization and intrinsic motivation. This underscores the necessity for a holistic incentive system.

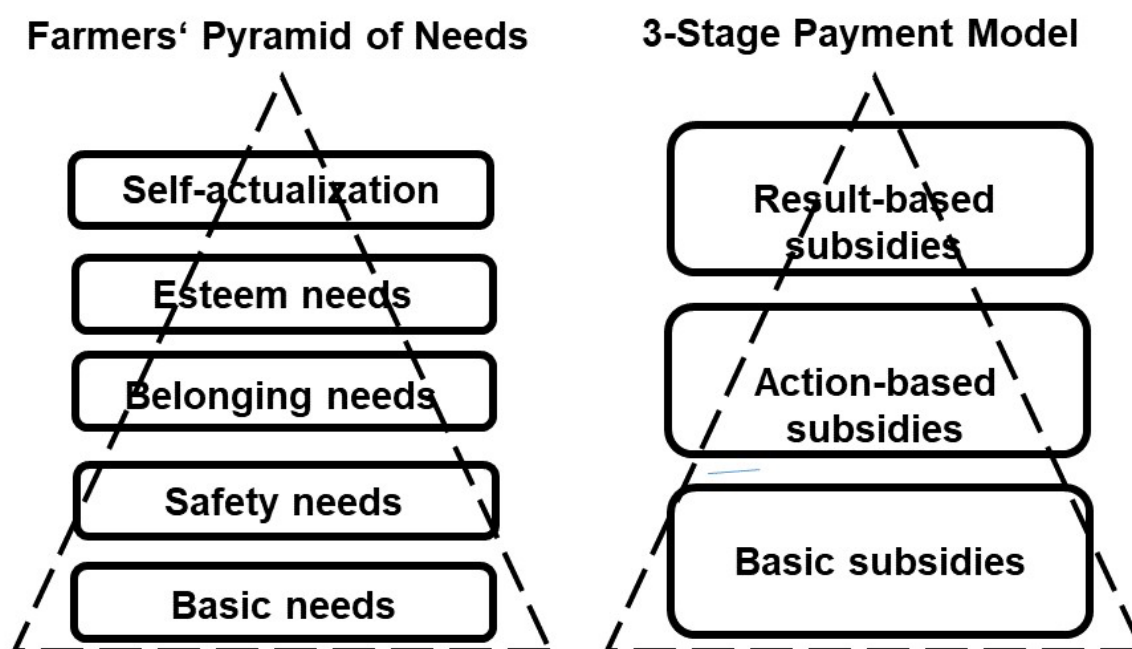


Figure 7: Understanding Farmers' Motivations: Maslow's Pyramid vs. the Three-Stage Payment Model (adapted from Maslow's Hierarchy of Needs and author's own illustration)

At the base of the hierarchy farmers prioritise economic survival, focusing on financial security, income stability and risk minimization. Basic subsidies fulfil this function by providing a guaranteed financial foundation, enabling farmers to cover essential operational costs. However, as illustrated in figure 7, these payments alone do not inherently drive biodiversity-engagement; rather, they create the necessary preconditions for farmers to consider additional conservation commitments.

As financial security is established, farmers begin to evaluate conservation incentives in terms of their social and professional identity. Action-based payments align with belonging and esteem needs as they reward visible conservation efforts enhancing farmers' status with peer networks and agricultural communities. Beyond direct financial compensation, these payments offer social validation, reinforcing the adoption of engaging in sustainable-driven practices. The illustration (fig. 7) highlights how this stage bridges economic security with conservation engagement, showing the importance of financial models that integrate both external incentives and intrinsic social motivations.

At the top of the hierarchy, result-based payments satisfy the self-actualization needs, where farmers engage in biodiversity conservation not merely for financial gain but as a part of a long-term ecological and professional vision. This stage requires a high degree of autonomy, allowing farmers to develop and implement conservation strategies suited to their local

environmental conditions. However, as previously discussed, result-based payments also introduce financial unpredictability. To mitigate this, hybrid payment structures should combine baseline security with performance-driven incentives, ensuring stability and long-term motivation.

4.4 Leveraging Contemporary Motivations Theories

Linking financial incentives with the three contemporary motivational theories mentioned above (chapter 2.4) strengthens the understanding of how farmers respond to conservation payments beyond economic reasoning.

The Self-Determination Theory (SDT) explains that farmers are more likely to engage in biodiversity programmes when they feel competence, autonomy, and relatedness to their decision-making. This is evident in farmers expressed desire for more flexibility and autonomy in programme design and implementation. As one focus group participant remarked: “Ich plädiere dafür, dass man das freier machen muss. Es muss mehr Flexibilität rein, dann wird das auch gemacht. (I am in favour of making this more liberal. It must more flexibility, then it will be done.)”; Farmer B1, interview (Turck 2025). This perspective aligns to the Three-Stage Payment Model, where basic subsidies provide security, action-based payments reinforce competence through structured engagement, and result-based payments offer autonomy by allowing farmers to determine their own conservation approaches. The Consistency Theory further highlights that individuals seek stability in their decision-making, explaining why farmers tend to favour predictable, low risk payment structures over financial uncertain result-based incentives. However, when consistency is paired with gradual incentive progression, farmers may transition from financial security to higher conservation engagement without perceiving abrupt economic risk. Lastly, the SCOAP-model offers a broader psychological perspective, emphasising that human motivation is driven by security, control, orientation, attachment and pleasure - all of which are inherently embedded in the hierarchical structure of financial incentives. By ensuring that each financial mechanism fulfils a corresponding psychological need, policy frameworks can create a more effective and sustainable approach to farmer participation in conservation.

5. Policy Implications

5.1 Addressing Farmers' Concerns

The effectiveness of biodiversity conservation is dependent on the trust and participation of farmers. This finding is consistent with international research, which emphasise that farmers' willingness to engage in conservation measures is shaped by both economic incentives as well as psychological and social factors (Prager et al. 2012) . Therefore, if conservation policies

are to be effective, it is essential that they address the practical, economic, and psychological concerns that influence farmers' willingness to participate in financial incentive programmes. Incentives models, that combine elements like basic payments to reduce risk for farmers, plus bonus system payments for achieving specific outcomes, and longer-term contracts, are increasingly recognised as a promising approach to encourage farmer engagement in biodiversity conservation. Research findings indicate that result-oriented measures, which reward farmers for achieving quantifiable outcomes as opposed to simply implement prescribed farming practices, can significantly enhance biodiversity effectiveness as well as farmer motivation (Burton and Schwarz 2013). Such schemes have been successfully piloted in a number of European countries, with particular promise for grassland biodiversity conservation. For example, in Baden-Württemberg (Germany), farmers are rewarded in accordance with the presence of indicator species, while in the Netherlands, payments have been used to protect meadow bird species. The examples illustrate that result-based schemes have the potential to be more cost-effective and to increase farmer participation provided that suitable indicators and monitoring systems are in place (Burton and Schwarz 2013).

However, the introduction of sole and only result-based payments introduces new challenges, such as the risk for farmers, as payments are dependent on outcomes that are influenced by factors beyond their control.

The study highlights several key barriers to farmers' engagement. Many farmers remain sceptical to participate in conservation schemes due to bureaucratic complexity, financial uncertainty, inconsistent policy, and a lack of institutional trust. One interviewed farmer articulates this sentiment as follows: "Von den Landwirtschaftsbehörde, Ämtern, sehe ich nur noch eine Kontrollfunktion. Aus der Beratung haben sie sich komplett zurückgezogen. Der Kontakt beschränkt sich auf ein Minimum. (I only see a control function for the agricultural authorities and offices. They have completely withdrawn. Contact is limited to a minimum.); Farmer C1, interview. Another farmer emphasised the need for clear and more supportive programme structures: "Klare Strukturen. Langfristige Bindung, wenn nötig. Kurze Versuchsmöglichkeiten gewährleisten. Kontrollen und Sanktionen abschwächen. Dass nicht Angst erzeugt wird, sondern auch Mut gemacht wird. (Sound structures. Long-term commitment, if necessary. Short trial periods guarantee. Ease controls and sanctions. That not fear is created, but rather provides encouragement.); Farmer E1, interview (Turck 2025). These insights underscore the importance of designing conservation measures that are not only financially viable but also transparent, reliable and supportive, both in administrative and interpersonally interactions.

A major barrier to engagement is the perception of excessive **bureaucracy**. Participants of the interviews frequently described the application procedures for subsidies lengthy, reporting

requirements excessive, and regulatory compliance confusing. One farmer conveyed his frustration like this: “Wenn es da ein Angebot gebe, dass man da ohne Bürokratieauflagen, ohne Pflegezeitpunktauflagen reinschnuppern könnte. (If there was an offer that you could get a taste of it without bureaucratic requirements and without the need for care at the required time.)”; Farmer D 1, interview (Turck 2025). Such statements reflect the desire for more accessible, simplified entry points to biodiversity-friendly measures.

These administrative challenges particularly affect small and medium sized farms, which lack the resources to handle complex documentation and time-intensive bureaucratic processes. Monitoring and compliance requirements pose an additional burden, with many farmers expressing dissatisfaction with the approach taken by regulatory agencies.

Financial predictability and stability are also concerns. Farmers are hesitant to adopt biodiversity conservation measures when financial incentives are perceived as short-term, unpredictable, or subject to political fluctuations. Moreover, financial uncertainty is made worse by the failure of subsidy structures to compensate for indirect costs associated with biodiversity conservation. Many programmes only cover direct payments for biodiversity-friendly measures, but do not take account of long-term impact on farm operations, such as increased labour costs or investment in infrastructure for habitat restoration. Furthermore, there is a lack of safeguard against external risks, and farmers fear that they might not receive payments despite adhering to conservation agreements.

A recurring statement of farmers is the perceived **inconsistency of policy frameworks**, particularly in the context of the European Green Deal and national-level agricultural regulations such as the Insektenschutzpaket (Insect Protection Package) and Agrarpaket (agricultural package) (Bundesgesetzblatt 2022; Jahberg 2019). The Green Deal establishes overarching sustainability goals at EU-level, including ambitious targets for biodiversity conservation. However, the implementation of these targets at national level can vary, resulting in perceived regulatory uncertainty and financial instability for farmers. As one participant of the conducted interviews noted: “Wir werden ständig mit wechselnden Neuerungen im Pflanzenschutz, Düngung, Tierhaltung konfrontiert und müssen uns permanent anpassen. Natürlich wünschen wir uns mehr Planungssicherheit. Gerade wenn es um größere Investitionen geht. (We are constantly confronted with changing innovations in plant protection, fertilisation, animal husbandry and have to constantly adapt. Of course we would like to have more planning security. Especially when it comes to major investments.)”; Farmer C1, interview. Another farmer expressed frustration: “Ich finde schade, dass wir zum politischen Spielball werden. (I think it's a disgrace that we are becoming a political playing ball.)”; Farmer C3, interview (Turck 2025). These statements demonstrate the tension between policy ambitions and the lived realities of implementation, underscoring the need for more coherent,

reliable, stable and long-term policy frameworks that enable farmers to plan with confidence and harmonise their practices with biodiversity objectives.

A further issue identified is the perception of a discrepancy between ecological objectives and financial incentives. The interviewed farmers frequently expressed concerns that the existing subsidy structures do not align with practical farming realities. This perceived misalignment has given rise to questions regarding the long-term viability of biodiversity requirements. As one farmer explained: “Ich würde überlegen, rentiert sich die Bewirtschaftung der Fläche. In Zukunft wird viel passieren müssen. Ein vernünftiges Einkommen wollen die Landwirte. (I will have to consider whether the cultivation of the area is financially viable. A lot will have to happen. Farmers want a reasonable income.)”; Farmer A3, interview (Turck 2025). This situation is indicative of the necessity for conservation payment schemes that reflect operational realities, thereby ensuring that environmental expectations are met with adequate and reliable financial support.

Additionally, farmers’ involvement in **policy formulation** is crucial for improving acceptance and commitment to biodiversity-friendly measures. Expanding participatory decision-making frameworks that actively engage farmers in policy discussions strengthens **trust**, ownership, and long-term engagement. Addressing farmers’ core concerns is essential for increasing engagement in biodiversity conservation measures. Table 2 outlines key barriers farmers’ encounter.

Table 2: Addressing Farmers’ Concerns with Key Challenges

Farmers’ Concerns	Key Challenges
Bureaucratic Complexity	- Excessive paperwork - Complex subsidy applications - Difficult monitoring requirements and compliance procedures
Financial Uncertainty	- Unpredictable conservation payments - Payments do not account for external risks - Compensation for indirect costs
Perceived Inconsistency in Policy Frameworks	- Frequent adjustments in conservation subsidy structures - Misalignment between ecological targets and financial incentive models - Economic viability
Lack of Trust in Policy Stability	- Increase of administrative obligations - Delayed payments - Subsidy structures do not account for regional farming realities

The effectiveness of biodiversity conservation finance is dependent upon the identification and mitigation of the key concerns and challenges faced by farmers. By understanding these barriers, policymakers can formulate targeted solutions that enhance engagement, trust, and sustainability in the context of farm biodiversity finance.

5.2 Applying Contemporary Motivations Theories

Building on the theoretical foundation established in chapter 4.4, this section explores how the integration of the contemporary motivation theories discussed can be applied to biodiversity conservation. As previously discussed, they provide valuable insights for designing more effective agricultural policies that encourage sustainable farming practices. Therefore, the integration of Self-Determination Theory (SDT), Consistency Theory and the SCOAP-model into policy frameworks helps to create incentive structures that align with farmers' intrinsic and extrinsic motivations.

International studies confirm that financial incentives alone are not sufficient to ensure long-term, voluntary engagement in biodiversity among farmers (Batáry et al. 2015; Herzon and Mikk 2007). Instead, policies have to address both, the extrinsic and the intrinsic motivational drivers, including autonomy, competence, relatedness social recognition, and psychological consistency. This is supported by comparative research across Europe, which highlights the importance of policy frameworks that are flexible, participatory, and attuned to the specific needs and realities of farmers (Münch et al. 2023).

SDT highlights the need for conservation policy frameworks that strengthen autonomy, competence, and relatedness. Farmers are more likely to engage in biodiversity programmes when they perceive decision-making as self-directed rather than being externally imposed. Policies should therefore prioritise flexible incentive structures that allow farmers to tailor conservation measures to their specific operational context. Action-based payments can enhance competence by providing structured engagement, while result-based payments promote autonomy, enabling farmers to determine their own conservation approaches. This approach is supported by arguments based on European research and case studies, which show that result-based payments combined with participatory governance and clear, measurable indicators are most effective in strengthening long-term commitment and innovation (Burton and Schwarz 2013).

Consistency Theory suggests that aligning financial incentives with farmers' existing values and identities increases long-term commitment. Conservation policies that provide gradual, predictable incentive progression can mitigate perceived economic risks and enhance long-term engagement. Rather than an immediate shift, a step-by-step implementation strategy – moving from financial security towards more result-based-oriented incentives - can support

behavioural consistency and reduce resistance to change. This is consistent with the findings from comparative studies in Estonia and Finland, where gradual, well-supported transitions (Herzon and Mikk 2007) and clear communication of policy objectives were the key to building trust and acceptance among farmers (Herzon and Mikk 2007).

The SCOAP-model reinforces the need for policies that address broader psychological drivers, including security, control, orientation, attachment and pleasure. Conservation incentives must go beyond financial compensation by integrating mechanisms that strengthen social recognition and reinforce the professional identity. Public acknowledgment of biodiversity efforts, peer-to-peer learning networks and participatory governance structures can enhance farmers' sense of belonging and professional validation increasing their willingness to adopt conservation friendly practices. This is echoed in European research, which finds social networks, peer influence, and public recognition are critical for the uptake and sustained adoption of agri-environmental measures (Batáry et al. 2015).

By incorporating these contemporary theories, policymakers can develop interventions that go beyond financial incentives, integrating social and psychological elements that enhance the effectiveness as well as the acceptance of biodiversity policies. The findings indicates that no singular financial strategy is sufficient; instead, an integrated multi-layered model is required that considers economic security and higher-order psychological drivers. While monetary incentives may initially motivate participation, long-term commitment is more likely when financial mechanisms also support intrinsic motivation, autonomy and social recognition. The integration of contemporary motivation theories provides a scientifically grounded approach to increasing farm engagement. While financial incentives remain critical, motivation theories demonstrate that factors such as autonomy, social validation and policy consistency are equally important. By embedding this insight into incentive structures policymakers can design effective psychological informed incentive mechanism that encourage long-term voluntary engagement in biodiversity programmes.

5.3 Enhancing Financial Incentives: A Roadmap for Policy Improvements

To promote financial incentives for biodiversity conservation, a strategic and adaptive policy framework is required, one that moves distinctly beyond compliance-based subsidies and enhances a dynamic, result-oriented approach. To achieve this, a roadmap for policy improvements is needed to ensure that conservation funding mechanisms are aligned with ecological objectives and the diverse economic realities of farmers. The Three-Stage Payment Model presented earlier provides a structured framework for progressive financial engagement that allows farmers to gradually increase their commitment to conservation while maintaining

their financial security as described above. The following section explores how payment structures can be tailored to meet farming conditions as they develop to ensure that conservation incentives remain responsive, equitable and performance-driven.

5.3.1 Policy Implications: Towards Integrated and Adaptive Strategies

The findings of this paper highlight that current financial incentive structures for biodiversity conservation lack flexibility, effectiveness and alignment with farmers' motivation to ensure long-term biodiversity conservation engagement. Existing subsidy schemes rely mainly on compliance-based mechanisms that often fail to account for farmers' intrinsic and extrinsic motivations. Their rigid structures neglect regional variations, economic risk perception, or the need for gradual engagement, all of which are important in shaping farmers' willingness to participate in biodiversity-friendly measures.

A structured policy roadmap is required to transition towards a more adaptable, outcome-driven financial model that aligns with farmers' motivations and behavioural drivers. The Three-Stage Payment Model, introduced in this paper, provides a tiered framework that offers progressive incentives based on conservation impact, enabling farmers to engage at different levels according to their economic, psychological and social motivations.

The first step in this roadmap is the establishment of a motivation-driven financial structure. The basic security payments (Stage 1) serve as an entry-level support mechanism, mitigating economic risk and addressing farmers' need for financial security (as informed by the SCOAP-model and SDT). This initial step ensures that conservation engagement does not threaten farmers' economic viability, a key concern for those hesitant to adopt biodiversity-friendly practices.

Action-based payments (Stage 2) provide targeted compensation for specific biodiversity-friendly practices, appealing to competence-driven motivations (farmers' desire to improve skills and knowledge in environmental-friendly measures). By linking payments to concrete conservation actions, it incentivises farmers to adopt conservation measures that align with their operational capacity and environmental conditions; this model strengthens gradual engagement and reduces perceived uncertainty about biodiversity conservation measures.

Finally, result-based incentives (Stage 3) recognise and reward farmers who achieve measurable biodiversity improvements. These incentives are designed to allow farmers to exercise autonomy and intrinsic motivation by determining the most effective methods for achieving conservation goals. This structure ensures that financial incentives develop in line with farmers' growing commitment to biodiversity.

Beyond financial mechanisms, the roadmap addresses structural barriers by advocating administrative simplification and alignment of conservation policies across governance levels.

Reducing farmers' uncertainty and strengthening predictability is essential for motivation according to Consistency Theory.

Furthermore, social motivations play an essential role in biodiversity engagement. Farmers are more likely to participate in biodiversity programmes when peer-networks, cooperative conservation models, and social recognition mechanisms are in place. The roadmap proposes enhancing participation through farmer-led conservation networks, sustainability certification schemes, and public recognition initiatives, reinforcing relatedness as a key motivator (SDT).

By following this structured approach, a phased implementation strategy is essential. It is within the domain of policymakers to ensure that conservation finance is not only economically viable and ecological effective but also behavioural informed and motivation-driven. In the short term (1-2 years), the focus should be on removing administrative barriers and integrating financial security as a foundation for engagement. In the medium term (3-5 years), subsidy structures should evolve to incorporate motivation-based incentives, ensuring that conservation participation is sustained beyond economic necessity. In the long term (5+ years), a fully developed, motivation-driven financial incentive system should be established, ensuring that biodiversity finance strengthens intrinsic commitment and long-term behavioural change among farmers. The visualisation of the proposed roadmap (fig. 8) provides a clear overview of the phased approach, indicating the key phases and strategic shifts over time.

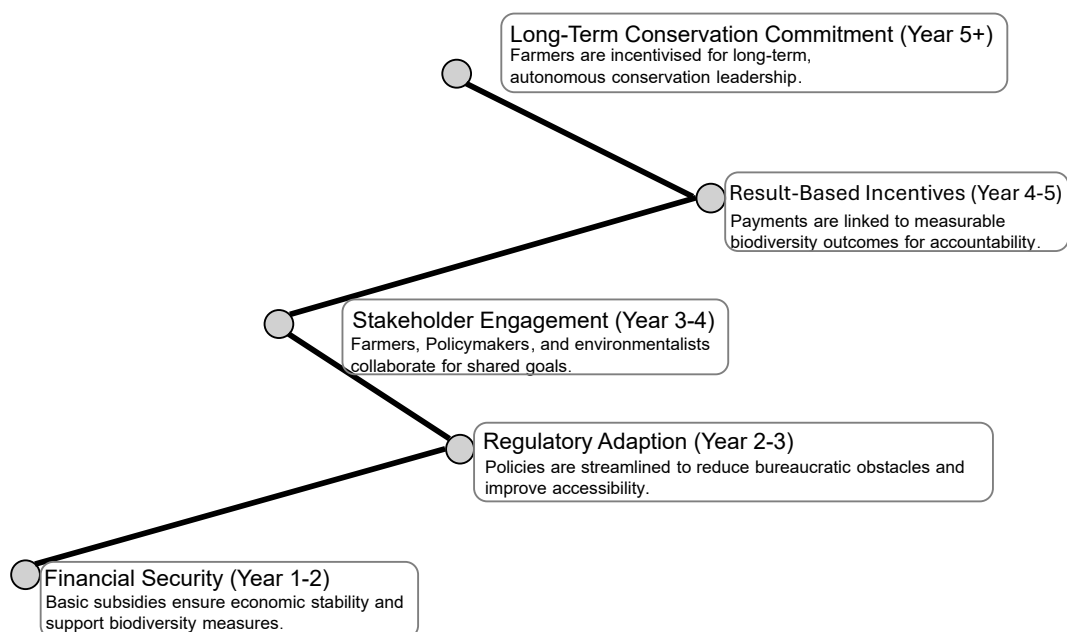


Figure 8: Structured Roadmap: Enhancing Financial Incentives for Biodiversity Conservation
(own illustration)

The findings of this paper emphasise that effective policy improvements have to align with farmers financial needs, psychological motivations, and social incentives to be effective. The proposed roadmap shifts conservation finance beyond compliance-driven models towards a dynamic, motivation-oriented model, maximising both farmers' participation and biodiversity outcomes.

A structured alignment of linking motivational theories within the roadmap ensures long-term engagement by integrating economic and psychological components. Table 3 illustrates the relationship between the selected motivational theories and the different phases of the roadmap for improving financial incentives in conservation. Early phases (years 1-3) prioritise stability and financial security, while later stages emphasise autonomy, achievement and long-term efficacy. The gradual transition from extrinsic motivation (monetary rewards) to intrinsic motivation (conservation as a personal goal) strengthens sustainable behavioural change.

Table 3: Alignment of Motivational Theories with Roadmap Phases

Theory	Financial Security (Year 1-2)	Regulatory Adaptation (Year 2-3)	Stakeholder Engagement (Year 3-4)	Result-Based Incentives (Year 4-5)	Long-Term Conservation Commitment (Year 5+)
Maslow: Safety Needs	Stability through basic financial security				
Consistency Theory		Adaptation to changing policy frameworks			
Self-Determination Theory			Promotion of autonomy and social inclusion	Linking incentives to intrinsic motivation	
SCOAP-Model			Strengthening control & belonging	Enhancing orientation and achievement	Increasing self-efficacy and sustainability
Maslow: Self-Actualization					Long-term intrinsic motivation and sustainable decision making

The integration of contemporary motivation theories, notably Self-Determination Theory (SDT), Consistency Theory, and the SCOAP-model, underscore the importance that conservation policies must extend beyond established financial compensation models. Policies should incorporate mechanisms that promote farmers' autonomy, competence, and social recognition, thereby encouraging voluntary engagement. Administrative simplification is crucial, proposing the reduction of bureaucratic complexity through digitalisation, regional governance frameworks, and participatory decision-making to allow for optimised implementation.

The policy implications of the Three-Stage Payment Model require careful calibration to ensure equitably and effectively financial distribution. It is important to adjust payment schemes to accommodate regional ecological and economic conditions to maximise conservation impact. Also, public awareness and market integration should be strengthened to assure that biodiversity-friendly agricultural products receive adequate economic support. This, in turn, is expected to facilitate the reinforcement of long-term behavioural change and commitment among farmers.

5.3.2 Moving Towards More Flexible and Adaptive Payment Schemes

To further enhance biodiversity conservation incentives, payment schemes should incorporate greater flexibility and adaptability. Introducing performance-based bonus systems can reward farmers for exceptional conservation outcomes, strengthening result-based oriented approach. Additionally, financial incentives should be extended to innovative biodiversity-enhancing measures, such as agroforestry, habitat restoration, and regenerative agriculture. Experimentation with new incentive structures through pilot programmes, closely involving farmers in their design and evaluation, can help refine subsidy models and identify best practices. Adaptive financial mechanisms will ensure that policies remain responsive to evolving ecological and agricultural conditions while maintaining farmers' engagement.

5.4 Strengthening Farmers-Society Relation and Public Awareness

Public perception and social recognition play a crucial role in shaping farmers attitudes towards biodiversity conservation. Strengthening the relationship between farmers and society through targeted public awareness campaigns, educational programmes, and market driven incentives can enhance participation in conservation initiatives. Certification schemes for biodiversity-friendly products, along with improved market integration for sustainable agricultural goods, can create economic opportunities while reinforcing farmers environmental contributions. Furthermore, strengthening community-led conservation initiatives and enhancing knowledge-sharing networks can increase peer recognition and motivation. Policies that elevate the societal status of farmers engaged in biodiversity-friendly measures can serve as powerful non-financial incentives, complementing existing economic support structures.

6 Conclusion

6.1 Summary of Key Findings

This study has systematically explored the economic, psychological, and social factors influencing farmers' engagement in biodiversity conservation within German NPAs. By integrating the adapted Maslow's Hierarchy of Needs with contemporary motivation theories, the research has provided a structured understanding of the interaction between financial incentives, regulatory frameworks, and social recognition in influencing motivational behaviour in conservation. The findings reveal that economic stability remains the dominant deciding factor for the enhancement of biodiversity engagement, with financial incentives playing an essential role in facilitating engagement. Nevertheless, factors such as community recognition, professional self-esteem, and the alignment of conservation efforts with farmers' intrinsic values, which are classified as social and psychological factors, are shown to be essential drivers of long-term commitment.

The Three-Stage Payment Model developed in this study offers a more nuanced approach to the structuring of financial incentives. By balancing economic security, performance-driven incentives (result-based payments), and long-term sustainability, the model effectively addresses the motivational levels of farmers while ensuring administrative feasibility and ecological effectiveness. The empirical results of the study indicate the necessity of adaptive policy frameworks that respond to regional as well as individual differences, thereby reducing financial and administrative constraints by maintaining transparency and fairness. The model's success depends on engagement of stakeholders, with farmers playing a key role in refining and evaluating payment structures. A persistent challenge is the development of robust biodiversity metrics that are both scientifically and practically suitable for on-farm assessment, especially in context of result-based payments. Farmers' diverse motivations have to be considered while mitigating financial and administrative demands.

Overall, the findings accentuate the potential of a revised financial incentive system to enhance participation in biodiversity-friendly measures by aligning economic incentives with ecological objectives while providing farmers with stability and autonomy. The incorporation of flexible yet reliable evaluation mechanisms will be crucial to facilitate long-term effectiveness and scalability across diverse agricultural landscapes.

6.2 Limitations and Areas for Future Research

Although the study provides a comprehensive framework for understanding farmers' motivations, certain limitations have to be acknowledged. While the reliance on focus group discussions and qualitative analysis is valuable for capturing in-depth insights, it may limit the generalisability of findings to the wider farming populations. It is recommended that future

research includes long-term studies and large-scale quantitative assessments to validate the effectiveness of proposed incentive structures.

Additionally, while the study has focused primarily on financial and motivational factors, future research should explore the ecological impacts of different incentive models, assessing the effectiveness in achieving measurable biodiversity gains. The role of emerging technologies, such as remote sensing and AI-driven biodiversity monitoring, also warrants future exploration to enhance the efficiency of result-based payments schemes.

6.3 Final Reflections

This study makes a significant contribution to the ongoing discourse on sustainable agricultural transitions by demonstrating that economic incentives alone are insufficient to drive long-term conservation engagement. Instead, a holistic approach that integrates financial security, regulatory flexibility, and social incentives is required to ensure that farmers remain committed to biodiversity conservation. The findings imply a need for a paradigm shift in agricultural policy, one that recognises farmers not only as economic actors but also as stewards of ecological sustainability.

In the future, policymakers should adopt a more inclusive and adaptive approach to conservation governance, with financial mechanisms designed to align with both economic realities and behavioural insights. Contemporary motivational theories can provide a framework for this, as can the simplification of administrative procedures and enhanced public recognition of farmers' conservation efforts. This integration of sustainable agriculture into a broader biodiversity conservation framework should enable the achievement of a balance between agriculture productivity and ecological stewardship, thus encouraging the development of resilient and thriving natural ecosystems.

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5 SUMMATIVE REFLECTIONS ON BIODIVERSITY AND STAKEHOLDER INTERACTION: AN AFTERWORD

5.1 Introduction

The challenge of biodiversity conservation in agricultural landscapes is closely linked to the motivations, hesitations and constraints faced by farmers, as discussed in preceding chapters and studies. These provide a detailed understanding of how biodiversity is threatened and potentially protected within NPAs. The three papers – *“Farmers are caught in Tri-Dilemma - Objectives and Challenges for Biodiversity in German Nature-Protected Areas”*, *“Hesitations and Aspirations of Farmers in Nature-Protected Areas”*, and *“Farmers’ Economic Demands and Motivations for Biodiversity in Nature-Protected Areas: A Maslow-based Evaluation”* - highlight the competing demands on farm land, the complexity of policy frameworks, and the psychological factors that influence farmers’ engagement with biodiversity measures. This concluding chapter synthesises the insights gained, drawing together themes of economic constraints, regulatory challenges, social expectations, and personal motivations. By integrating these perspectives, it presents a holistic view of biodiversity governance within NPAs emphasising the need for a more balanced and stakeholder-sensitive approach.

5.2 The Land Use Trilemma: A Persistent Dilemma for Farmers

The papers *“Farmers are Caught in Tri-Dilemma - Objectives and Challenges for Biodiversity in German Nature-Protected Areas”* and *“Hesitations and Aspirations of Farmers in Nature-Protected Areas”* both identify the land use trilemma as a major challenge for farmers. The three competing demands, i.e. biodiversity conservation, food security, and climate change mitigation, place farmers in a difficult position, where it is often impossible to prioritise one goal without compromising the others. Policymakers and environmentalist call for biodiversity-friendly land use, but economic pressures and policy constraints make this difficult to achieve in practise.

This trilemma is complex and manifests in multiple ways:

- (i) Economic Pressures: Farmers face declining profit margins and price competition, making biodiversity investments financially risky.
- (ii) Regulatory Obligations: Compliance with CAP-driven biodiversity measures and other environmental regulations add administrative challenges without always delivering clear economic benefits.

(iii) Public Expectations vs. Market Behaviour: While society calls for sustainable farming, consumer purchasing behaviour remains cost-driven, often undermining incentives for biodiversity protection.

This trilemma is therefore not simply a theoretical construct; it is a lived reality that shapes decision-making processes in agricultural landscapes.

5.3 Farmers' Motivations: A Maslow-Inspired Perspective

A critical addition to this discussion is provided by *"Farmers' Economic Demands and Motivations for Biodiversity in Nature-Protected Areas: A Maslow-based Evaluation"*, which applies Maslow's Hierarchy of Needs to explain farmers' varying levels of engagement with biodiversity conservation:

(i) Basic Needs and Economic Viability: Without financial security, farmers cannot prioritise conservation. Direct payments and subsidies are essential but insufficient if they do not align with market realities.

(ii) Safety and Regulatory Stability: Farmers require predictable policy frameworks to make long-term biodiversity investments; unstable or overly bureaucratic regulations create uncertainty and resistance.

(iii) Social Belonging and Peer Influence: Social norms within the farming community heavily influence conservation behaviour; farmers embedded in strong networks are more likely to engage in biodiversity-friendly measures.

(iv) Recognition and Esteem Needs: Lack of public appreciation for farmers' environmental contributions leads to disengagement. Incentive structures must recognise and reward sustainability efforts beyond financial compensation.

(v) Self-Actualization and Sustainability Leadership: Some farmers adopt biodiversity measures due to intrinsic motivations such as long-term land stewardship or ethical considerations. However, these motivations typically emerge only when lower-level needs are satisfied.

This psychological framework under discussion adds depth to previous analyses by showing that financial incentives alone cannot drive behavioural change. It suggests that a multi-dimensional approach is necessary, one which includes social validation and regulatory stability.

5.4 Policy Instruments: Between Incentives and Bureaucratic Overload

The studies collectively emphasise that while financial incentives exist, their effectiveness is limited by structural inefficiencies. The CAP framework provides direct and indirect payments, but farmers perceive them as bureaucratic, unpredictable and sometimes insufficient.

Three key lessons emerged from the policy analyses:

(i) Result-Based Payments vs. Action-Based Payments: Farmers prefer financial incentives that provide autonomy such as result-based payments, over rigid, prescriptive measures that restrict decision-making.

(ii) Administrative Simplification: It is evident that the current level of bureaucracy and compliance costs associated with biodiversity programmes is a significant barrier to participation, and that the simplification of these processes would, therefore, be an effective measure to enhance participation.

(iii) Long-term Commitment and Trust-Building: Consistent policy commitments are required to ensure stability, as changing subsidy models every few years has shown to erode trust and investment in biodiversity. In addition, fairness in the distribution of sustainability costs across the food chain plays a role in trust-building; cooperative network structures, both horizontal and vertical, can help to balance these burdens (Schiefer and Deiters 2015).

These findings demand a policy design that is more farmer-centred, with the aim of reducing administrative obligations, strengthening long-term planning security, and promoting fairer collaboration along the value chain. In this context, it is also important to consider the potential of digital technologies to reduce administrative burdens and improve policy effectiveness. Digital integration, agent-based systems, and smart communication networks have the potential to promote new forms of cooperation and enhance efficiency in the agri-food sector. When applied to biodiversity-oriented policy instruments, such technologies have the potential to reduce transaction costs, strengthen feedback mechanisms, and improve implementation at farm level (Schiefer 2004). For instance, advancements in autonomous weed control indicate that biodiversity conservation and crop productivity are not necessarily mutually exclusive. It is demonstrated that, with sufficiently detailed ecological input information and selective interventions, it is possible to maintain high level of weed diversity in the field while minimising yield losses. The potential of robotics and precision farming to harmonise ecological and economic objectives in modern farming systems are increasingly recognised as being transformative for sustainable agriculture (Zingsheim and Döring 2024). They enable reduced input without compromising productivity. Their potential to align ecological and economic goals is of particular relevance for NPAs and biodiversity-friendly farming practices.

5.5 The Role of Stakeholder Interaction: Bridging the Divide

A valuable insight from *“Hesitations and Aspirations of Farmers in Nature-Protected Areas”* relates to the role of stakeholder interaction in shaping biodiversity governance. Farmers do not operate in isolation, their decisions are influenced by interactions with policymakers, environmental groups, and consumers.

(i) **Conflicting Stakeholder Expectations:** Policymakers emphasise compliance, while environmentalists demand stricter regulations, and consumers want both sustainability and affordability. Farmers must navigate these conflicting demands while maintaining economic viability.

(ii) **Lack of Farmers’ Representation in Decision-Making:** many farmers feel excluded from biodiversity policymaking, perceiving it as a top-down process that disregards their practical knowledge.

(iii) **Need for Participatory Governance:** Strengthening farmers’ involvement in biodiversity planning through advisory councils, cooperative governance, and knowledge-sharing networks could enhance policy acceptance and implementation.

A more inclusive approach where farmers are seen as partners rather than targets of regulation is essential for strengthening biodiversity commitment.

5.6 The Global Risk, Economic Implications and Climate-Biodiversity Nexus

The following chapter provides a broader macro-economic and global policy perspective to complement the previous German farmers’ centred discussions. Lately, a growing body of evidence emphasises the systemic risk associated with biodiversity loss, not only to agriculture but to global economies, financial markets, and climate resilience. The global risk report 2025 by the World Economic Forum identifies biodiversity loss and equals system collapse among the top three most severe risk in the coming decade (World Economic Forum 2025). This aligns with the studies, highlighting that biodiversity conservation cannot be seen as a niche concern but as an essential challenge requiring urgent action.

5.6.1 Economic Costs of Biodiversity Loss

The Organisation for Economic Co-operation and Development (OECD) and the World Bank have identified the degradation of key ecosystem services including pollination, water regulation, soil fertility as a major threat to the global economy (World Bank 2021; OECD 2023). These economic risks are particularly severe in the agricultural sector, where the stability of food production is a cornerstone of the global economy. It is therefore essential, to consider biodiversity as a foundational economic asset rather than a mere conservation

concern. Farmers, as direct land managers, are already experiencing rising production costs due to biodiversity degradation:

- Pollination Loss: The decline of wild pollinators results in the need for artificial solutions such as managed honeybee colonies, increasing production costs.
- Soil Degradation: Reduced soil biodiversity diminishes fertility, requiring higher inputs of synthetic fertilisers, which are both costly and environmentally harmful.
- Market Uncertainty: despite increasing consumer awareness of sustainability, price-driven competition in food markets fails to compensate for biodiversity-friendly practices.

These challenges intensify earlier discussions on farmers' economic challenges - as outlined in section 5.3, which emphasised the importance of economic security as a prerequisite for biodiversity engagement - and on the need for market-based incentives for biodiversity. The latter is addressed in 5.4, in which the inefficiency of current CAP payments is criticised, and more targeted financial support is called for. While policy interventions such as the CAP attempt to bridge this economic gap, the findings suggest that biodiversity payments must better reflect the real costs of conservation.

5.6.2 The Climate-Biodiversity Nexus: Mutual Reinforcement of Crises

The WWF Living Planet Report warns that the next five years are of utmost significance in averting irreversible biodiversity tipping points, such as the collapse of coral reef ecosystems or large-scale deforestation (World Wide Fund for Nature 2024). Climate change and biodiversity loss are deeply interwoven:

- Climate Change Accelerates Biodiversity Loss: Extreme weather, rising temperatures, and altered precipitation patterns disrupt ecosystems, making it harder for species to survive.
- Biodiversity Loss Accelerates Climate Change: The destruction of carbon binding ecosystems (forest, wetlands, peatlands) increases atmospheric carbon, leading to further climate instability.

The interconnected crisis has direct implications for farmers, particularly those in NPAs, as discussed in 5.2 on the land use trilemma and in 5.5 on stakeholder interactions in biodiversity governance. Farmers must navigate conflicting pressures to ensure food security while complying with regulations. Moreover, the trilemma of land use (5.2) means that farming practices intended to maximise productivity inadvertently contribute to degradation of biodiversity. At the same time, the disconnect between environmental policies and the realities

experienced by farmers, as outlined in 5.5, signifies biodiversity-oriented farming practices are frequently perceived as additional strain rather than a viable long-term strategy.

- Extreme weather events, characterised by crop failures, reduce farmers' capacity to invest in biodiversity conservation.
- Soil erosion and water scarcity disrupt agricultural productivity, leading to an increase in dependency on external inputs.
- Agricultural emissions contribute to climate change, requiring a transition to climate-smart and biodiversity-friendly farming practises.

Without addressing these interdependencies, biodiversity policies fall short, and farmers struggle to adopt biodiversity-friendly practices. To visually demonstrate these interconnected relationships, the following illustration (fig.4) highlights the feedback loops between biodiversity loss, climate change, economic instability, and food security threats, while also showcasing the role of policy and financial interventions in mitigating these risks.

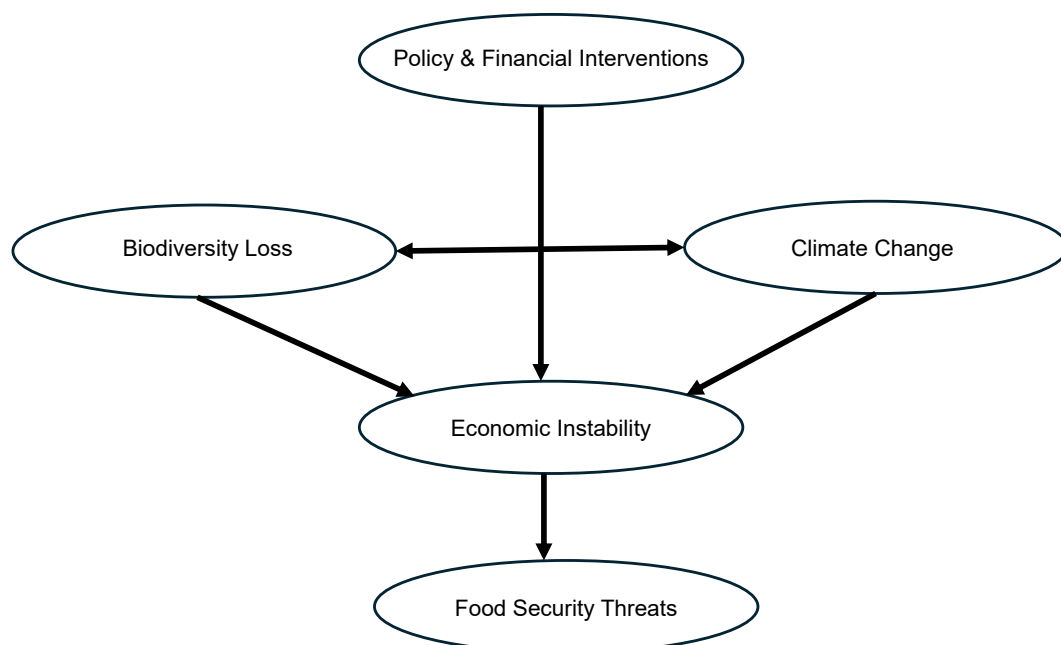


Figure 4: Interconnections Between Biodiversity, Climate, and Economic Risks (own illustration)

5.6.3 The Need for Integrated Solutions

Addressing the link between biodiversity loss, climate change and food security - and thus agricultural productivity - requires integrated policy frameworks that do not treat these challenges in isolation. Policies have to be designed for synergies that allow farmers to play a central role in mitigation and adaptation efforts. Integrated solutions have to consider the

complex socio-ecological dynamics that facilitate agricultural systems. This includes the recognition of feedback loops between biodiversity, resilience and long-term economic viability, as highlighted in chapter 5.4 on policy instruments, which criticises the current incentives failing to align with farmers' needs, and in chapter 5.6 on multi-stakeholder approaches, which emphasises the importance on participatory governance in biodiversity strategies.

Recent EU-level frameworks place additional emphasis on the relevance of contingency planning and coordinated stakeholder action as part of a wider resilience strategy (Schiefer, G., Sanchez, O. 2024).

To integrate biodiversity and climate resilience more effectively, key interventions include:

- Carbon credits for biodiversity: Farmers should be incentivised for biodiversity-positive practises that also enhance carbon sequestration. A more structured carbon market could reward biodiversity conservation as an ecosystem service, linking it to climate action.
- Climate-smart agricultural subsidies: Current CAP and national subsidies should prioritise funding for biodiversity-enhancing farming practices that also improve climate resilience, such as agro-forestry, regenerative farming, and reduced chemical inputs. This addresses the shortcomings in current policy structures discussed in 5.4.
- Strengthening financial sector engagement: As the Nature Finance Report highlights, financial institutions are beginning to recognise nature-related financial risks. The incorporation of biodiversity risks into insurance pricing, investment portfolios, and bank policies could create stronger market-based incentives for biodiversity-positive farming, complementing the governance recommendations made in 5.6.

By embedding biodiversity conservation within a broader climate resilience framework, policymakers can create more effective and sustainable incentives for farmers. Without this integration, the economic and ecological risks of biodiversity loss will continue to escalate, undermining both food security and climate adaptation efforts. The active inclusion of local actors, notably farmers, whose decisions directly shape the land use outcomes, is therefore critical for sustainable transitions.

5.7 Final Reflections and Recommendations

The synthesis of findings of the preceding chapters highlights that biodiversity conservation in NPAs cannot be effectively achieved without simultaneously addressing farmers' economic conditions, psychological motivations, and governance challenges.

The studies examined - *“Farmers are caught in Tri-Dilemma - Objectives and Challenges for Biodiversity in German Nature-Protected Areas”*, *“Hesitations and Aspirations of Farmers in Nature-Protected Areas”* and *“Farmers` Economic Demands and Motivations for Biodiversity in Nature-Protected Areas: A Maslow-based Evaluation”* - demonstrate that policies must be farmer-centred, integrating financial, regulatory, and social dimensions.

The following table (Table 1) provides a structured overview of the insights and recommendations. It synthesises key challenges, corresponding research findings, and recommended actionable solution. These are those that policymakers, researchers, and stakeholders should consider when designing biodiversity governance strategies in agricultural landscapes.

Table 1: Balancing Biodiversity and Economic Viability in Nature-Protected Areas
(Author's own work)

Key Challenge	Insights from Findings	Recommended Action	Related Study
Economic Viability & Financial Constraints	Farmers see biodiversity conservation as financially risky due to declining profit margins, high operational costs, and weak CAP incentives.	Strengthen result-based payments, ensure long-term financial stability , and increase biodiversity-linked income sources .	<i>Farmers are caught in Tri-Dilemma</i>
Regulatory Complexities & Administrative Burden	CAP biodiversity measures are often rigid and bureaucratic , leading to low participation.	Simplify administrative processes , provide multi-year regulatory commitments , and introduce farmer-led policy co-design .	<i>Hesitations and Aspirations of Farmers in Nature-Protected Areas</i>
Climate-Biodiversity Nexus	Farmers must balance biodiversity conservation, climate adaptation, and food security, but policies do not align with it.	Integrate biodiversity funding into climate resilience policies , promote carbon credits for conservation , and expand agro-ecological transition incentives .	<i>Farmers are caught in Tri-Dilemma</i>
Farmers' Psychological Motivations & Hierarchical Needs	Economic security is a prerequisite for biodiversity engagement; without it, conservation efforts feel secondary. Farmers also seek peer validation and public recognition .	Link biodiversity payments to income security , establish peer-led conservation networks, and strengthen public narratives about farmers as environmental stewards.	<i>A Maslow-based Evaluation</i>
Consumer Behaviour & Market Incentives	Consumers demand sustainability but often prioritise cheaper, mass-produced food , making biodiversity-friendly farming less competitive .	Expand eco-labelling systems , introduce biodiversity-friendly purchasing incentives , and promote public awareness campaigns .	<i>Hesitations and Aspirations of Farmers in Nature-Protected Areas</i>

Stakeholder Collaboration & Farmer Representation	Farmers feel excluded from biodiversity policymaking are view regulations as top-down impositions rather than cooperative efforts.	Promote participatory governance models, involve farmers in regional biodiversity planning , and increase knowledge-sharing platforms .	<i>Hesitations and Aspirations of Farmers in Nature-Protected Areas & A Maslow-based Evaluation</i>
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The following overarching conclusions can be drawn from the insights presented in table 1, which outlines the challenges and recommended actions of the complex interplay.

Overarching conclusions:

1. Biodiversity Conservation Cannot Exist in Isolation from Economic and Social Realities: Policies that ignore farmers' economic constraints or fail to provide regulatory stability will not succeed.

2. Psychological and Social Dimensions Matter: Beyond financial incentives, farmers need social validation, autonomy, and a sense of purpose in biodiversity efforts.

3. Policy Reforms Must Prioritise Simplicity, Stability, and Flexibility: A shift towards result-based payments, reduced administrative complexity, and consistent long-term commitment is crucial.

4. Stakeholder Collaboration is Key: Farmers must be actively engaged in shaping biodiversity policies rather than merely complying with externally imposed regulations.

5. Public Awareness and Consumer Responsibility: Societal demands for biodiversity-friendly agriculture must align with purchasing behaviour. Without consumer support for sustainable farming, economic incentives remain limited.

As the global biodiversity crisis intensifies, agricultural landscapes are set to assume an increasingly vital role in the context of conservation efforts. However, it is both unrealistic and counterproductive to expect farmers to shoulder this responsibility alone. The provision of adequate support, economic security, and social recognition are essential. Biodiversity conservation is not just a responsibility of farmers but a global economic imperative. Recent assessments by World Economic Forum, OECD, and IPBES warn that failure to act now will lead to economic instability supply chain disruptions, and financial losses far exceeding the costs of proactive conservation (World Economic Forum 2025). Moreover, the successful implementation of biodiversity measures at the local level is crucial for achieving the global Sustainability Development Goals (SDGs). Without effective action on the ground, overarching international targets remain unattainable. Therefore, it is essential to highlight biodiversity

governance at global, European, national and local levels ensuring that conservation efforts are not only well-integrated into climate adaptation, financial market incentives, and sustainable food systems but also effectively implemented on-site where they have the most immediate impact.

A holistic, multi-stakeholder approach that aligns ecological objectives with economic and social realities is therefore recommended as the optimal path forward.

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