



**AgEcon** SEARCH  
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

*The World's Largest Open Access Agricultural & Applied Economics Digital Library*

**This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.**

**Help ensure our sustainability.**

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

[aesearch@umn.edu](mailto:aesearch@umn.edu)

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

*No endorsement of AgEcon Search or its fundraising activities by the author(s) of the following work or their employer(s) is intended or implied.*

# 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, and Wiltrud Terlau

*International Centre for Sustainable Development (IZNE), Bonn-Rhein-Sieg University of Applied Sciences, Sankt Augustin, Germany  
darya.hirsch@h-brs.de; angela.turck@h-brs.de; wiltrud.terlau@h-brs.de*

*Received June 2021, accepted December 2021, available online January 2022*

---

## ABSTRACT

Contract-based nature protection schemes are a voluntary mechanism, with a limited contract duration, that aim to raise the acceptance of biodiversity conservation practices in agriculture among farmers and other land users. The purpose of this paper is to analyse the institutional settings of contract-based nature protection based on the “Institutions of Sustainability” (IoS) framework in the German Rhine-Sieg district, and to outline the way in which policy measures should be designed to encourage farmers to participate in contract-based nature protection programmes. This was achieved by answering research questions to identify the challenges, potentials and obstacles of a contract-based nature protection scheme in different “sub-arenas” as defined in the IoS framework. Qualitative research methods were used as the methodology. The analysis shows that main constraints for sufficient implementation of contract-based nature protection schemes are the limited consideration of the impact of climate change during the contract period, the limited consideration of regional conditions as regards the measures taken on the ground and an inflexible contract duration.

**Keywords:** *Agri-environment schemes; Payment for Ecosystem Services (PES); institutional analysis; Institutional Analysis and Development (IAD) framework; Institutions of Sustainability (IoS) framework.*

---

## 1 Introduction

Biodiversity and well-functioning ecosystems are essential foundations of our lives. Yet species extinction and the loss of valuable habitats are still on the rise. According to the World Biodiversity Council (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)), one million plant and animal species around the world are at risk of becoming extinct (Díaz et al., 2019). The loss of biodiversity is one of the greatest threats to ecosystems (Díaz et al., 2019).

The loss of biosphere integrity is one of the essential planetary boundaries of the concept popularised by Rockström and his colleagues (Rockström et al., 2009a, 2009b) in 2009 and updated in 2015 (Steffen et al., 2015). This concept defines a safe space for humanity to act based on the inherent biophysical processes that regulate the stability of the earth system (Steffen et al., 2015). The original proposed concept of “planetary boundaries”, published in 2009, “lays the groundwork for shifting our approach to governance and management, away from the essentially sectoral analyses of limits to growth aimed at minimizing negative externalities, toward the estimation of the safe space for human development. Planetary boundaries define, as it were, the boundaries of the “planetary playing field” for humanity if we want to be sure of avoiding major human-induced environmental change on a global scale” (Rockström et al., 2009b). Later on, in 2015, an update to the concept was published (Steffen et al., 2015), confirming the set of boundaries and updated analysis that four of nine planetary boundaries – namely climate change, loss of biosphere integrity, land-system change and altered biogeochemical cycles (phosphorus and nitrogen) – have been crossed. Changes in one of the planetary boundaries affect the status of other planetary boundaries (Lade et al., 2020).

Intensive use of land for agriculture worldwide, especially in Europe, has resulted in a loss of farmland biodiversity and degradation of ecological processes (Kleijn et al., 2009). This has both endangered the conservation of biodiversity and negatively influenced ecosystem services, such as the pollination and biological control of crop pests, which are essential for agricultural productivity (Potts et al., 2016).

Attempts to mitigate the negative environmental impacts of agricultural intensification have been made through a number of reforms introduced as part of the Common Agricultural Policy of the European Union (CAP), among other things. In 2013, “greening” measures for farmers who follow a specified set of mandatory farm practices, such as crop diversification i.e. a greater variety of crops makes soil and ecosystems more resilient, the maintenance of permanent grassland i.e. supporting carbon sequestration and protecting biodiversity, or the dedication of 5% of arable land to areas beneficial for biodiversity such as trees, hedges or land left uncultivated (EC–European Commission, 2017) were introduced in the first pillar (Matthews 2013; European Commission Ed. 2013). However, the environmental effectiveness of the 2013 reform is heavily debated (Pe'er et al., 2017; Alons, 2017).

The voluntary agri-environment measures (AEMs) are supported by the second pillar of the EU CAP (European Commission 2013). In these extremely multifaceted measures, farmers or land users undertake nature-friendly and environmentally sound agricultural application methods that go beyond the legal and statutory requirements of the first pillar. Such practices include conversion to organic farming management or AEMs such as extensive grassland use, cultivation of diverse crops in arable farming, planting of flowering strips, cultivation of catch crops, creation of riparian strips and erosion guard bars, contract-based nature conservation programmes and the breeding and keeping of endangered breeds of domestic animals (Ministerium für Umwelt, Landwirtschaft, Natur- und Verbraucherschutz des Landes Nordrhein-Westfalen, 2021), among other things. The aim of this contract-based nature protection scheme is to preserve or restore the livelihoods of endangered or threatened animal and plant species. It also aims to prevent the natural balance from shifting to a damaging extent or being destabilised. The system is complex and involves a wide range of actors with different roles and responsibilities. There are a number of studies that analyse why some AEMs/PES have worked better than others - in other words, that look at the success of the AEMs. Meyers et al. (2015) referred to a publication that emphasised that “the success of environmental policy measures may be assessed through an analysis of efficiency and effectiveness”, whereby efficiency is difficult to assess unless different comparable policy options are available to achieve the desired goal. Therefore, the success of AEMs is usually based on effectiveness aspects such as participation and ecological outcomes. Matzdorf et al. (2014) observed that, in addition to high expectations with regard to ecological impact, social and institutional criteria are also relevant. These included a large number of actors with the necessary expertise who are wholly committed to AEMs, accessible advisory services and the building of trust between these actors, e.g. established through personal contacts (Matzdorf and Meyer, 2014).

## 2 Rationale of the study and research questions

Against the above-mentioned background, the subject of this paper is to determine how current contract-based nature protection schemes in the German Rhine-Sieg district could be successful as voluntary agri-environment measures. This paper addresses the design and implementation of contract-based nature protection schemes, analysing the interaction between the physical and social world as well as applied institutions. The primary goal of the paper is to understand the institutional settings [actors involved – their roles, characteristics, attitudes and perceptions] of contract-based nature protection schemes. A secondary goal is to analyse interactions between human activities [nature protection] and natural systems, in our case with a focus on land use. The Institutions of Sustainability (IoS) framework will be applied as an analytical framework. A tertiary goal of this paper, after the performance of institutional analyses (Goal 1 and 2), is to outline the way in which policy measures should be designed to encourage farmers to participate in contract-based nature protection programmes.

Considering these objectives, the investigation aims to provide answers to the following research questions:

1. What are main challenges of contract-based nature protection schemes on the sub-arenas: policy design, policy implementation and farmers' practices?
2. What are main potentials of contract-based nature protection schemes on the sub-arenas: policy design, policy implementation and farmers' practices?
3. What are main obstacles of contract-based nature protection schemes on the sub-arenas: policy design, policy implementation and farmers' practices?

The qualitative research methods used to address these questions include literature review, review of legal documents and political frameworks, and semi-structured interviews.

## 2 Contract-based nature protection in Germany

### Historical outline

Contract-based nature protection is a special form of nature conservation based on cooperation with land users - usually farmers. As mentioned previously, these measures are under the jurisdiction of federal states, which are very strict about delimiting their competences from those of the federal government. As a result, contract-based nature protection in Germany is regulated and co-financed exclusively by the federal states.

Inspired by exemplary activities in other European countries such as France, Greece, Ireland, the Netherlands and Italy, German federal states devised a series of contract-based nature conservation programmes, even before the McSharry reform of 1992, which involved farmers receiving rewards for economic measures that promoted nature conservation (Hampicke, 2013). The readiness for this was also ripening at EU level; after the first step of the "Efficiency Regulation" (Regulation (EEC) 797/85) in 1985, the breakthrough came in 1992 in the form of the "flanking measures" regulated by Regulation (EEC) 2078/92 (Commission of the European Communities, 1992). Since the agricultural reform of 1992, and increasingly since Agenda 2000, the contract-based nature protection programmes of the federal states have been co-financed by the EU. This has made it possible for the monetary support for contract-based nature conservation to grow steadily. Because of the limited financial resources available to the federal states, co-financing by the EU has significantly fostered the expansion of contract-based nature protection in Germany. This support does, however, bring with it the requirement for the management and control mechanisms of the EU, namely the Integrated Administration and Control System (IACS), to be adopted. This has revealed some hardships and problems, as these requirements were originally tailored for the first pillar of EU agricultural policy and are not always suitable for contract-based nature conservation measures (Güthler et al., 2003).

Agriculture, which is intensively practised in large parts of North Rhine-Westphalia, often exhibits shortfalls in the area of nature protection. Adding to this are the dense settlement of people in North Rhine-Westphalia and the associated high pressure on land, which makes it urgently necessary to support environmental protection and nature conservation measures and attempts to preserve cultural landscapes.

## Principles

As mentioned previously, contract-based nature protection is an AEM and a type of remuneration for environmental services in the agricultural sector (Güthler et al., 2003), in other words – PES. AEMs are developed and financed by the EU and its member states. These measures are implemented and monitored by the respective federal states.

Contract-based nature protection is based on two principles (Thiele, 2020): voluntary participation and financial compensation for the management of grassland and arable land/maintenance of valuable cultural biotopes, and takes place predominantly via agri-environment programmes (supported by the second pillar of the EU CAP) or targeted nature conservation measures and goes beyond the legal and statutory requirements of the first pillar of the EU CAP (European Commission, 2013) in other words, incentives in the form of political instruments are created for the provision of ecosystem services by individual farmers or land users. These PES “are highlighted as a promising solution to halt the degradation of ecosystems” (Kaiser et al., 2021) and “have been of major importance for solving agri-environmental problems throughout the EU for many years” (Meyer et al., 2015). Salzmann et al. (2018) estimated that there are over 550 PES programmes in place around the world with approximately USD 36–42 billion in annual transactions (Salzman et al., 2018).

Although the definitions of PES are very diverse (Kaiser et al., 2021; Meyer et al., 2015), considering a wide array of different aspects and exhibiting fundamental differences, it was possible to develop a taxonomy based on key ex-ante criteria, e.g. addressing the concept and design of specific PES programmes and ex-post effectiveness criteria related only to the programmes that are already running. The ex-ante criteria comprises **conditionality** (both action-based, e.g. any general environmentally friendly land use measures to protect ecosystem services, and performance-based, e.g. individually measured ecosystem services), **voluntariness** (fully or partly voluntary or involuntary, e.g. “driven by compliance of regulation, both on the demand and the supply side” (Sattler and Matzdorf, 2013), **incentive** (monetary and non-monetary), **transparency** (“the timely and reliable provision of information to all stakeholders” (Tacconi, 2012)), **directness of transfer** (“related to the actors involved in the transaction” (Kaiser et al., 2021)) and **definition of ecosystem services** (well-defined or ill-defined). Ex-post criteria include **additionality**, e.g. improved condition of ecosystem services and no loss or degradation of ecosystem services elsewhere, and **welfare gain** covering social justice, poverty evaluation and a win-win approach.

## Funding structure

In order to meet a manifold of demands on the management of different habitats, contract-based nature protection offers a delineated funding structure. The description of this structure is as follows: contract-based nature protection is one of the agri-environment measures of the EU CAP. 45% of the measures are funded by the EU through the North-Rhine Westphalia (NRW) Rural Area Programme (known here as the European Agricultural Fund for Rural Development (EAFRD) (European Commission, 2005). The national share for Germany amounts to 55%. This share comprises funds from the state of North Rhine-Westphalia and municipal funds from the respective district or self-governing city, depending on the local measure being funded. The composition of the national share depends on the type and location of the funded measure on the ground. It is therefore possible for the state of NRW to contribute between 30 and 100%.

The remaining municipal funds are provided by the districts or self-governing cities (kreisfreie Städte, such as Bonn). The federal government does not participate in grants for contract-based nature conservation.

In the research-rich Rhine-Sieg district in the state of NRW, contract-based nature protection has already been in practice since the mid-1980s. Farmers and other land managers receive financial compensation for managing their grassland and arable land in line with nature conservation objectives and for managing and maintaining valuable cultural biotopes such as rough grassland, heaths, orchards and hedges. Contract-based nature protection schemes are an incentive-based mechanism and contribute significantly to the preservation and improvement of biodiversity goals in NRW, which are anchored in the Biodiversity Strategy, developed by the Ministry for, Environment, Agriculture, Conservation and Consumer Protection of the State of North Rhine-Westphalia in 2015. The Guidelines on the Granting of Allowances for Contract-based Nature Protection of 8 September 2015 (short name: Framework Guidelines for Contract-based Nature Conservation (Rahmenrichtlinien Vertragsnaturschutz - RRL) is the primary legal document, which summarises various funding measures for contract-based nature protection. The guidelines also contain a description of funding objectives, funding areas and regulations on organisational and administrative procedures in connection with the approval and processing of the funding measures. Regulations on dealing with changes and violations during the term of measures are also available.

The Rhine-Sieg district offers funding opportunities for nature protection as part of the “Cultural Landscape Programme of the Rhine-Sieg District” (KUPRO-RSK). It applies to all nature conservation areas as well as other areas which are deemed important for nature conservation by the programme. The main purpose of the programme is to safeguard and develop preserved grassland biotopes, species-rich farmland and orchards for the future through appropriate management and equipment (Rhein-Sieg-Kreis, 2014).

**Data and facts**

The protection of biodiversity is necessary not only in one region, but worldwide. The goal is to preserve and enhance diversity. Every region counts when it comes to nature conservation – oriented management of green areas, farmland and biotope maintenance. The Rhine-Sieg district also plays a role in this (Werking-Radtke and König, 2011, 2015).

It is widely known that intensive farming practices lead to a reduction in species diversity on farmland. One goal of contract-based nature protection is achieved through extensive management in order to obtain, promote and ensure biodiversity. Evidence of (successful) implementation is presented by means of impact indicators such as species number, target species, nitrogen number, etc. (Werking-Radtke and König, 2011). The red list of endangered species and the monitoring of agricultural areas with high nature value also illustrate the impacts (v.d. Decken et al., 2017).

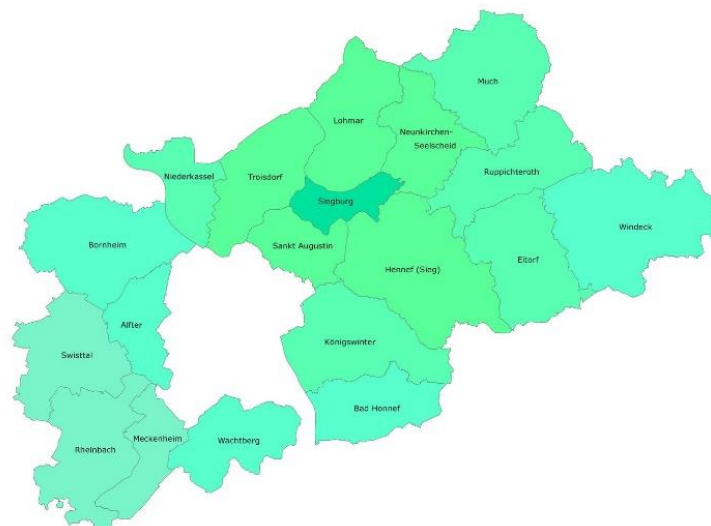
With its contract-based nature protection measures, the Rhine-Sieg district therefore makes a non-negligible contribution to maintaining and boosting biodiversity with increasing numbers of contributory farmers and farmland (see Table 1).

**Table 1.**  
Areas with contract-based nature protection schemes in the Rhine-Sieg district

Indicator	2015	2016	2017	2018	2019	2020	6 yrs growth, %
Agricultural land, ha	1020	1320	1343	1350	1450	1550	+52
Farms under contract-based nature protection	133	178	183	207	231	260	+95

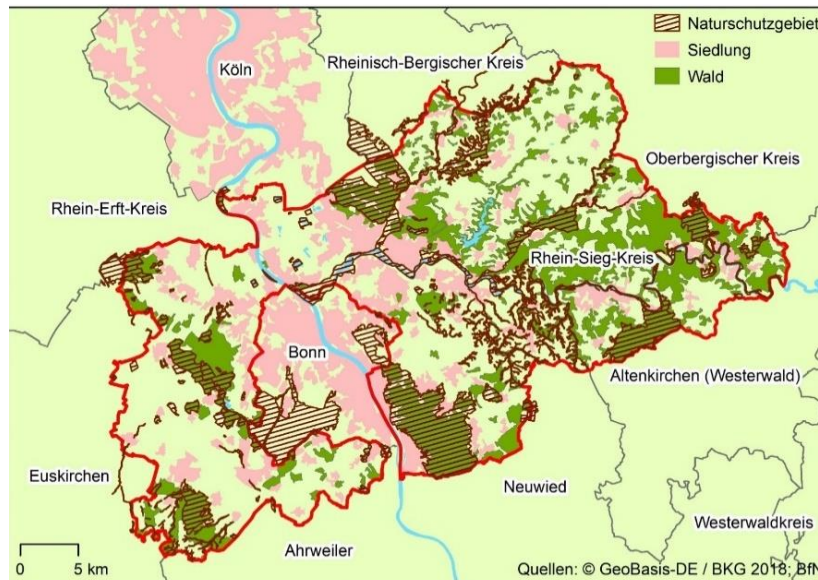
(Source: own calculation based on data provided by the biological station for the Rhine-Sieg district in 2021, e-mail exchange with the lower nature conservation authorities and the payment agency for North Rhine-Westphalia in January 2021)

The Rhine-Sieg district is located in the German federal state North Rhine-Westphalia, has 599,780 inhabitants (Statista, 2021) and covers a total area of 115,321 ha (Becker, 2016). In terms of its population, the Rhine-Sieg district is the second largest district in Germany after the Recklinghausen district (Rhein-Sieg-Kreis, 2021). The Rhine-Sieg district comprises a total of 19 cities and municipalities (Rhein-Sieg-Kreis, 2021).



**Image 1.** Map of the Rhine-Sieg district (Source: Rhein-Sieg-Kreis 2021)

The area under nature protection<sup>1</sup> in the Rhine-Sieg district amounts to 171.94 km<sup>2</sup> (14.91 %), and the area under landscape protection to 597.62 km<sup>2</sup> (51.82 %). The extent of the nature park area in the district is 990.00 km<sup>2</sup> (85.85 %) (Rhein-Sieg-Kreis, 2018).



**Image 2.** Map of the Rhine-Sieg district and its nature protection areas (hatched) (Source: GeoBasis-DE/BKG, 2018)

In the annual implementation report for North Rhine-Westphalia (Ministry of Environment, Agriculture, Nature and Consumer Protection, 2014) for the period from January to December 2019, there is evidence of encouraging progress when it comes to the acceptance of contract-based nature conservation: 5,480 farms (16% of all farms in NRW<sup>2</sup>) (i.e. 32,823 ha (2% of the total agricultural area in NRW) - in the case of package combinations, no multiple entries are permitted for the area) have submitted payment claims. This was set to rise to 37,000 ha in 2020 (Ministry of Environment, Agriculture, Nature and Consumer Protection 2014). The upward trend in the acceptance of these measures within the Rhine-Sieg district is shown in Table 1.

### 3 Methodology

In order to achieve the main goal defined for the paper – to analyse the design and implementation of contract-based nature protection schemes – an analysis of the interaction between the physical and social world as well as applied institutions was carried out based on both IoS methodology developed by Hagedorn (Hagedorn, 2008) and the Institutional Analyses and Development (IAD) framework created by Ostrom (Ostrom, 2009). The IAD framework has been developed for the purposes of analysing a complex world of commons, such as fishery stocks or woodlands. Ostrom (Ostrom, 2009) explored how institutions operate and change over time on account of certain types of so-called “action situations”- abstract typical situations in which actors interact with each other and make choices that collectively determine the outcomes of a particular aspect of a policy issue. The analysis consists of five elements, which Prager (2010) summarised as follows: “1. the action arena which has a concrete action situation in its core (typically a situation where a decision has to be made, e.g. in regard to what kind of governance approach to apply, what type of resource management to implement, etc.); 2. a set of contextual conditions influencing the action situation (e.g. bio-physical, political, social, etc.), 3. interactions in which action takes place (e.g. interactions between different social actors, social actors and different environmental resources), which leads to 4. certain outcomes resulting from these interactions (e.g. met demands of the different social actors, state of the environmental resource in question. Finally, outcomes are evaluated by 5. specific evaluation criteria, which feed back to the initial conditions” (Prager 2010).

Hagedorn (Hagedorn, 2008) expanded upon the IAD framework to create the IoS framework for analysing nature-related sectors. The IoS framework has been applied several times in the past. It has been pointed out that “scholars often do not find the operationalization of the framework straightforward.

<sup>1</sup> Definitions according to Federal Nature Conservation Act (BNatSchG), Bundestag, of 29 July 2009.

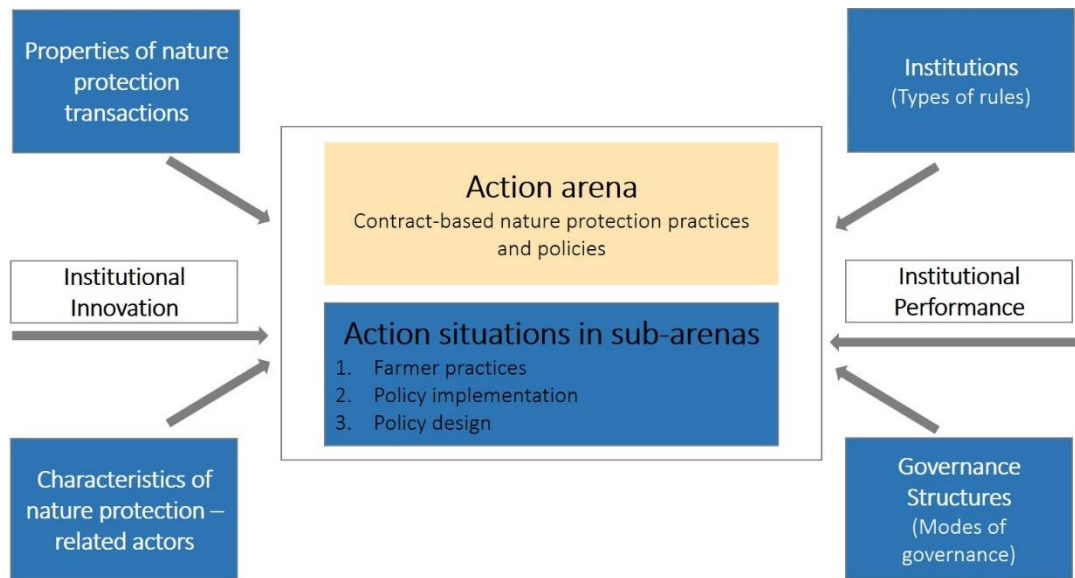
<sup>2</sup> <https://www.it.nrw/statistik/eckdaten/landwirtschaftliche-betriebe-nach-groessenklassen-lz-2020-1481>.



Beyond recognizing the IoS as an adequate analytical framework they are faced with many choices regarding the relevant transaction(s), the definition of the action arena(s) and a suitable methodology” (Prager, 2010).

### Conceptual basis

The IoS framework (Hagedorn, 2008; Hagedorn et al., 2002a) was chosen as the analytical framework for institutional and policy analysis and adjusted to the specific context of contract-based natural protection practices and policies in Rhine-Sieg district, Germany.



**Figure 1.** The IoS framework as adapted for the analysis of contract-based nature protection policies (Source: adapted and expanded from Hagedorn, 2002b; Hagedorn, 2008)

The framework integrates the properties of transactions, characteristics of actors, institutions and governance structures and displays their relevance in action arenas (Figure 1) and is to be interpreted as follows:

The main analytical elements are applied for the purposes of understanding institutions and focusing on how human actions which lead to transactions that affect the relationship between natural and social systems can be regulated. The assumption behind this is that “institutions (sets of rules) and governance structures that make them effective emerge either spontaneously through self-organisation or intentionally through human design. How these institutions and governance structures are socially constructed depends on the properties of the transactions and the characteristics of the actors involved in such transactions” (Hagedorn, 2008).

This framework has proved to be a useful analytical tool when it comes to identifying particular features of institutions that either support or contradict the sustainable use of natural resources (Gatzweiler, 2003; Penov et al.; Schleyer, 2004; Sikor, 2004; Theesfeld, 2005).

The IoS framework has been applied in this paper for the purposes of presenting and discussing the institutional settings of contract-based nature protection as an AEM based on the Institutions of Sustainability (IoS) analytical framework in the German district of Rhine-Sieg, and outlining the implications for successful contract-based nature protection policies and their implementation in farming areas.

The IoS framework has been adapted to the subject matter of this paper as follows: contract-based nature protection practices and policies have been defined as an action arena. By way of reminder, “individual actors” act in “action arenas,” which are social structures created by external forces (e.g. governments) (Ostrom, 2005). Based on the complexity of the social world, action arenas can be and actually are divided into sub-arenas according to the fields of action (e.g. land, soil, water, air, climate,



etc.) and the scale at which these actions play out, such as globally, internationally, nationally, regionally and locally.

### Data set and methodological approach

The data for this research was collected through a literature and document review and through a series of semi-structured interviews. The duration of the interviews was 60 minutes.

First of all, scientific literature relating to ecosystems payments with respect to contract-based nature protection policies was selected and legal documents such as regulations and documentation pertaining to the European Commission, national and regional programmes on biodiversity and nature protection were assessed. We also scrutinised regional statistical information as well as policy, administrative evaluation and research reports; e.g. the annual implementation report for NRW from the German Rural Development Programme (Regional).

Based on the above-mentioned literature and published reviews of current debates, key players were identified and used to develop questions for the semi-structured, guided interviews based on the IoS framework. The respondents were selected by means of snowball sampling, i.e. individuals from initial stakeholder categories were interviewed, who then identified further stakeholder categories and contacts. In total, six interviews were carried out. The respondents were

1. The Nature Conservation Authority of the Rhine-Sieg district
2. The “Contract-based nature protection” department of the State Agency for Nature, Environment and Consumer Protection of NRW (LANUV)
3. Farmer(s)
4. The Chamber of Agriculture
5. An EU-appointed payment agency and
6. A consulting company assigned to evaluate EC agricultural subsidies

All interviews were recorded, transcribed and analysed based on content analyses by Mayring (2020). This kind of analysis is used when examining the content of communication. It facilitates the analysis of data as the text documents are scrutinised carefully. Words or phrases were arranged by topic, grouped systematically and coded into textual categories. The deductive categories determined in this manner were constructed on the basis of the IoS framework (Hagedorn, 2008) and existing examples of the operationalisation of this framework (Prager, 2010).

## 4 Results

This section presents an example of “zooming in” on parts of the framework and how we unpacked a particular action situation (contract-based nature protection; Figure 1) for analysis. This is necessary because the action situation is the focus of our analysis. One part of the analysis covers nature protection and farming practices (agri-environment analysis), while the other part focuses on the actors and policies (institutional and policy analysis). Each analysis is divided into steps indicating the clusters of research activities. These steps are described and difficulties with overlap are discussed. In this paper, we primarily focus on institutional analysis in which actors operate in different sub-arenas with institutions (set of rules) and governance structures suitable for coordinating the interdependence of the actors.

Action situations in sub-arenas, participants and their roles

Action situations in sub-arenas include policymaking and implementation activities at different levels as well as farmers’ management decisions and practices on the ground (see Figure 1).

The next relevant groups of actors who are or should be directly or indirectly involved in contract-based nature protection efforts or policies are identified and classified in the sub-arenas in which they may be active:

- farmers’ practices (e.g. a farmer deciding to adopt a certain contract-based nature protection practice);
- policy implementation (e.g. agricultural or environmental administrative bodies implementing a certain procedure to monitor farmers’ compliance with restrictions on land use);
- policy design (e.g. policymakers at EU, national or regional level defining specific restrictions on land use in nature protection zones or determining the set of agri-environment measures to be offered in a region) (see Table 2).

**Table 2.**  
Categories of actors related to contract-based nature protection

	Sub-Arena: Farmers' practices	Sub-Arena: Policy implementation	Sub-Arena: Policy design
Actors that are part of an organisation with a hierarchical or bureaucratic structure	<ul style="list-style-type: none"> <li>● Individual farmers</li> <li>● Land users</li> <li>● Farm extension</li> <li>● Farm advisory services</li> <li>● On-farm advisors</li> </ul>	<ul style="list-style-type: none"> <li>● Ministry of Environment, Agriculture, Nature and Consumer Protection of North Rhine Westphalia</li> <li>● "Contract-based nature protection" department at the State Agency for Nature, Environment and Consumer Protection of North Rhine-Westphalia</li> <li>● Chamber of Agriculture- Team Biodiversity</li> <li>● Biological station for Rhine-Sieg</li> <li>● Lower nature conservation authority of the Rhine-Sieg district</li> </ul>	<ul style="list-style-type: none"> <li>● EU – CAP</li> <li>● Ministry of Environment, Agriculture, Nature and Consumer Protection of North Rhine Westphalia</li> <li>● EU-appointed payment agency</li> <li>● Consulting companies evaluating agricultural subsidies</li> </ul>

(Source: own illustration based on a compilation by Prager 2010)

According to Ostrom, "action arenas include two interdependent elements: an action situation and the participant of that situation... An action situation refers to the social space where participants with diverse preferences interact, exchange goods and services, solve problems, dominate one another, or fight..." (Ostrom, 2009). But, who are the participants of the "contract-based nature protection" action arena? Those participants were identified in the first step of the actors' analysis, and their positions were described (Table 3).

**Table 3.**  
Roles of actors related to contract-based nature protection

Main actor	Role/position	Action situation	Resulting behaviour and actions
Individual farmers/land users	Implementing	Farmers' practices	<ul style="list-style-type: none"> <li>● Implementation/performance of contract-based nature protection</li> </ul>
Biological station	Advising/acquisition	Policy implementation	<ul style="list-style-type: none"> <li>● Active in promotion</li> <li>● Supervision of measures</li> </ul>
Chamber of Agriculture/ farm advisors	Advising/support	Policy implementation	<ul style="list-style-type: none"> <li>● Acquisition and consulting</li> </ul>
Lower nature conservation authority of the Rhine-Sieg district	Grant authorisation	Policy implementation	<ul style="list-style-type: none"> <li>● Granting authority</li> <li>● Administrative partner and control</li> </ul>
"Contract-based nature protection" department at the State Agency for Nature, Environment and Consumer Protection of North Rhine-Westphalia	Subject-specific supervision	Policy design	<ul style="list-style-type: none"> <li>● Technical supervision of contract-based protection</li> <li>● Update of technical standards</li> <li>● Performance review</li> </ul>
Ministry of Environment, Agriculture, Nature and Consumer Protection of North Rhine Westphalia	Programme design	Policy design and implementation	<ul style="list-style-type: none"> <li>● EAFRD programme planning</li> <li>● Programme implementation/funding</li> <li>● Evaluation reports</li> </ul>
EU-appointed payment agency	Monitoring/operational processing of funding measures	Policy design and implementation	<ul style="list-style-type: none"> <li>● On-site inspection</li> <li>● Control of payments transactions</li> <li>● Punishment of rule violations</li> <li>● Delegation arrangements with granting authorities</li> </ul>
EU-CAP	Framework design and formulation	Policy design	<ul style="list-style-type: none"> <li>● Frameworks/finance e.g. EAFRD, direct payments and delegated acts</li> </ul>

(Source: own illustration based on a compilation by Prager 2010)

Actors were classified according to groups of actors representing the organisation to which they belong, the administrative level at which they act and the role they play in policy implementation. Information on the actors' characteristics such as interests, knowledge, capacities, resources and networks was complemented by information on their attitudes and perceptions. Interviews revealed the actors' perceptions, e.g. their perception of contract-based nature protection, and their perception of policy measures in terms of their effectiveness, costs and benefits. Actors' perceptions and values determine their objectives, which will play out in the decision to engage in certain actions and behaviours. This process may, for example, materialise in the form of policies, regulations and their enforcement through governance structures, or result in a farmer adopting contract-based nature protection measures.

### **Regulation of actors' behaviour**

The way in which contract-based nature protection is implemented to make regulations effective influences actors in their actions. The targeted implementation of the EAFRD is one of the measures adopted by North Rhine-Westphalia for the purposes of reversing or at least halting the decline in biodiversity (European Commission, 2005). All funding measures based on this regulation are bundled in the rural development programmes in effect in North Rhine-Westphalia (Ministry of Environment, Agriculture, Nature and Consumer Protection, 2014). The main objective of a number of measures applied in contract-based nature conservation and the agri-environment area is to protect or counteract the loss of biodiversity in agricultural landscapes. As mentioned previously, these programmes are co-financed by the EU.

The given framework guidelines on contract-based nature conservation (Ministry of Environment, Agriculture, Nature and Consumer Protection, 2014) provide farmers and other land users in NRW with information about financial compensation for management within the nature protected areas.

In order to ensure that a uniform approach to contract-based nature protection is taken throughout the country, the "Contract-based nature protection" department at the State Agency for Nature, Environment and Consumer Protection of North Rhine-Westphalia was established to act as a technical supervisor of contract-based nature protection. This department is responsible for driving forward the development of measures that are suitable for achieving the nature conservation goals. Measures are developed in close cooperation between lower nature conservation authorities, biological stations, the Chamber of Agriculture and the payment agency for North Rhine-Westphalia.

*"And they ask: what is needed for further development? How do you envisage it? And we prepare the input and then discuss these [measures] again" ("Contract-based nature protection" department at the State Agency for Nature, Environment and Consumer Protection of North Rhine-Westphalia)*

As mentioned in the introduction of this paper, farmers and land users receive financial compensation (contract-based nature protection). A payment agency for North Rhine-Westphalia at the North Rhine Westphalian Chamber of Agriculture is ultimately responsible for ensuring that every payment transaction is completely correct and fully paid out.

*"We ["Contract-based Nature Protection" department], as the technical supervisor of contract-based nature conservation, are responsible for the more substantive control. Of course, we also make sure that everything is handled correctly, but the focus is actually on handling the measures themselves, i.e. not the formal legal handling, but the handling of the content... For example, we provide nationwide checklists for reviewing applications to determine whether the substantial requirements for funding are met. In principle, however, we are also the contact point for all questions that arise not only during the application phase, but also during the contract processing phase, which stretches over five years..." ("Contract-based nature protection" department at the State Agency for Nature, Environment and Consumer Protection of North Rhine-Westphalia)*

The correctness of payment transactions is supported by on-site inspections carried out by the payment agency for North Rhine-Westphalia.

*"In the case of on-site inspections, we have the special feature that they are usually carried out by two people. One person is from the Chamber of Agriculture, and is responsible for the measuring part, and the second inspector is an employee of the approval authority, who checks the technical side. This means that we have a combined audit performed by the Chamber of Agriculture and the*

*approval authority, meaning that the technical questions and requirements are usually checked by the auditor of the respective approval authority, district, city [e.g. lower nature conservation authority]” (payment agency for North Rhine-Westphalia)*

The lower nature conservation authority as a granting authority has additional funding sources for nature protection measures which differ from those listed in the so-called “management packages”, i.e. the support measures with associated premiums, which are compiled in Annex 1 of the RRL (Ministerium für Klimaschutz, Umwelt, Landwirtschaft, Natur-und Verbraucherschutz NRW 12.01.2017).

*“But, if [farmers] want to manage an area differently, substantially differently, then I have to use a different funding instrument. In that case, it doesn't quite fit [Rural development programmes in NRW] (lower nature conservation authority).*

*“And then there are opportunities to work with a pure federal state subsidy - there are state subsidy guidelines for nature conservation here in North Rhine-Westphalia called FöNa (Umweltministerium NRW 2001). According to this, you can also conclude contractual arrangements. Alternatively, there are other instruments, such as the one we currently apply in the Rhine-Sieg district – a federal funding programme in which we participate as part of the “Chance.Natur” federal funding scheme (Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit, 2021). We have the “Chance 7” project (chance7 2021) here in the Rhine-Sieg district” (lower nature conservation authority).*

The biological station plays the role of mediator between land users, farmers, recreationists and other parties with an interest in nature conservation. Increasing awareness for contract-based nature protection requires a lot of consulting work to be carried out. A particularly important task of the biological stations is to encourage farmers to become advocates for nature conservation. In doing so, the stations arrange state subsidies for the farms, which are an incentive to work the land in a manner that complies with the interests of nature conservation.

The biological station for the Rhine-Sieg district, as well as the lower nature conservation authority and the Chamber of Agriculture provide farmers and land users with information about contract-based nature protection measures.

*“Ever since I started working with the biological station in 2003, we have actually been getting along quite well with each other in terms of demands and the possibilities of implementation. Every now and then there's something you have to discuss ... measures or something along those lines. But it usually works out fine” (farmer in Rhine-Sieg district who participated in a contract-based nature protection programme).*

In some cases, for example due to climate-induced changes to land cover or vegetation, the classification as an area under contract-based nature protection is revoked by the payment agency during an on-site inspection.

*“We also have contract-based nature conservation areas which... have now changed due to the climate history, which.... also, in terms of vegetation, were actually once mapped as grassland and recognised as such by the Chamber of Agriculture until now, this year or last year... And then, for example, what was once classified as grassland has now been transformed because completely different plant communities have spread there. And the grassland is no more. I have lost my entitlement to premiums, for example for grassland direct payments” (farmer in Rhine-Sieg district who participated in a contract-based nature protection programme).*

In such cases, the responsible lower nature conservation authority will find a solution and compensate farmers for their nature protection efforts from their planned budget.

*“The Rhine-Sieg district must now step in and take over the direct payments that are normally paid by the first pillar [EU GAP policy]. And this has now increasingly occurred in several areas” (farmer in Rhine-Sieg district who participated in a contract-based nature protection programme).*

*“I would also like to have more scope of action. Be able to say, you [inspector] set a deadline now, in spring, to cut back a blackberry hedge in the coming growing season. That would be okay, you*

*[farmer] could wait for the vegetation and say, you cut it in winter. Then it works out fine... That kind of thing would make sense in practice. That would be in the sense of nature conservation. But there is no such thing [currently]" (farmer in Rhine-Sieg district who participated in a contract-based nature protection programme).*

## 5 Discussion

The previous sections of this paper revealed important information about the actors' landscape and their roles in contract-based nature protection. This section provides an overview of the challenges, potentials and obstacles of contract-based nature protection in its practical application, as well as policy implementation and design.

Contract-based nature protection faces quite a number of challenges (Thiele, 2020): reduction of administrative burdens e.g. accurate measures of areas is needed, as well as reliability and trust. And yet, contract-based nature conservation is indeed the way forward, even if it is still in its infancy. In this paper, we have examined contract-based nature protection through the lens of the IoS framework and identified sub-arenas and their actors.

In this paper, the main **challenges** facing the "farmers' practices" sub-arena have been identified as the avoidance of repayments or withdrawal of payments despite existing conditionality<sup>3</sup>, both action-based and performance-based, fixed duration of contracts, and conflicts of a variety of interests between practices and implementation. The most relevant **potentials** revealed in the same sub-arena are the fact that contracts give farmers broader scope when it comes to their decisions concerning nature protection, as well as flexibility in the duration of the contracts themselves. From the perspective of the farmer, another potential is to find the best subsidies for his/her areas (economical vs. ecological incentives). There are also a series of major **obstacles** that need to be overcome. The main obstacles identified are inaccuracies in measuring areas, differences in valuing nature (flora and fauna) between farmer and grant authorities, and insecurity for farmers due to changes in CAP and national regulations (e.g. planning insecurity).

In terms of the "policy implementation" sub-arena, we can summarise that the main **challenges** are accuracy of on-site documentation and measurements of areas, consideration of regional conditions as regards measures taken on the ground, and competition between authorities when it comes to responsibilities relating to contract-based nature protection. The major **potentials** are increased availability of free extension/assistance services, audit-specific adjustments, advance notice as regards timing, advance notice at least 14 days in advance and a reduction in regulatory burdens, e.g. measurement tolerance. The main **obstacles** in the "policy implementation" sub-arena were identified as similarity of programmes/competition between programmes (e.g. the Cultural Landscape Programme of the Rhine-Sieg district (KUPRO-RSK) and the North-Rhine Westphalia (NRW) Rural Area Programme (known here as the European Agricultural Fund for Rural Development (EAFRD)), coordination of audit scheduling (e.g. the suggestion of combining audits of contract-based performance with a possible hearing process involving farmers and authorities in the event of contradictions).

When it comes to the "policy design" sub-arena, which sets the direction of contract-based nature protection, the main **challenge** is designing measures that are adjusted to the respective local areas and their practicability. The major **potentials** identified for this sub-arena are appropriateness of regulations in terms of their practicability, easier conditions in the implementation of contract-based nature protection, and enhanced communication concerning the promotion of funding structures and flexible duration of contracts. Last but not least, the main **obstacles** are discrepancies between well-intended and practical implementation, EU subsidy law and subsequent inspections, and uniform processing for all EU countries.

## 6 Conclusions, limitations and outlook

The purpose of this paper is to analyse the institutional settings of contract-based nature protection on the basis of the Institutions of Sustainability (IoS) framework in the German Rhine-Sieg district and to

---

<sup>3</sup> business-like principle' only to be paid if the service is actually delivered — is the most innovative feature of PES vis-à-vis traditional conservation tools (Wunder, 2005)

outline the way in which policy measures should be designed to encourage farmers to participate in contract-based nature protection programmes. The IoS analytical framework was successfully operationalised by breaking down the three specified sub-arenas, representing clear added value for other researchers. Applying the IoS framework enabled us to reflect more deeply on current institutional settings of contract-based nature protection, such as the complexity of the actors involved, their roles and relationships, and their resulting interdependencies. The empirical results obtained largely line up with those from studies conducted on contract-based nature protection in Germany (Güthler et al., 2003; Schumacher, 2012; Thiele, 2020). When it comes to encouraging the design of contract-based nature protection measures, it can be concluded that the practicability and feasibility of designed and offered measures are issues that cannot be underestimated. It can also be concluded that the attitude of farmers towards nature conservation plays an essential role. Moreover, the strategy of integrating nature conservation into farming practice requires not only a willingness to cooperate, but also the ability to put oneself in the shoes of farmers to consider their mindset, values, plans and wishes. The acceptance of measures by farmers also largely depends on the fact that conditions for use are practice-oriented and, to a certain extent, flexible. It is also important that nature conservation services are adequately remunerated to ensure that contract-based nature conservation can develop into an interesting business branch in the long term.

This paper does, however, uncover a number of limitations, for instance, the part of the IoS framework that addresses the reciprocal cause and effect relationship between human actions and natural systems is not covered by this paper and needs further examination. We did not review any general or specific measures (e.g. ground-breeding species such as the lapwing or field hamster, etc.) due to a lack of time. Another shortcoming lies in the fact that informal institutions still operate under the radar.

Future scientific work could be conducted on the following topics: social acceptance of farmers' work towards biodiversity, greater acceptance of contract-based nature protection by farmers due to a shorter duration of contracts ("nature protection for testing"), the scope of communication on monitoring any environmentally-induced changes to vegetation, and the meaningfulness of measures, including in the context of contracts.

## 7 References

- Alons, G. (2017). Environmental policy integration in the EU's common agricultural policy: greening or greenwashing? *Journal of European Public Policy*, **24**(11): 1604–1622. DOI: 10.1080/13501763.2017.1334085.
- Becker, Th. (2016). Landwirtschaft im Regierungsbezirk Köln - Herausforderungen. Chancen. Perspektiven. Available at <https://www.landwirtschaftskammer.de/landwirtschaft/landentwicklung/regionalentwicklung/landwirtschaft-koeln.htm>.
- Bundesministerium für Ernährung und Landwirtschaft (BMEL 2014). Gemeinsame Agrarpolitik (GAP) - Geschichte der Gemeinsamen Agrarpolitik. Available at <https://www.bmel.de/DE/themen/landwirtschaft/eu-agrarpolitik-und-foerderung/gap/gap-geschichte.html>.
- Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit (BMU 2021). chance.natur – Bundesförderung Naturschutz. Available at <https://www.bmu.de/themen/natur-biologische-vielfalt-arten/naturschutz-biologische-vielfalt/foerderprogramme/chancenatur/>.
- Bundestag (2009). Bundesnaturschutzgesetz (BNatSchG).
- chance7 (2021). chance7 - Wir fördern Heimat : Startseite. Available at <https://www.chance7.org/startseite/>.
- Commission of the European Communities (1992). Council Regulation (EEC) No 2078/92/EEC of 30 June 1992. *Official Journal of the European Communities*, **215**: 85-90. Available at <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31992R2078&from=EN>.
- Díaz, S., Settele, J., Brondízio, E., Ngo, H., Guèze, M., and Agard, J. (2019). The global assessment report on biodiversity and ecosystem services: Summary for policy makers: Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. Available at <https://ri.conicet.gov.ar/handle/11336/116171>.
- EC–European Commission (2017): Report from the Commission to the European Parliament and the Council on the implementation of the ecological focus area obligation under the green ... Hg. v. EC.

- European Commission Ed. (2013): CAP Reform—an explanation of the main elements. MEMO/13/937. EC.
- European Commission (2005). European Agricultural Fund for Rural Development (EAFRD). Council Regulation (EC) No 1698/2005. Available at <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex:32005R1698>.
- Gatzweiler, F. (2003). Patterns of institutional change for sustainability in Central and Eastern European Agriculture 16. Available at [https://www.ssoar.info/ssoar/bitstream/document/37597/1/ssoar-2003-gatzweiler-Patterns\\_of\\_institutional\\_change\\_for.pdf](https://www.ssoar.info/ssoar/bitstream/document/37597/1/ssoar-2003-gatzweiler-Patterns_of_institutional_change_for.pdf).
- Güthler, W., Kretzschmar, Ch., and Pasch, D. (2003). Vertragsnaturschutz in Deutschland. Verwaltungs- und Kontrollprobleme sowie mögliche Lösungsansätze. Bonn: BfN Bundesamt für Naturschutz (BfN-Skripten, 86). Available at <http://www.bfn.de/fileadmin/MDB/documents/skript86.pdf>.
- Hagedorn, K. (2008). Particular requirements for institutional analysis in nature-related sectors. *Eur Rev Agric Econ*, **35**(3): 357–384. DOI: 10.1093/erae/jbn019.
- Hagedorn, K., Arzt, K., and Peters, U. (2002a). Institutional arrangements for environmental co-operatives: a conceptual framework. In: Hagedorn, K. (Ed.), *Environmental Co-operation and Institutional Change. Theories and Policies for European Agriculture*: Edward Elgar Publishing: 2–28.
- Hagedorn, K. (Ed. 2002b). *Environmental Co-operation and Institutional Change. Theories and Policies for European Agriculture*: Edward Elgar Publishing.
- Kaiser, J., Haase, D., and Krueger, T. (2021). Payments for ecosystem services: a review of definitions, the role of spatial scales, and critique. *E&S*, **26**(2). DOI: 10.5751/ES-12307-260212.
- Kleijn, D., Kohler, F., Báldi, A., Batáry, P., Concepción, E., and Clough, Y. (2009). On the relationship between farmland biodiversity and land-use intensity in Europe. *Proceedings. Biological sciences*, **276**(1658): 903–909. DOI: 10.1098/rspb.2008.1509.
- Hampicke, U. (2013). *Kulturlandschaft und Naturschutz: Probleme-Konzepte-Ökonomie* Springer Vieweg (Praxis).
- Lade, S., Steffen, W., Vries, W., Carpenter, St., Donges, J., and Gerten, D. (2020). Human impacts on planetary boundaries amplified by Earth system interactions. *Nat Sustain*, **3**(2): 119–128. DOI: 10.1038/s41893-019-0454-4.
- Landesbetrieb IT.NRW (2021). Agricultural farms per size-class of agriculturally used land. Available at <https://www.it.nrw/statistik/eckdaten/landwirtschaftliche-betriebe-nach-groessenklassen-lz-2020-1481>.
- Matthews, A. (2013). Greening agricultural payments in the EU's Common Agricultural Policy. *Bio-based and Applied Economics*, **2**(1): 1–27.
- Matzdorf, B., Meyer, C. (2014). The relevance of the ecosystem services framework for developed countries' environmental policies: A comparative case study of the US and EU. *Land Use Policy*, **38**: 509–521. DOI: 10.1016/j.landusepol.2013.12.011.
- Mayring, Ph. (2020). Qualitative Inhaltsanalyse. In: *Handbuch Qualitative Forschung in der Psychologie*: Springer, Wiesbaden.
- Meyer, C., Reutter, M., Matzdorf, B., Sattler, C., and Schomers, S. (2015). Design rules for successful governmental payments for ecosystem services: Taking agri-environmental measures in Germany as an example. *Journal of environmental management*, **157**: 146–159. DOI: 10.1016/j.jenvman.2015.03.053.
- Ministry of Environment, Agriculture, Nature and Consumer Protection (2014). *NRW-Programm\_Laendlicher\_Raum\_April\_2021*. Available at [https://www.umwelt.nrw.de/fileadmin/-redaktion/PDFs/landwirtschaft/programm\\_laendl\\_raum/NRW-Programm\\_Laendlicher\\_Raum\\_-\\_April\\_2021.pdf](https://www.umwelt.nrw.de/fileadmin/-redaktion/PDFs/landwirtschaft/programm_laendl_raum/NRW-Programm_Laendlicher_Raum_-_April_2021.pdf).
- Ministerium für Klimaschutz, Umwelt, Landwirtschaft, Natur- und Verbraucherschutz NRW (MULNV) (2017). *Richtlinien über die Gewährung von Zuwendungen im Vertragsnaturschutz (Rahmenrichtlinien Vertragsnaturschutz)*.
- Ministerium für Umwelt, Landwirtschaft, Natur- und Verbraucherschutz des Landes Nordrhein-Westfalen (2021). *Umweltministerium NRW: Agrarumweltmaßnahmen*. Hg. v. Das Ministerium für Umwelt, Landwirtschaft, Natur- und Verbraucherschutz des Landes Nordrhein-Westfalen.



- Ostrom, E. (2009). *Understanding Institutional Diversity*. Princeton: Princeton University Press.
- Pe'er, G., Zinngrebe, Y., Hauck, J., Schindler, S., Dittrich, A., and Zingg, S. (2017). Adding Some Green to the Greening: Improving the EU's Ecological Focus Areas for Biodiversity and Farmers. *Conservation Letters*, **10**(5): 517–530. DOI: 10.1111/conl.12333.
- Penov, I., Theesfeld, I., and Gatzweiler, F. (2003). *Irrigation and Water Regulation Systems in Transition: The Case of Bulgaria in Comparison with Latvia, East Germany and Romania*. Available at <https://ageconsearch.umn.edu/record/18900/files/fa030003.pdf>.
- Potts, S., Imperatriz-Fonseca, V., Ngo, H., Aizen, M., Biesmeijer, J., and Breeze, Th. (2016). Safeguarding pollinators and their values to human well-being. *Nature*, **540**(7632): 220–229. DOI: 10.1038/nature20588.
- Prager, K. (2010). Applying the institutions of sustainability framework to the case of agricultural soil conservation. *Env. Pol. Gov.*, **20**(4): 223–238. DOI: 10.1002/eet.548.
- Rhein-Sieg-Kreis (2014). *Richtlinien für das Kulturlandschaftsprogramm des Rhein-Sieg-Kreises (KuPro-RSK)*. Available at [https://www.rhein-sieg-kreis.de/vv/ressourcen/medien/downloads/Amt\\_66\\_-\\_Amt\\_fuer\\_-\\_Umwelt-\\_und\\_Naturschutz/21\\_03\\_22\\_KuPro-Richtlinie-RSK-2020\\_Aend\\_Rechtsverweis\\_final.pdf](https://www.rhein-sieg-kreis.de/vv/ressourcen/medien/downloads/Amt_66_-_Amt_fuer_-_Umwelt-_und_Naturschutz/21_03_22_KuPro-Richtlinie-RSK-2020_Aend_Rechtsverweis_final.pdf).
- Rhein-Sieg-Kreis (2018). *Zahlen und Fakten auf einen Blick*. Available at [https://www.rhein-sieg-kreis.de/vv/ressourcen/medien/downloads/01/Zahlen\\_und\\_Fakten2018\\_pdf](https://www.rhein-sieg-kreis.de/vv/ressourcen/medien/downloads/01/Zahlen_und_Fakten2018_pdf).
- Rhein-Sieg-Kreis (2021). *Kreisangehörige Städte und Gemeinden*. Available at <https://www.rhein-sieg-kreis.de/micosites/integrationsportal/ansprechpersonen/staedte-und-gemeinden.php>.
- Rockstrom, J., Steffen, W., Noone, K., Persson, A., Chapin, F., and Lambin, E. (2009a). Planetary boundaries: exploring the safe operating space for humanity. *Ecology and Society*, **14**: 1–33. Available at <https://researchonline.jcu.edu.au/11008/>.
- Rockstrom, J., Steffen, W., Noone, K., Persson, A., Chapin, F., and Lambin, E. (2009b). A safe operating space for humanity. *Nature*, **461**(7263): 472–475. DOI: 10.1038/461472a.
- Salzman, J., Bennett, G., Carroll, N., Goldstein, A., and Jenkins, M. (2018). The global status and trends of Payments for Ecosystem Services. *Nat Sustain*, **1**(3): 136–144. DOI: 10.1038/s41893-018-0033-0.
- Sattler, C., Matzdorf, B. (2013). PES in a nutshell: From definitions and origins to PES in practice—Approaches, design process and innovative aspects. *Ecosystem Services*, **6**: 2–11. DOI: 10.1016/j.ecoser.2013.09.009.
- Schleyer, Ch. (2004). Economic and ecological transformation processes in East German water management regimes: the role of property rights and governance structures. *Environmental Management*, **34**(2): 281–290. DOI: 10.1007/s00267-003-3009-3.
- Schumacher, W. (2012). *Entwicklung, Erfolge und Perspektiven des Vertragsnaturschutzes in Nordrhein-Westfalen*. Available at [https://www.researchgate.net/profile/wolfgang\\_schumacher\\_prof\\_dr/-publication/292286839\\_schumacher\\_w\\_2012\\_entwicklung\\_erfolge\\_und\\_perspektiven\\_des\\_vertragsnaturschutzes\\_w\\_in\\_nordrhein-westfalen\\_in\\_nua-seminarbericht\\_band\\_10\\_hrsg\\_natur-\\_und\\_umweltschutzakademie\\_nrw\\_issn\\_1436-0284/links/56ac8d1708aeaa696f2c6b5d/schumacher-w-2012-entwicklung-erfolge-und-perspektiven-des-vertragsnaturschutzes-w-in-nordrhein-westfalen-in-nua-seminarbericht-band-10-hrsg-natur-und-umweltschutzakademie-nrw-issn-1436-0284.pdf](https://www.researchgate.net/profile/wolfgang_schumacher_prof_dr/-publication/292286839_schumacher_w_2012_entwicklung_erfolge_und_perspektiven_des_vertragsnaturschutzes_w_in_nordrhein-westfalen_in_nua-seminarbericht_band_10_hrsg_natur-_und_umweltschutzakademie_nrw_issn_1436-0284/links/56ac8d1708aeaa696f2c6b5d/schumacher-w-2012-entwicklung-erfolge-und-perspektiven-des-vertragsnaturschutzes-w-in-nordrhein-westfalen-in-nua-seminarbericht-band-10-hrsg-natur-und-umweltschutzakademie-nrw-issn-1436-0284.pdf).
- Sikor, Th. (2004). The commons in transition: agrarian and environmental change in Central and Eastern Europe. *Environmental Management*, **34**(2): 270–280. DOI: 10.1007/s00267-003-3007-5.
- Statista (2021). *Rhein-Sieg-Kreis - Einwohnerzahl bis 2019*, Statista. Available at <https://de.statista.com/-statistik/daten/studie/1133345/umfrage/entwicklung-der-gesamtbevoelkerung-im-rhein-sieg-kreis/>.
- Steffen, W., Richardson, K., Rockström, J., Cornell, S., Fetzer, I., Bennett, and Elena M. (2015). Sustainability. Planetary boundaries: guiding human development on a changing planet. *Science*, **347**(6223): 1259855. DOI: 10.1126/science.1259855.
- Tacconi, L. (2012). Redefining payments for environmental services. *Ecological Economics*, **73**: 29–36. DOI: 10.1016/j.ecolecon.2011.09.028.

- Theesfeld, I. (2005). A common-pool resource in transition. Available at [https://www.researchgate.net/profile/insa\\_theesfeld/publication/35415915\\_a\\_common\\_pool\\_resource\\_in\\_transition\\_determinants\\_of\\_institutional\\_change\\_for\\_bulgaria's\\_post-socialist\\_irrigation\\_sector/links/57593b7608aec91374a1cfd4/a-common-pool-resource-in-transition-determinants-of-institutional-change-for-bulgarias-post-socialist-irrigation-sector.pdf](https://www.researchgate.net/profile/insa_theesfeld/publication/35415915_a_common_pool_resource_in_transition_determinants_of_institutional_change_for_bulgaria's_post-socialist_irrigation_sector/links/57593b7608aec91374a1cfd4/a-common-pool-resource-in-transition-determinants-of-institutional-change-for-bulgarias-post-socialist-irrigation-sector.pdf).
- Thiele, U. (2020). Vertragsnaturschutz in NRW: Bilanz und Herausforderungen. *Natur in NRW 2020*, (4): 19–23. Available at [https://www.lanuv.nrw.de/fileadmin/lanuvpubl/5\\_natur\\_in\\_nrw/naturinnrw-04-2020.pdf](https://www.lanuv.nrw.de/fileadmin/lanuvpubl/5_natur_in_nrw/naturinnrw-04-2020.pdf)
- Umweltministerium NRW (2001). Förderrichtlinie Naturschutz (FöNa). Available at <https://www.umwelt.nrw.de/naturschutz/natur/foerderprogramme/foerderrichtlinie-naturschutz-foena>.
- v.d. Decken, H., Jessel, B., Krug, A., Schuster, B., and Stratmann, U. (2017). BfN Agrar-Report. Biologische Vielfalt in der Agrarlandschaft. Hg. v. BfN. Available at [https://www.bfn.de/fileadmin/BfN/landwirtschaft/-Dokumente/BfN-Agrar-Report\\_2017.pdf](https://www.bfn.de/fileadmin/BfN/landwirtschaft/-Dokumente/BfN-Agrar-Report_2017.pdf).
- Werking-Radtke, J., König, H. (2011). Wirkung von Vertragsnaturschutz-und Agrarumweltmaßnahmen. *Natur in NRW 2011* (3): 28–32. Available at [http://vns.naturschutzinformationen.nrw.de/vns/web/-babel/media/nin\\_3-2011\\_28-32\\_evaluation.pdf](http://vns.naturschutzinformationen.nrw.de/vns/web/-babel/media/nin_3-2011_28-32_evaluation.pdf).
- Werking-Radtke, J., König, H. (2015): Wirkungen von Agrarumwelt-und Vertragsnaturschutzmaßnahmen. *Natur in NRW* (2): 30–35. Available at [https://www.lanuv.nrw.de/fileadmin/lanuvpubl/-5\\_natur\\_in\\_nrw/50034\\_natur\\_in\\_nrw\\_2\\_2015.pdf#page=30](https://www.lanuv.nrw.de/fileadmin/lanuvpubl/-5_natur_in_nrw/50034_natur_in_nrw_2_2015.pdf#page=30).