Institutional aspects of governmental payments for ecosystem services:

Insights from EU and US environmental and agri-environmental policies

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Thanks to Kathrin, my parents Elisabeth and Kurt-Henning, my sister Hilke, and my friends for all their great support!

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Preface & Acknowledgements

When I started my dissertation project, I already was a fully trained German lawyer who had experienced different aspects of the legal profession. After working for the German Federal Environmental Agency, I decided to expand and internationalize my skills and knowledge beyond law by enrolling in an English language master's program in Integrated Natural Resource Management in the Department of Agricultural Economics and Social Sciences, Faculty for Agriculture and Horticulture, Humboldt-Universität zu Berlin. Encouraged by my master's thesis in the field of resource and institutional economics and by the pleasure I took in the topic as well as in the scientific work itself, I took a further step toward a scientific career and chose to write an interdisciplinary doctoral thesis. As this turned out to be my second career path, it was important for me not only to conduct my own research but also to be included in a lively scientific environment with opportunities for exchange and to experience all further different facets of the scientific profession. On this basis, I joined the recently started CIVILand junior research group funded by the Federal Ministry for Education and Research (BMBF) through the Social-ecological Research (SÖF) program, which was based at the Leibniz-Centre for Agricultural Landscape Research (ZALF).

The CIVILand research group generally focused on the diversity of Payments for Ecosystem Services (PES) in Germany, Great Britain, and the United States of America (US) as well as on the roles of the different actors involved, with a special emphasis on civil society. Because my master's thesis essentially addressed the implementation of ecosystem-based EU environmental regulations in Germany, I thereby realized the actual major impact of governmental financial incentives for the governance of ecosystems and understood that building upon this to focus my research on governmental financial incentives, which have been increasingly discussed internationally under the term PES, was a next plausible step. Furthermore, due to the knowledge that I gained from my master's in terms of the influences of informal rules and mental models on environmental governance, which are strongly dependent on the cultural context, I considered the possibility of conducting a multi-country comparison through the CIVILand research group a very valuable starting point for my research.

The research group was composed of seven to eleven team members trained in almost as many disciplines who worked on various thematic subprojects in a collaborative structure. My focus on governmental PES flanked the

other subprojects, which were rather targeted to civil society initiatives and impacts. Various general aspects of the core topic of PES have been collaboratively examined from different perspectives. All in all, the group provided an interdisciplinary, innovative, flexible, inspiring, and adaptive research environment that enabled me, on the one hand, to consider my research objectives in a contemporary manner through a cumulative dissertation by collaborating with different colleagues on various sub-questions and, on the other hand, to always maintain the right combination of profound theoretical thought and practical relevance. Furthermore, the research group's considerable funding facilitated the presentation of the results at several international and self-organized conferences as well as at external workshops, which allowed for manifold external input, networking, and scientific self-positioning.

Finally, my affiliation with the Leibniz-Centre for Agricultural Landscape Research (ZALF) enabled me to gain various experiences in the scientific profession itself. In particular, the development of and the participation in new research projects within the scope of my research interests fruitfully broadened the perspective of my dissertation project and this work substantially contributed to satisfactory understanding and management of my research objectives. Furthermore, the ZALF supported my participation in different advanced trainings on the topic as well as a visiting scholarship at New York University to obtain further content input and conclude certain aspects of my thesis. At the end of my dissertation project, I would like to state that the positive experience of working on my doctoral thesis within both the CIVILand research group and the ZALF has encouraged me to follow the scientific career path.

Herewith, I would like to thank to my supervisors and referees. First of all, I am extremely grateful to Prof. Dr. Bettina Matzdorf, who introduced different aspects of the scientific career to me, offered me various opportunies to participate in diverse projects, gave me a lot of freedom to follow my ideas, and always supported me with good advice and constructive criticism. Second, I am indepted to Prof. Dr. Klaus Müller, who gave me the scientific and financial support of the ZALF to finish this dissertation. Third, I thank Prof. Dr. Stefanie Engel for her willingness to co-supervise my dissertation, the fast evaluation process, and her supportive and constructive input. And finally, I am grateful to Dr. Christian Schleyer, Dr. Carsten Mann, Dr. Lasse Loft, and Dr. Jens Rommel for a supportive and inspiring defense.

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The generous funding for my doctoral studies came mainly from the Federal Ministry for Education and Research (BMBF) through the Social-ecological Research (SÖF) program (grant no. 01UU0911). I received additional funding from the Testing and Development Project (grant no. 3510 88 0300) granted by the Federal Agency for Nature Conservation (BfN), and institutional funding from the Leibniz-Centre for Agricultural Landscape Research (ZALF) e.V.

Summary

The central focus of my thesis is the identification and analysis of institutional aspects of governmental Payments for Ecosystem Services (PES) in developed countries. In recent years, PES have been progressively acknowledged as useful governance solutions for resource management, and researchers as well as practitioners have been increasingly engaged in this approach. In the public policy context, on the one hand, PES is based on the academic ecosystem service (ES) concept that has entered the policy arena, while, on the other hand, some previously designed governmental policy measures, such as agri-environmental schemes, influence the developing definition of PES. These juxtaposed tendencies are not independent from each other. On the contrary, both tendencies are part of a continuous process of defining and specifying PES. Correspondingly, my analysis is twofold. In the first part, I analyzed the design and performance of existing governmental environmental payment schemes that are increasingly defined as PES even if they are not focused on clearly defined ES. In my dissertation, I also applied a broad definition of PES that includes such existing agri-environmental payment schemes. In the second part, I examined the influence of the ES concept on the framing and design of as well as the environmental governance through such payments schemes. Based on institutional economics ideas, I broadly structured my two general research objectives in terms of institutional design, performance, and interplay.

Five individual research papers shed light on the issues raised above. Regarding existing incentives, *the first paper* explores relevant design principles of German governmental agri-environmental payments to meet environmental goals. *The second paper* shows how German and US governmental payments interact with the institutional arrangements in place. In terms of the ES concept, *the third paper* depicts the design principles of an ES-based policy, shows where to find them among existing EU and US agri-environmental and environmental policies, demonstrates possible influences on preferences and values, and points to interactions of ES with environmental policies, especially PES. The two further publications provide a broader empirical basis for these more specific analyses: *The fourth paper* classifies German and US PES in general, and *the fifth paper* examines agri-environmental payment integration into environmental policy and cross-sectoral interplay in Germany. Each paper mainly addresses one of the objectives, but together, these papers deliver important contributions to both objectives.

My key findings indicate certain design rule sets that can be crucial for environmentally effective governmental PES. Here, a combination of targeting one specific environmental goal and area/habitat, feasibility of application for land users, and information and advice are especially important. In addition to such specifically targeted schemes, the multi-targeted whole farm approach organic farming, a payment scheme that concurrently targets different environmental goals and all farm areas also implies environmental effectiveness. I argue that mixes of both special single goal/area targeting and broader multi-targeting PES seem promising to enable extensive ES provision. Payments for Ecosystem Services interact with the institutional arrangements in place, especially property rights. The payments may be used to foster compliance with regulations or to induce changes in informal or formal rules. Potential crowding-in and crowding-out effects are outlined, for example, changes in rule acceptance or in assumptions about use rights. Furthermore, governmental agri-environmental payment schemes can help to ensure the fulfillment of overall national environmental goals and may interact vertically and horizontally with other policies. Therefore, cross-sectoral and cross-level cooperation as well as vertical integration are required and new institutions may emerge. Finally, payments may combine environmental and social goals. When used to reduce inconsistencies and/or generate justification, such payments are often poorly targeted, and the resulting ES provision is strongly affected by other factors, such as price fluctuations in commodity markets or other policies fostering actions.

Regarding the ES concept, I revealed that, so far, design principles for ES-driven policies have hardly been included in existing EU and US environmental policies but that their integration is proceeding. The ES concept has a large influence on actors' perceptions, preferences, and values. It can improve ecosystem-related resource understanding and considering different ES based on win–win scenarios and trade-offs of different decisions and actions. Implementing ES in environmental and agri-environmental policies will, on the one hand, require broad cross-sectoral and cross-level cooperation but, on the other hand, will facilitate the latter. The greatest future influence on policy design is predicted regarding climate and agricultural policies, especially on existing payment schemes (already in a broad PES definition). The ES concept is increasingly assumed to merge with existing governmental agri-environmental payment schemes, placing ES at the center to explain and legitimize financial support for agricultural sector. I assume that ES-based agri-

environmental payment schemes could especially foster targeting of and collaborating between the environmental and agricultural sectors.

Finally, I assume that governmental PES are essential elements of a contemporary developed country's environmental policy mix. Effective targeting and integration of governmental PES are important, for example, in the alignment of agri-environmental payment implementation and EU water policy. The decision of when to use input- or output-based payments shall be carefully considered. Further knowledge on the integration of a mix of different PES into environmental and agricultural policies is required. Moreover, to create and achieve a sound mix of PES with environmental regulations and income (social) support policies, the property rights situation, the reference point for application of the 'provider-gets' and 'beneficiary-pays' principles, and any deviations therefrom should be made transparent. For sound PES integration, different actors must collaborate on basis of common denominators, which may be based on the ES concept. Correspondingly, I discuss the potential of ES to enhance communication among actors and provide new impulses for cross-sectoral and cross-level cooperation in existing governmental payments scheme (defined as PES) implementation. I further argue that regarding governmental payments, systematic ES definition and quantification may offer the opportunity to enhance targeting, even if this is a very complex procedure. Economic valuation and monetarization of ES, in turn, are not necessary for PES, and the application of such methods must be carefully considered. Yet, these methods potential usefulness, i.e., producing meaningful results in particular situations, should not be neglected.

Zusammenfassung

Meine Doktorarbeit untersucht institutionelle Aspekte von staatlichen Payments for Ecosystem Services (PES, deutsch: positive Anreizinstrumente in Form von Zahlungen für Ökosystemleistungen) in Industrieländern. In den vergangenen Jahren wurde der Nutzen von PES als Umweltsteuerungsinstrument vermehrt hervorgehoben und eine steigende Anzahl Wissenschaftler und Praktiker befassen sich zunehmend mit einer Weiterentwicklung und Umsetzung von PES. Dabei werden zum einen existierende Umweltpolitiken und -gesetzgebungen von einem wissenschaftlichen Ecosystem Services (ES) Konzept (Ökosystemleistungskonzept) geprägt. Andererseits beeinflussen gleichzeitig die bestehenden staatlichen finanziellen Anreizinstrumente wie Agrarumweltmaßnahmen ihrerseits die Weiterentwicklung des PES-Verständnisses. Beide Tendenzen sind nicht unabhängig voneinander, sondern Teil eines kontinuierlichen Definitions- und Spezifizierungsprozesses. Dementsprechend ist meine Analyse zweiteilig. Im ersten Teil untersuche ich das Design und die Performance von bestehenden staatlichen finanziellen Anreizinstrumenten, welche vermehrt als PES verstanden werden, auch wenn sie keine klar definierten ES bereitstellen. Dabei greife ich für meine Arbeit auch auf eine weite Definition von PES zurück, die unter anderem Agrarumweltmaßnahmen umfasst. Im zweiten Teil der Analyse untersuche ich die Relevanz des ES Konzeptes für die Ausgestaltung von bestehenden Zahlungsmechanismen und deren Wirkung. Diese beiden generellen Forschungsfragen werden vor dem Hintergrund institutionenökonomischer Ideen hinsichtlich institutionellem Design, institutioneller Performance und institutionellem Interplay strukturiert und konkretisiert.

Die im Rahmen der Forschung gewonnenen Erkenntnisse werden in fünf individuellen Veröffentlichungen dargestellt. Das *erste Paper* fokussiert auf existierende PES und beleuchtet die relevanten Gestaltungprinzipien deutscher Agarumweltmaßnahmen für die Erreichung von Umweltzielen. Das *zweite Paper* zeigt, wie staatliche agrar- bzw. agrarumweltpoltitische Zahlungen in Deutschland und den USA mit bestehenden institutionellen Strukturen interagieren. Hinsichtlich der Ausgestaltung des ES Konzeptes hebt das *dritte Paper* Prinzipien einer auf dem ES Konzept basierenden Politik hervor und beschreibt, wo diese in EU und US Umwelt- und Agrarumweltpolitiken zu finden sind. Hierbei werden mögliche Einflüsse auf Präferenzen und Werte der Akteure sowie Wechselwirkungen mit bestehender Umwelt- und Agrar-

umweltpolitik, insbesondere mit Zahlungsmechanismen, aufgezeigt. Zwei weitere Paper definieren den Kontext für diese konkreteren Analysen: Das *vierte Paper* klassifiziert die allgemeinen Grundlagen deutscher und US-amerikanischer PES, während das *fünfte Paper* darstellt, wie Agarumwelt-maßnahmen sektorübergreifend in die ökosystembezogene Umweltsteuerung integriert werden müssen. Die Inhalte der einzelnen Publikationen tragen in erster Linie zu einem der beiden Forschungsziele (die Untersuchung bestehender Instrumente sowie des Einflusses des ES-Konzeptes) bei, während sie in der Gesamtschau einen umfassenden Beitrag zu beiden Zielen liefern.

Die Hauptergebnisse meiner Arbeit sind die Ableitung und Darstellung bestimmter Gestaltungsregeln, die entscheidend für die effektive Gestaltung staatlicher PES sein können. Es zeigt sich, dass eine Kombination aus Zielgerichtetheit (ein Umweltziel, bestimmte Fläche oder Habitate), Flexibilität in der Anwendung für den Landnutzer und Informationen und Beratung für den Erfolg von PES wichtig sind. Neben solch spezifisch zielgerichteten Maßnahmen verspricht auch der auf verschiedene Umweltziele ausgerichtete, den ganzen landwirtschaftlichen Betrieb mit einbeziehende Ansatz des ökologischen Landbaus effektive Wirkungen. Darauf aufbauend wird diskutiert ob eine optimalere Versorgung mit nachgefragten ES durch gut abgestimmte Instrumentenmixe aus spezifisch auf ein Ziel gerichteten PES und breiteren, verschiedene Ziele erfassenden Maßnahmen gewährleistet werden kann. Payments for Ecosystem Services interagieren mit bestehenden institutionellen Strukturen, insbesondere mit Eigentumsrechten. Sie könnten dafür genutzt werden, die Einhaltung bestimmter Gesetzgebung zu fördern oder Veränderungen informeller und formeller Regeln einzuleiten. Diesbezüglich werden potentielle ‚Crowding-in' und ‚Crowding-out' Effekte beschrieben, wie z.B. eine veränderte Akzeptanz von Regeln oder eine veränderte Annahme über eigene Nutzungsrechte an Ressourcen. Ferner können staatliche PES (insbesondere Agrarumweltmaßnahmen) dabei helfen, grundsätzliche nationale Umweltpolitikziele zu erfüllen, und interagieren dabei vertikal und horizontal mit verschiedenen anderen Umweltpolitiken. Dafür sind insbesondere sektor- und ebenenübergreifende Kooperationen sowie eine vertikale Integration wichtig und es können neue Institutionen entstehen. Schließlich können durch Zahlungen Umweltziele und soziale Ziele kombiniert werden, um instrumentelle Inkonsistenzen zu reduzieren oder Rechtfertigungen zu generieren. Solche Zahlungen sind oft nicht zielgerichtet und die Bereitstellung von Ökosystemleistungen ist stark von anderen Einflü-

ssen abhängig, wie Preisveränderungen an Rohstoffmärkten oder anderen Politiken.

Hinsichtlich des ES-Konzeptes legt die Arbeit dar, dass das ES-Konzept bisher nicht vollständig in den Umwelt und Agrarumweltpolitiken der EU, der nationalen Mitgliedstaaten und der USA integriert wurde, eine Integration aber fortschreitet. Dem ES-Konzept wird ein großer Einfluss auf die Wahrnehmung, Präferenzen und Werte der Akteure zugesprochen, welcher zu einem ökosystembezogeneren Ressourcenverständnis führen kann, bei dem verschiedene Win-win-Situationen und Trade-offs betrachtet werden. Die Implementierung des Konzeptes wird auf der einen Seite große sektor- und ebenenübergreifende Kooperationen erfordern. Auf der anderen Seite kann das ES-Konzept solche Kooperationen auch erleichtern. Der größte zukünftige Einfluss wird für die Klima- und Agrarpolitik vorausgesagt, insbesondere für schon bestehende Zahlungsmechanismen. Dabei wird angenommen, dass das ES-Konzept verstärkt in die schon bestehenden Zahlungssysteme der Agarumweltmaßnahmen integriert wird (Diese sind schon Teil einer breiten PES Definition). Das ES-Konzept kann dabei genutzt werden, um Zahlungen für den landwirtschaftlichen Sektor zu erklären und zu legitimieren. Es wird ferner diskutiert, inwieweit auf dem ES-Konzept basierende Agrarumweltmaßnahmen zielgerichteter gestaltet werden können und eine Zusammenarbeit zwischen Umweltsektor und landwirtschaftlichem Sektor verbessert werden kann.

Zusammenfassend lässt sich sagen, dass staatliche PES unerlässliche Elemente in einem gegenwärtigen umweltpolitischen Instrumentenmix in Industriestaaten sind. Hierbei sind insbesondere Zielgerichtetheit und Integration der PES wichtig. So zum Beispiel die Abstimmung der EU Agrarumweltmaßnahmen mit der EU Wasserpolitik. Die Entscheidung, ob bestimmte Zahlungen für die Umsetzung einer Maßnahme oder ergebnisorientiert für die Leistung erbracht werden soll, muss sorgsam unter Abwägung der Gesamtumstände getroffen werden. Ein großer Forschungsbedarf besteht hinsichtlich der Verknüpfung von unterschiedlichen Instrumenten (Instrumentenmix), sowohl von PES-Instrumenten miteinander als auch mit anderen Steuerungsinstrumenten der Umwelt- und Agrarumweltpolitik. Für einen funktionierenden Instrumentenmix von PES mit Regularien sowie von PES mit Einkommensunterstützung (Sozialpolitik), müssen die jeweiligen Eigentumsrechtsituationen, der Referenzpunkt für die Anwendung der ‚Provider-gets' und 'Beneficiary-pays' Prinzipien und alle

Abweichungen von einer Anwendung dieser Prinzipien transparent gemacht werden. Auch müssen für eine funktionierende PES-Integration verschiedene Akteure auf einer gemeinsamen Basis zusammenarbeiten. Diese gemeinsame Basis könnte das ES-Konzept sein. Demgemäß wird diskutiert, welches Potential das ES-Konzept dafür hat, die Kommunikation zwischen den verschiedenen Akteuren zu verbessern und neue Impulse für sektor- und ebenenübergreifende Kooperation zu geben, die zu einer Integration bestehender staatlicher PES (insbesondere Agarumweltmaßnahmen) führen kann. Schließlich wird argumentiert, dass eine systematische ES Untersuchung und Quantifizierung bessere Möglichkeiten für die Zieldefinition und das Monitoring bieten könnte. Eine ökonomische Bewertung und Monetarisierung von ES ist dagegen nicht notwendig und die Anwendung dieser Ansätze sollte sorgfältig geprüft werden. Das Potential solcher Methoden, in bestimmten Situationen hilfreiche Lösungsansätze zu bieten, sollte aber auch nicht vollständig vernachlässigt werden.

List of Publications

The following five research papers represent the basis of this cumulative dissertation. They are referred to throughout the text as **Papers 1** to **5**. At the time of the thesis' submission, all papers have been published.

Paper 1

Meyer, C., Reutter, M., Matzdorf, B., Sattler, C., 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. (2013 Impact Factor: 3.188; 5yr impact Factor: 3.850)

Short summary: *We conducted a comparative analysis of agri-environmental measures' (AEMs) institutional arrangements by examining 49 German cases. We analyzed the effects of rule combinations on the success of AEMs. The different rules were evaluated in regard to their necessity and sufficiency for success using Qualitative Comparative Analysis (QCA). Our results show that combinations of certain design rules, such as environmental goal targeting and area targeting, conditioned the success of the AEMs. Hence, we generalize design principles for AEMs and discuss implications of the general advancement of ecosystem services and the PES approach in agri-environmental policies.*

Paper 2

Meyer, C., Matzdorf, B., Müller, K. & Schleyer, C. (2014).

Cross Compliance as payment for public goods? Understanding EU and US agricultural policies.

Ecological Economics 107, 185-194. (2013 Impact Factor: 2.517; 5yr impact Factor: 4.002)

Short summary: *We employed institutional economics theory to analyze Cross Compliance (CC) in the EU and US. We determined whether the instrument may be understood as payment for public ecosystem services; we also analyzed the implications for enforcement and performance and the effects on actors' values and interests. We found EU CC, as payments for public ES do not generally align with the existing German property rights distribution and may cause changes in values*

and institutions. In both the EU and US, CC implementing standards above regulatory law has characteristics of a payment for ES but creates severe problems due to its mixed policy character.

Paper 3

Matzdorf, B., Meyer, C., *equal contribution* (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. (2013 Impact Factor: 3.134; 5yr impact Factor: 3.314)

Short summary: To answer the question of whether the ES framework has the capacity to cause institutional change in environmental policy, we developed certain criteria for an "ideal" ES-driven policy. Based on these criteria, we analyzed the main water and biodiversity laws, current policy developments, and future trends within the US and the EU. Our analysis shows that most acts cannot be explicitly characterized as ES-driven policies, but parts of the concept are already included. The ES framework, increasingly a driver in several policy fields, can be assumed to be a major future influence of existing environmental policies in the coming decades.

Paper 4

Sattler, C., Trampnau, S., Schomers, S., Meyer, C., Matzdorf, B. (2013).

Multi-classification of payments for ecosystem services: How do classification characteristics relate to overall PES success?

Ecosystem Services 6, 31–45. (2013 Source Normalized Impact per Paper (SNIP): 1.521)

Short summary: We introduce a system for the multi-classification of PES schemes. The classification is based on different PES characteristics and their specifications. Analyzed characteristics include, among others, PES type, ecosystem service paid for, payments specifics, actors involved, duration, and spatial scale. The classification system is applied to 22 PES cases from Germany and the US that were assessed as successful by experts. A comparative analysis is used to investigate how certain characteristics relate to PES success.

Paper 5

Meyer, C., Thiel, A. (2012).

Institutional change in water management collaboration: implementing the European Water Framework Directive in the German Odra river basin.

Water Policy 14 , 625-646. (2013 Impact Factor: 0.867; 5yr impact Factor: 0.904)

Short summary: This paper investigates changes in water management collaboration in a German federal state. Based on qualitative methods, it presents a case study of nutrient pollution governance. We examined the most relevant actors in this management problem: public administrations, agricultural sector, and environmental non-governmental organizations. To capture institutional change, a conceptual framework was constructed to evaluate changes in collaboration. We explain institutional change as a product of multiple dynamics, including shared mental models and acost-benefit calculation that takes transaction costs into consideration.

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List of Abbreviations

AEM	Agri-environmental measures
CAP	Common Agricultural Policy
CC	Cross Compliance
EU	European Union
ES	Ecosystem Services
ICDPs	Integrated Conservation and Development Projects
IPCC	Intergovernmental Panel on Climate Change
MA	Millennium Ecosystem Services Assessment
NGOs	Non-governmental organizations
PES	Payments for Ecosystem Services
PSA	Payments for Environmental Services (Costa Rica)
PSAH	Payments for Hydrological Environmental Services (Mexico)
SLCP	Sloping Land Conversion Program
US	United States of America
USDA	United Stated Department of Agriculture
TEEB	The Economics of Ecosystems and Biodiversity
WFD	Water Framework Directive

1 Introduction

Humankind depends on ecosystems. Interrelations among ourselves and ecosystems are governed through institutions in the form of rules and conventions (Vatn, 2010, 2005).[1] Thus, the governance of ecosystems involves the formation of institutional structures based on social priorities about natural resource use and coordination (Vatn, 2005).[2] In turn, the state of ecosystems always depends on the developed institutional structures (Prager, 2010). As ecosystem goods are often common or public goods, governments[3] strongly influence the institutional structures of ecosystem governance (Matzdorf et al., 2013). However, the existing institutional structures for ecosystem governance are frequently unable to address ecosystem interdependencies in terms of trade-offs and synergies between environmental goals. Furthermore, fundamental coordination problems with private ownership interests and corresponding externality issues have been recognized (Vatn, 2010).

1.1 Research background

In recent years, there have been several attempts to enhance the focus of environmental governance on ecosystem interdependencies – in science as well as in practical environmental governance. Several scientific concepts and political initiatives that aim at a more comprehensive management of natural resources have appeared (Moss, 2012; Folke, 2006; Young, 2002). One approach, arising from ecological science, taken up by economics, and finding its way into the policy arena, is the Ecosystem Services (ES) concept (Gómez-Baggethun et al., 2010). Encompassing different ideas, the ES concept is discussed as a breakthrough approach to enhance the view on ecosystems, the

[1] Thereby, I do not simply see institutions as constraints on individual interaction but as influencing the individual as well as the individual's values and preferences (cf. Vatn, 2005, 2011).

[2] Governance is about the establishment and change of institutional structures for the organization of natural resource use, taking into account social priorities, conflict resolution, and human coordination (Vatn, 2010; Paavola, 2007; Bromley, 1991).

[3] I take a broad understanding of government, including legislative, executive, and judicial authority at all governmental levels as well as the supranational European Union, which exercises transferred national executive powers. Therefore, the EU may only take action if the nation-state EU members cannot achieve certain measures at the member-state level (Article 5, Treaty on European Union, see also Paper 3: p. 512).

environment, and environmental governance. Generally, the ES concept seeks to explain the importance of ecosystems to humans in terms of provisioning human needs and demands, and the corresponding effects of human activity on ecosystems and their provisioning function (Braat and de Groot, 2012). Thus, ES may be understood as an explanatory concept. Ecosystem Services have been broadly defined as benefits that people obtain from ecosystems in the Millennium Ecosystem Assessment (MA, 2005)[4], including provisioning, regulating, cultural, and supporting services.[5] Combined with the general ideas shaping our economic system, the ES concept, which supports a rather anthropocentric and utilitarian understanding, led to the scientific idea of Payments for Ecosystem Services (PES), which is acknowledged as an innovative and useful governance solution to resource coordination problems. Payments for Ecosystem Services have been defined as a voluntary transaction wherein a well-defined ecosystem service is bought by a buyer from a service provider if he/she can secure its provision (Wunder et al., 2008). This development paralleled the recent tendency in environmental governance to prefer economic incentive-based instruments.[6]

To solve coordination problems with ownership interests, governments increasingly rely on paying land users to change their environmental behaviors to reduce negative externalities or increase positive externalities, in addition to or instead of regulation (Baylis et al., 2008). In terms of governmental PES, two developments can be observed. On the one hand, an academic and theoretical PES concept closely connected to the ES concept has entered the policy arena and has been influencing state representatives' ideas and actions regarding environmental policy development (Gómez-Baggethun et al., 2010). On the other hand, existing economic incentive-based instruments for natural

[4] ES definitions have evolved over time. For example, *"Ecosystem Services are the conditions and processes through which natural ecosystems and the species that make them up, sustain and fulfill human life"* (Daily, 1997: p. 3); *"[f]inal Ecosystem Services are components of nature, directly enjoyed, consumed, or used to yield human well-being* (Boyd and Banzhaf, 2007: p. 619); or *"Ecosystem Services are the direct and indirect contributions of ecosystems to human well-being"* (TEEB Foundations, 2010: p. 33).

[5] Examples from the Millennium Ecosystem Assessment (MA, 2005): (i) supporting services: nutrient cycling, soil formation, primary production; (ii) provisioning services: food, fresh water, wood and fiber; (iii) regulating services: climate and flood regulation, water purification; (iv) cultural services: aesthetic, recreational, spiritual.

[6] Matzdorf et al. (2013: p. 57) see an increasing attention on PES, furthered by an ongoing worldwide degradation of biodiversity and ecosystem services as well as a current environmental policy that cannot prevent climate change, and refer to IPCC (2013), MA (2005), and COM (2011).

resource management (such as agri-environmental measures) have significantly influenced ideas of what PES are, could be, and should be (cf. Jack et al., 2008; Matzdorf et al., 2013). Many of these 'old' instruments, however, do not focus on clearly defined ES in the abovementioned sense. Consequently, PES definitions were broadened to include existing governmental payments for the internalization of negative externalities and production of positive externalities (cf. Muradian et al., 2010; Vatn, 2010). Furthermore, the juxtaposed tendencies are not independent but can instead be perceived as elements of a continuous overall process of defining and concretizing PES schemes. Correspondingly, in terms of governmental policy instruments, new PES programs have been created, especially in developing countries (cf. Corbera et al, 2007), while in developed countries, a broad range of existing governmental economic incentives was reclassified as governmental PES. For the most part, existing extensive agri-environmental payment programs in the EU and US have been subsumed under the term PES scheme (Schomers and Matzdorf, 2013).

Even though the largest governmental PES can be found in the EU and US, reaching many actors and covering vast areas, much of the existing research under the PES label has focused on developing and transitioning countries (cf. Corbera et al., 2007; Pagiola et al., 2008). Although PES research in developed countries is comparatively less established, there is literature on agri-environmental payment schemes (without PES framing) that focuses important aspects of the PES discourse (e.g., targeting, remuneration, or additionality). Thus, agri-environmental payment schemes appear to be valuable research objects for governmental PES in developed countries. Furthermore, I see a great need for EU and US agri-environmental policy research integration because, on the one hand, the international PES discourse could profit from such exchange (Schomer and Matzdorf, 2013) and, on the other hand, the PES discourse could significantly add to the research on agri-environmental payments. To integrate research on agri-environmental payments and PES, an encompassing investigation of the ES concept's influence on environmental and agri-environmental policies appears particularly crucial.

1.2 Research objectives

Against the backdrop of the prominence of agri-environmental payments, understood as governmental PES (Baylis et al., 2008), and the increasing impact of the ES concept in EU and US environmental and agri-environmental policies (cf. Hauck et al., 2013; Salzman, 2005), in this dissertation, I aim to

investigate and improve the understanding of governmental PES in developed countries from an institutional economics point of view. The research background outlined above, especially the juxtaposed tendencies within societal and political process of defining and concretizing PES, led to various questions for different individual aspects of PES and ES as parts of broader structures for ecosystem management and in terms of their direct relationship. Thus, on the one hand, I will address the governmental agri-environmental payment instruments that were created before the development of the ES concept but are now defined as PES.[7] On the other hand, I will address the ES concept's effects on existing instruments and their further development. The focus will be on the institutional design and performance of existing governmental PES in terms of ecosystem management and ownership interests as well as the performance of PES within broader structures for ecosystem management. Further, the main elements of the ES concept in terms of environmental policy and impact on environmental policies design and performance will be addressed. Correspondingly, I focus on two general research objectives:

- *Objective A: To understand how existing governmental PES are institutionally designed and how they perform.*
- *Objective B: To understand the relevance of the ES concept for public environmental policy, especially for governmental PES.*

1.3 Structure and organization

The two general research objectives have been targeted by individual publications (see Annex). Overall, the research conducted for five peer-reviewed publications added significantly to my understanding of the overall issues (see Fig. 1). Thereby, three papers (cited here as Paper 1, Paper 2[8], and Paper 3)

[7] Governmental agri-environmental payment instruments that were created before the development of the ES concept have been included in my PES definition (see *sec. 2.2*), even if many of these instruments do not focus on clearly defined ES. Throughout my thesis, I sometimes refer to PES and sometimes to agri-environmental payments to describe the same existing instruments, depending on the respective context.

[8] Paper 2 compares EU/German governmental agricultural Cross Compliance mechanisms and Compliance Payments in the US. Cross Compliance/Compliance payments essentially encourage farmers to fulfill certain environmental conditions in return for governmental support payments. Even if agricultural Cross Compliance/Compliance payments may not be seen as a classical PES mechanism, I included it in my analysis. The mechanism is well suited to consider issues of multi-targeted PES (combining environmental and social goals) as well as payments' interplay with regulations and property rights distributions.

depict the specific issues of my doctoral thesis in depth. Two additional publications provide a broader overview of PES design in general (cited as Paper 4) and of governmental PES integration into environmental policy (cited as Paper 5[9]).

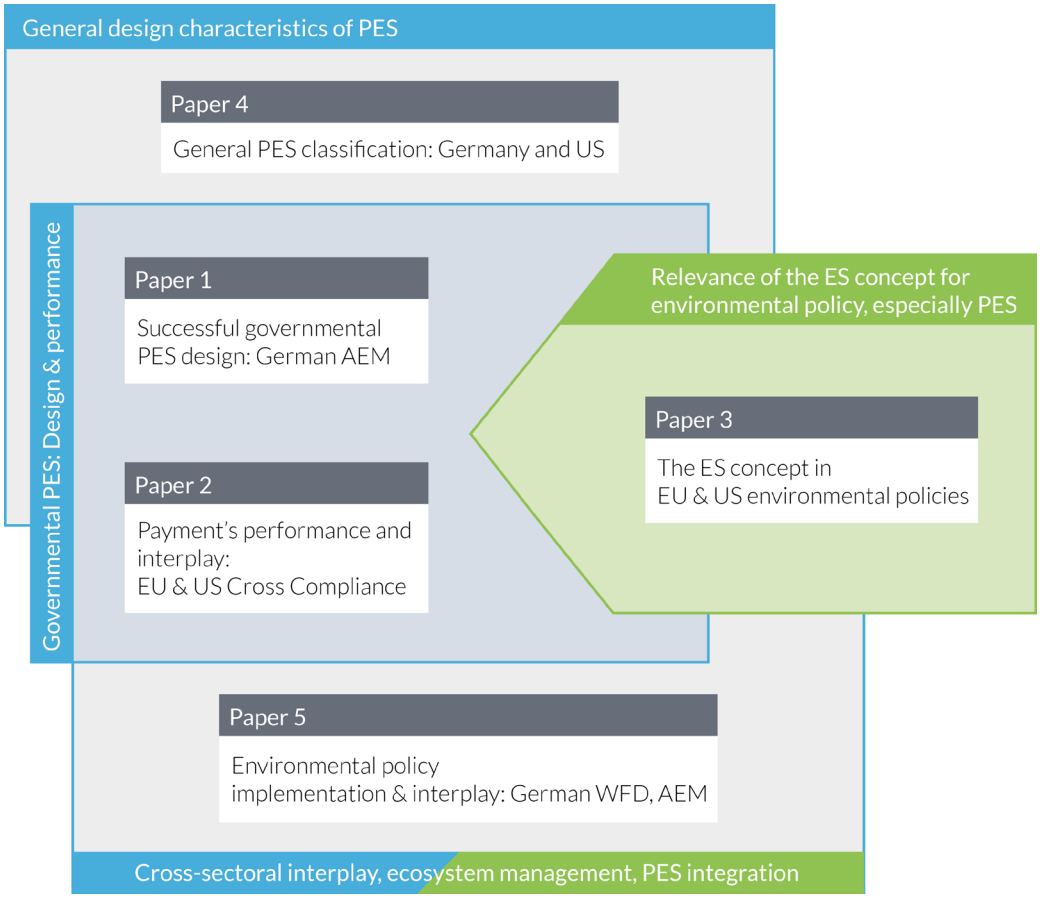

Figure 1: Paper contributions to research objectives

Each paper focuses on a particular topic, which mainly contributes to one of the two objectives. Jointly, these papers provide important contributions to each objective. Within this dissertation framework, the contributions of the individual paper results to the general research objectives are depicted in detail. Therefore, I substantiate the overall objectives through more specific research questions that are broadly based on institutional economics theory, which then are answered based on the content of the five papers. In particu-

[9] Through Paper 5, I link the ideas of my preceding master's thesis on institutional change in ecosystem management and my basic knowledge of the impact of governmental PES on environmental policy implementation as well as of the influences of informal rules and mental models on environmental governance to the investigation of governmental PES design and performance (see also, *Preface*).

lar, additional work is used to discuss my findings from the US, EU, and German environmental and agri-environmental policies.

In *Section 2*, I will present the state of the art. Taking my starting point into account, the initial scientific emphasis on ES, and the juxtaposed tendencies within the definition and concretization process of PES specified above, I will explain the ES concept's development and then turn to the understanding of governmental PES and its performance, as this procedure facilitates the presentation of the overall picture. In *Section 3*, I will concretize the individual research questions based on institutional economics ideas. In *Section 4*, I will present my answers to the raised questions. Finally, in *Section 5*, the results will be discussed. *Section 6* concludes the dissertation.

2 The ES concept and governmental PES: State of the art

Humans live within a common natural environment and resources are shared. Thereby, *"[t]he way we think about the environment and the interactions between the environment and the economy must certainly influence the way we treat it"* (Vatn, 2005: p. 231) and impact other individuals. The understanding of these interactions is changing continuously. Recently, the fact that economics and environmental conservation have been treated separately has been critically highlighted (Gómez-Baggethun and Ruiz-Pérez, 2011). The concept of ES may offer a partial solution (Folke, 2006). As humans depend on common environmental resources and their functions, the dependence can be framed in terms of ES (Vatn, 2010). Societal goals in terms of ES distribution and provision may be reached through various policy measures and mixes thereof. The main different types of public policies have been characterized as regulations, economic instruments, and information (Vedung, 2009). Regulatory approaches have been especially criticized for their lack of implementation (Engel and Zimmermann, 2007) as well as their cost-effectiveness deficits (Stavins, 2000), which are expected to be solved by economic instruments. Thus, governments have increasingly focused on the

implementation of economic incentive-based instruments, especially PES.[10] Further, the inclusion of the ES concept in governmental policies has been discussed (Martin-Ortega, 2012; Hauck et al., 2013). Although there is much enthusiasm, there is also considerable criticism of ES, neoliberally oriented PES, and the institutionalization of these concepts (Norgaard, 2010; Kosoy and Corbera, 2010). While the enthusiasm is grounded in a widely assumed compatibility of the ES concept – and accordingly, PES – with environmental governance in the prevalent economic system (cf. Gómez-Baggethun et al., 2010), the criticism involves mainly social and ethical aspects, which are often grounded in scientific and technical limitations (cf. Jax et al., 2013; Redford and Adams, 2009).

2.1 Development of the ES concept

Defining nature-society relationships

The ES concept involves a certain way of looking at the world by assessing nature-society relationships. In terms of a conceptual view, Potschin and Haines-Young (2011) describe something of a production chain linking ecological and biophysical structures and processes on the one hand, and, elements of human well-being on the other and argue that, potentially, a series of intermediate stages between them exists. Different definitions have evolved over time, with varying focus on more ecological or more economic interpretations of the concept (summarized by Braat and de Groot, 2012: p. 5). The discussion in terms of different perceptions of ecological and economic issues continues (cf. Boyd and Banzaf, 2007; Fisher et al., 2009; Farley, 2012; Lele et al., 2013; Fisher and Brown, 2014). From the initial ecological perspective, the limitedness of natural resources and the analysis of nature's role in economic and social dynamics led to a demonstration of the importance of nature's functions for humans (Spangenberg et al., 2014; Braat and de Groot, 2012 referring to, for example, Carson, 1962, Ehrlich, 1968, and

[10] Pirard (2012) reviews economic incentive based instruments and categorizes the different heterogeneous approaches as direct markets, tradable permits, reverse auctions, Cosean-type agreements, regulatory price signals, voluntary price signals. Governments especially draw back on what he calls tradable permits (e.g. emission quotas in the European ETS, Individual Transferable Quotas for fisheries) and regulatory price signals (e.g. eco-tax, agro-environmental measures).

Meadows et al., 1972). In the second half of the 20th century, economists began to explain and assess the undervaluation of ecosystem contributions to welfare. Gómez-Baggethun et al. (2010) show the continuous development of the scientific ES framework toward economic decision making, from the inclusion of the idea of the values of nature's functions (e.g., King, 1966; Helliwell, 1969) to the utilitarian, economic framing of ecological concerns (e.g., Westman, 1977; de Groot, 1987). Mainstreaming of the scientific discourse has been driven by the publications of de Groot (1992), Daily (1997), and especially, Costanza et al.'s (1997) paper on the economic value of global natural capital.

Entering the policy agenda

In the new millennium, the ES concept appeared on the international policy agenda (e.g., MA, 2005), manifesting the concept's importance for policies and defining ES as *"the benefits people obtain from ecosystems"* (MA, 2005: vi; cf. Fisher and Brown, 2014). An exponentially increasing literature addressing ES in some form can be found (Fisher et al., 2009). Global problems have also been framed as ES-based and in economic terms, as by the Stern Review on Economics of Climate Change[11], the Cost of Policy Inaction study by the EU (Braat and ten Brink, 2008), and The Economics of Ecosystems and Biodiversity (TEEB, 2010). Recently, the concept has floated into national environmental policies (Paper 3; Hansen et al., 2015; Hauck et al., 2013; Martin-Ortega, 2012). The increasing policy focus on the value of ecosystem services has in turn been understood as a promotion of ES as a paradigm for environmental management (Norgaard, 2010). In this regard, Norgaard (2010) summarizes, *"[o]ver a period of about 15 years, an eye-opening metaphor intended to awaken society to think more deeply about the importance of nature and its destruction through excessive energy and material consumption transformed into a dominant model for environmental policy and management … for the globe as a whole."* Correspondingly, the interest of policy makers in economic policy instruments has been enhanced by this concept as well (Braat and de Groot, 2012).

[11] Sir Nicholas Stern, Head of the Government Economic Service and Adviser to the Government on the economics of climate change and development, led a major review on the economics of climate change to comprehensively show the nature of the economic challenges and how they can be met (http://goo.gl/9DeRGG).

Advantages and disadvantages

Fisher and Brown (2014) argue that economic approaches apply the ES concept as a utilitarian and anthropocentric concept. Risks have been observed regarding a possible outweigh of noneconomic justifications for conservation, ignorance of the economically irrelevant parts of the ecosystem, and a mismatch in or lack of institutions available for value realization (Redford and Adams, 2009). Against such arguments, it has been noted that the concept expands the audience for conservation messages and does not diminish the non-economic values and arguments, but simply expresses it in other ways (Skroch and López-Hoffman, 2010). Independently from economic ideas, the ES concept has been observed as a helpful communication tool to explain the dependence of human life on ecosystems (Redford and Adams, 2009), with the potential to evaluate the existence values of land or biota in cultural or social terms, targeting and prioritizing resource management (Skroch and López-Hoffman, 2010; Farley, 2012). However, independently of economization, other problems with the concept have been acknowledged, such as its general support of a human-centered worldview, lack of intrinsic values (Fisher and Brown, 2014), reduction of holistic ideas (Adams and Redford, 2010) and blinding effect toward natural system complexity (Norgaard, 2010). Correspondingly, in recent years, there have been concrete advances in practical applications, methods for identification and quantifications of ES, models, and indicators (cf. Braat and de Groot, 2012).

2.2 Governmental PES

Coasean or Pigouvian

Initially, the scientifically shaped PES idea was closely linked to the ES idea, ideal markets, and so-called Coasean market solutions to environmental issues (Coase, 1960; see also Vatn, 2010), focused on direct negotiations between parties to improve efficiency (Pasqual et al., 2010; Engel et al., 2008). The approach is underpinned by environmental economic ideas that see environmental degradation results from market failure caused by environmental externalities and free-riding (van Hecken and Bastiaensen, 2010). The corresponding definition understands PES as a voluntary transaction regarding a well-defined ES (or a land-use likely to secure it), which is being bought by one or more ES-buyers from one or more ES-providers if conditionality is on hand (Wunder, 2005: p. 3). The definition has been broadened over

time, partly because of its little practical relevance (definition overviews can be found in Muradian et al., 2010; Matzdorf et al., 2013; Derissen and Latacz-Lohmann, 2013; Wunder, 2015). Different mixed-type governance structures relating to Pigouvian ideas based on environmental taxation and subsidization to correct market externalities have been included (see Pigou, 1920; Baumol, 1972; in general Schomers and Matzdorf, 2013). Such a conceptualization of PES extends it to include any financial incentive to correct environmental externalities, for example, Muradian et al. (2010: p. 1205) understand PES *"as a transfer of resources between social actors, which aims to create incentives to align individual and/or collective land use decisions with the social interest in management of natural resources"*.[12]

The state is the buyer

Governance has been defined as the establishment and change of institutional structures for the organization of natural resource use (cf. Fn. 2; Vatn, 2010; Paavola, 2007; Bromley 1991). Vatn (2010) identifies three main types of governance structure, hierarchies, markets, and community management, and emphasizes that mostly all types operate together. Within the diverse existing PES governance structures, the state and hierarchies (command systems, bureaucracy, and distribution of public funds[13]) may play an important role (Vatn, 2010; Corbera et al., 2007; Salzman, 2005). Matzdorf et al. (2013) developed a framework to assess the diverse types of PES governance structures, focusing on the government's key role as a legal driver of ES demand and/or as an ES buyer (Figure 2).

[12] Criticism of Muradian et al's (2010) definition has been expressed by Matzdorf et al. (2013: 58-59) who see the specification of well-defined ES (including biodiversity goals) as an essential criterion for payment under the PES approach, even if the payment is then made for an activity thought to deliver the ES (input-based). They emphasize that the specification of a clear ES objective is important to distinguish PES from more conventional Integrated Conservation and Development Projects (ICDPs) and from the broad variety of agricultural subsidies.

[13] Vatn (2010: 1246) defines a hierarchy as system of command where the power of decision rests with top level, including the capacity to command agents at subordinate levels. He understands bureaucracy as the dominant form of a governance hierarchy in modern societies and the basic system of allocation through distribution of common funds.

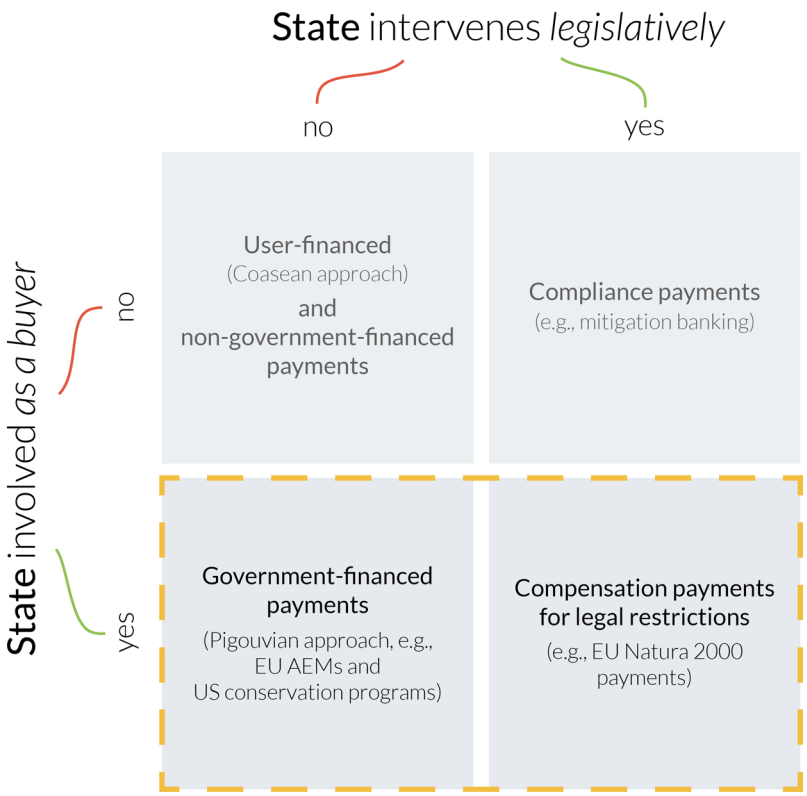

Figure 2: PES governance model (following Matzdorf et al., 2013: p. 60)

For my thesis, I apply a broad definition of PES (cf. Muradian et al., 2010) and assume that governmental PES schemes are those in which the state acts as a buyer of ES (cf. Vatn, 2014). Thus, I include existing *Government-financed payments* and *Compensation payments for legal restrictions* (Matzdorf, 2013, Fig. 2). The relevance of such payments in PES research and development has been shown by Schomers and Matzdorf (2013), who state that most of the existing literature refers to large, national governmental payment programs. Even if many of US and EU programs are not labeled as PES schemes, the underlying economic mechanisms correspond to such payment programs that have been extensively promoted as 'novel' PES approaches in the Latin American context as well as to Chinese environmental payments, which are generally based on regulations and quotas (Schomers and Matzdorf, 2013). In particular, agri-environmental measures (AEM) in Europe, conservation programs in the US (Baylis et al., 2008; Claassen et al., 2008), Payments for Environmental Services (PSA) in Costa Rica (Pagiola et al., 2008)[14], and Payments for Hydrological Environmental Services (PSAH) in Mexico (Muñoz-

[14] At least in parts, PSA have also been understood as a kind of *compensation payments for legal restrictions* (cf. Schomers and Matzdorf, 2013).

Piña et al., 2008) can be understood as *Government-financed payments*. In cases of *Compensation payments for legal restrictions*, the state regulates the production of negative environmental externalities but compensates the fulfillment of regulations, as in the cases of the EU Natura 2000 nature conserconservation areas, the EU Water Framework Directive (WFD) (Matzdorf et al., 2013) as well as in parts the Sloping Land Conversion Program (SLCP) in China (Xiong and Wang, 2010).

2.3 Development and performance of existing governmental PES

Public policy design

The land use practices of landowners and their ES production are influenced by a wide range of often-interrelated rules and policies (cf. Prager et al., 2010; Corbera et al., 2009; Vatn, 2005). Basically, the design of such public environmental policies depends on the property regimes in place and policy choices, in turn, influence the rationalities and values of the actors. Different policies imply various possibilities for distribution and redistribution of rights, for example, the generation or internalization of externalities via contracts or government regulation (Vatn, 2005). By using contracts, the state may generate positive external effects by paying for the production of ES (Hampicke, 1994). There are two possible solutions. One is the allocation of property rights by creating and paying for ES as commodities and establishing the necessary economic incentives (cf. Baylis et al., 2008). The second and most common solution, especially in terms of agri-environmental payments, is payment for specific actions by a farmer that lead to greater ES production (Matzdorf, 2004). Payments for the reduction of negative externality production remunerate the landowner for not negatively influencing an ecosystem's ES production (Rodgers, 2009; Matzdorf, 2004). Agreements and government regulation can also be combined. The prevention of negative externality production through regulation is supported by additional compensation payments (Matzdorf et al., 2013). In all cases, in my understanding of governmental PES, the state itself 'buys' the ES and is considered a *"third party acting on behalf of service buyers"* (Engel et al., 2008: 666). Therefore, governments organize the PES, set the prices, and substitute the demand side (Vatn, 2010).

PES design

In case of *Government-financed payments* (cf. Fig. 2), the government essentially provides payments to land users who voluntary promote environmental objectives beyond existing legal requirements (Matzdorf, et al. 2013). Thus, the design of PES is initially subject to the ownership of the relevant resources and the owner's rights to use them (Vatn, 2010). In addition to organizing public ES production, governments may be driven by additional motives for payments and their organization (Baylis et al., 2008), and therefore, governmental PES often do not focus on conditionality (Matzdorf et al., 2013). Thus, Baylis et al. (2008) see agri-environmental payments in the US and EU as examples of paying farmers for ES by transferring public funds. Correspondingly, the remuneration plays a crucial role. The two extremes are payments for outputs of measured ES or payments for inputs or technology use (Baylis et al., 2008).[15] Thereby, many governmental PES are *'take it or leave it contracts'* without an opportunity to negotiate the contract terms (Mettepenningen et al., 2009: p. 652) and do not constitute a market (cf. Vatn, 2014). In the case of *Compensation payments for legal restrictions* (cf. Fig. 2), states use legal requirements to reach environmental goals. Specific forms of resource use and ES provisions are obligatory. Moreover, the state pays to compensate land users for equity concerns or to improve the acceptance of and compliance with the regulations (Matzdorf et al., 2013). The latter especially occurs due to the difficulty of implementing regulations (such as the polluter pays principle) due to long histories of agricultural income support (Baylis et al., 2008) and corresponding path dependencies.

PES performance

In general, the performance of PES has been broadly analyzed within different settings, exhibiting strengths, weaknesses, and limitations as well as issues of implementation (cf. Kemkes et al., 2010; Muradian et al., 2010; Vatn 2010; Kosoy and Corbera, 2010; Fisher et al., 2009; Engel et al., 2008; Wunder et al., 2008). Furthermore, particular questions on governmental PES, regarding their role and performance as environmental policy instruments, have been studied, especially in terms of effectiveness and efficiency. For agri-environmental payments, our main PES cases, various analyses show

[15] PES schemes may be *input-based*, also called *activity-based*, or else *output-based*, also called *performance-based* or *result-oriented* (Matzdorf et al., 2013: p. 58).

environmental effects (e.g., Carey et al., 2005; Kleijn et al., 2006). According to Uthes and Matzdorf (2013), it is usually questioned whether agricultural practices that are supposed to deliver environmental effects or to protect certain habitats are effectively targeted. Quite a few suggestions on how to improve such schemes have been made. The effects of farmer's participation in and adoption of schemes may be influencing factors (Schomers et al., 2015; Mettepenningen et al., 2013) in addition to the impacts of spatial targeting (Uthes et al., 2010; van der Horst, 2007; Latacz-Lohmann and Hodge, 2003) and remuneration alternatives (e.g., input-based, output-based, auctions) (Klimek et al., 2008, Bertke et al., 2008; Claassen et al., 2008). Different actors from the government (environmental and agricultural entities) and non-governmental organizations may be involved in the agri-environmental design and decision-making processes and may influence performance at various scales (Uthes and Matzdorf, 2013), for example, through cooperation (Prager and Freese, 2009) or advice (Sutherland et al., 2013).

3 Framing research on governmental PES

Both enthusiasm and criticism regarding PES are related to central questions of environmental policy: Who does or has to do what, how, and why? Who pays or has to pay whom, for what, and why? Answers to these questions depend on the institutional context (cf. Vatn, 2005, also Paper 2). In this thesis, I understand institutions as the conventions, norms, and legal rules that guide human interactions, from facilitating coordination to conflict resolution (Vatn, 2011), and I broadly framed the objectives against an institutional economics background.

3.1 Theoretical background

Within institutional economics, assumptions about individuals, behaviors, and the development of institutions differ (Vatn, 2005). Corresponding to individual journal articles, my analysis is generally based on the economic institutionalist perspectives introduced by Vatn (2005, 2009) and Bromley (1989, 1990), who understand institutional change as instances of social and political contexts rather than as results of utility maximizing, rational individuals. Thus, institutional development and change are understood as products of the control and power of the involved actors. One individual's actions influence the opportunities of others (cf. Vatn, 2005). Individuals are seen as

multi-rational with context dependent preferences and values (Vatn, 2005). I further recognized formal and informal institutions that structure the relations among individuals and natural resource use (Vatn, 2005). Property rights, as a subset of institutional structures, define access to and use of resources (cf. Bromley, 1991).

Environmental management depends on various institutional arrangements[16] at different scales of socio-political organization that interact with each other (Berkes, 2002). Policy measures may be perceived as institutional arrangements for reaching certain societal goals. The use of complex, interconnected natural resources results in external effects that may be addressed by institutional arrangements setting demarcations. However, demarcations can only be partial and are dependent on existing institutional structures and power relations (Vatn, 2005, elaborated in Paper 2). Thus, public policy design implies institutional development and change dependent on the institutional context and prevalent power structures. For example, the decision of how to distribute and redistribute use rights to internalize certain externalities via agreements or government regulation depends on the existing property rights situation as well as public perceptions of the environmental problem (cf. Vatn, 2005). To concretize my general research *objectives A* and *B*, in the following, I focus on public policy institutional design and performance, which is enhanced by the crosscutting concept of interplay.

3.2 Concretizing the research objectives

Institutional design and performance

Institutional design means modifying or replacing institutional arrangements, if they are suspected sources of a problem, or creating incentives to cope with the bio-geophysical drivers, if the problems are based upon those (cf. Young, 2002). As described above, new institutional arrangements are influenced by existing institutions, individual preferences, and power relations (cf. Vatn, 2005). Young (2002) sees institutional design as especially constrained by limitations in the human ability to foresee institutional

[16] Institutional arrangements are understood as the institutional structures that regulate resource use, called *resource regimes* by Vatn (2005: p. 252). In general, "*The structure of the relationships between the institutions involved in some type of common endeavour*" (Imperial, 1999: p. 454).

performance in complex systems. Most institutional arrangements are designed to meet a goal, *"the solution of more or less well-defined problems"* (Young, 2002: p. 17). Accordingly, institutional performance analysis identifies the extent of an institution's contribution to achieving – or not achieving – a specific goal (Mitchell, 2008). An evaluation of institutional performance in terms of the set goals requires the definition of criteria against which the institution can be evaluated (Corbera et al., 2009). Due to the complexity of socio-economic systems, there are no best design solutions. However, several scholars tried to identify sets of functioning institutional design principles for collective natural resource management (cf. Corbera et al., 2009: p. 745; referring to the principles developed by Agrawal, 2002 and; Ostrom, 1990). Correspondingly, I refine *objectives A* and B (see Fig. 3) into two questions:

- *What are the relevant institutional design principles for reaching the environmental goals of governmental PES?*
- *What are the institutional design principles of an ES-based policy, and where are they found in environmental policies?*

Thereby, it must be understood that even if a policy regime solves a well-defined problem, there are often other social concerns to better use the same resources to solve other problems (Young, 2002). As to that, Vatn and Veldeld (2012) see strong normative elements in institutional design and performance. Ecosystems are not fixed entities; the set goals will influence and change perceptions of problems and ideas of the biophysical system. Thus, for example, the measurement of values of ES requires institutions of criteria and indictors, which are influenced by the prevalent economy, culture, and biology (cf. Gatzweiler, 2014). Correspondingly, I finally refine *Objective B* (see Fig. 3) into a question about the ES concept's influence on actor perceptions of biophysical systems and corresponding preferences and values:

- *Does the ES concept influence actors' preferences and values?*

Institutional interplay

The existing institutions as well as the values and preferences of the resource users will influence the design and performance of new institutional arrangements (cf. Vatn and Vedeld, 2012) and cause institutional interplay. The concept of institutional interplay cuts across institutional design and performance, which complements our research focus. Figure 3 shows the specifications of the research goals against the background of design, perfor-

mance, and interplay in the overview. As a cross cutting issue, institutional interplay concerns how institutions affect one another and how interactions between two or more institutions can influence outcomes (Corbera et al., 2009). According to Young (2002), there are two different dimensions of interplay. First, he distinguishes between horizontal (at the same level of social organization) and vertical (between different levels of social organization) institutional interplay. Second, he sees functional interdependence (two or more institutions are linked in biogeophysical or socioeconomic terms) and politics of design and management (intentionally forged links among institutions) interplay. As to Corbera et al. (2009), questions following the interplay concept include whether PES influence or are influenced by other institutions and which types of synergies or conflicts exist. Institutional interplay may especially be triggered by different spatial, temporal, or functional relations of various interrelated institutional arrangements within environmental systems. Correspondingly, I refine *objectives A* and *B* (see Fig. 3) into two questions:

- *How do PES interact with other institutional arrangements?*
- *How can ES-based rules interact with existing environmental policies, especially PES?*

Understanding the whole picture of interactions is regarded as important for managing institutional interplay (cf. Paavola et al., 2009). Young (2006) categorizes different general patterns of scale that depend on cross-level interplay responses, such as dominance, separation, merger, negotiated agreement, or system change. Addressing institutional interplay through negotiated agreements could, for example, take place through new institutional arrangements, such as multi-stakeholder bodies or co-management organizations (cf. Berkes, 2002).

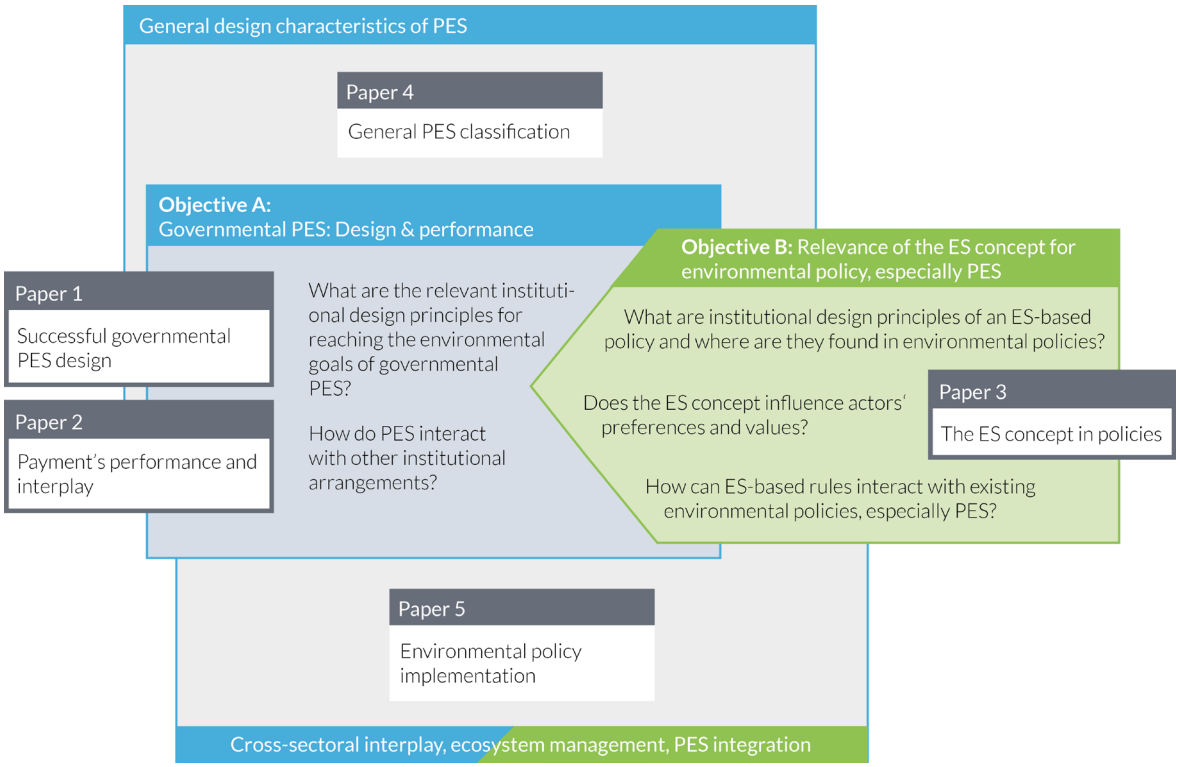

Figure 2: Paper contributions to research questions

4 Results on institutional aspects

In the following, I will provide answers to the above questions by drawing on the results presented in my individual papers. Thereby, Section 4.1 addresses *objective A*, governmental PES design and performance, and Section 4.2 addresses *objective B*, the relevance of the ES concept for environmental policy, especially PES. All findings will be presented and summarized in Table 2.

4.1 Governmental PES design, performance, and interplay

Relevant PES design principles

To answer the questions about the relevant institutional design principles to reach PES environmental goals, Table 1 presents four rules that shape governmental PES (reviewed in Papers 4 and 1)[17]. Based on the basic elaborations

[17] I understand governmental PES as defined in *Section 2.2*. More specific information on the relevant rules and the reviewed literature can be obtained within section 2 of *Paper 3* and section 2 of *Paper 4*.

in Paper 4 and the detailed review of AEM in Paper 1, different sets of institutional design principles for governmental PES are identified (Paper 1). Two rule sets are found to be sufficient for environmentally effective PES: targeting only one environmental goal in addition to application to a certain area/habitat as well as an accessible advice system in combination with either flexible application or obligatory participation of a nature protection agency (Paper 1). Thus, I see the general importance of specific targeting, application feasibility for land users, information and advice.

PES Rules	ES types and environmental goals	Targeting	Payments and contract length	Actor involvement
Important features of governmental PES	PES address single types of ES or ES bundles, single environmental goals or bundles of goals (**Papers 1** and **4**)	PES may be open to all ES providers and all areas, or targeted on specific providers or areas (**Papers 1** and **4**)	Usually payments cover opportunity, implementation, and transaction costs (**Paper 4**)	Governmental PES may be under the responsibility of one or more administrative entities (**Paper 1**)
	A PES aim can be additionality of ES production, but also preservation of the status quo (**Paper 4**)	Targeting may be performed by ES providers through application choices (e.g., area, practices, or times) (**Paper 1**)	Payments are either for input (land-use or management activity) or output (measured ES) (**Paper 4**)	Different governmental entities may be involved in PES design and implementation (**Paper 1**)
	A PES can have additional objectives beside environmental goals, e.g., social support (**Papers 2** and **4**)	Also bundling PES may be targeted to more than one goal (**Papers 1** and **4**)	Long-term contracts offer security and permanent ES provision, short-term contracts flexibility (cf. **Papers 1** and **4**)	Non-governmental intermediaries can inform, advice, mediate, negotiate, monitor and control (**Papers 1** and **4**)

Table 1: Important design rules for governmental PES

Furthermore, Paper 1 provides hints about the additional relevance of whole-farm multi-target approaches through the case of organic farming that is focusing on all farm areas and different environmental goals. This leads to two parallel routes for successful PES design: either focusing on one special environmental issue and a certain area/habitat (in combination with other design rules) or targeting all areas and multiple goals using a whole-farm approach. My results also indicate that a combination of specifically targeted PES and multi-target whole-farm approaches in a policy mix could be promising. Furthermore, the property rights situation is relevant to PES success. PES must be available for rights owners to ES/resources that are relevant to fulfill

the targeted environmental goals (Paper 1). In terms of remuneration, Paper 4 discusses a link between output-based remuneration and PES success, even if, in practice, the number of output-based schemes remains small and the sample of Paper 4 does not allow generalization[18]. Output-based remuneration may be supported by the suggested design principles (see Discussion). Moreover, contract length may play a crucial role; if they are not safeguarded, ES providers might exit schemes, which may especially be a factor if there is interplay with other policy goals (Paper 2). Finally, the integration of different actors and their knowledge is important for governmental PES success. Regarding agri-environmental payment design, Paper 1 generally finds positive influences in terms of existing agri-environmental advice[19] and the participation of nature protection agency cooperation in implementation. Paper 4 also indicates that non-governmental intermediaries can play a crucial role in PES implementation and advice.

PES interaction with other institutional arrangements

To answer the question of PES interactions with other institutional arrangements, I initially draw on property rights. Designing PES involves interplay with the existing property rights. The state may decide to change rights by regulations or by paying the land user for exercising or not exercising their existing use rights or privileges. Moreover, policy choices depend on actors' control and power; preferences and values; and administration, enforcement, monitoring costs (Paper 2). Authority structures may not be able to enforce governmental regulations, or regulation may cause social resistance. Therefore, payments may be intentionally used beside regulations (Paper 2 on EU Cross Compliance, cf. Fn. 19). Several arguments support such interaction, especially improved compliance or further institutional change. Possibly, land users may shift toward positive environmental behavior and rule acceptance (crowding in). Interaction could also imply crowding out effects: land users may assume that they retain use rights that regulatory laws have removed from their ownership bundle, as authorized by a socio-political decision to pay for ES. They may become reluctant to comply with laws or to

[18] The aim of the analysis was to classify a set of PES as successful. The sample is not based on representativeness in terms of all possible types of PES existing in reality. The overall number of cases did not allow for a statistical analysis. The findings are preliminary and must be supported by further research.

[19] Different types of advice services exist, as for example state agricultural offices, chambers of agriculture, private advisory systems (Knuth and Knierim, 2013).

adopt management practices without payments, even if they would have done so without before (Paper 2). Furthermore, governmental PES are often functionally linked to other environmental policies because they are highly relevant for the fulfillment of overall environmental goals, as in the case of EU and US agri-environmental measure. As segregated environmental policies often govern only one resource without including cross-sectoral cooperation (Paper 3 and 5), in cases where PES integration is required, formal and informal institutional change in response to interplay has been noticed, especially co-management tendencies, inter-organizational working groups and participatory bodies (Paper 5). Finally, payments may intentionally combine environmental and social policies. Such policy combinations are, for example, used to reduce inconsistencies and/or generate justifications. The policy combinations could extend the inclusion of land users, spread environmental goals, save transaction costs, and close legislative deficiencies. A change in the perception of environmental problems may affect the behavior and acceptance of new rules (crowding in). However, if payment rules are decoupled from environmental goals, the resulting ES provision is strongly affected by other factors, such as price fluctuations in commodity markets or other policies fostering actions (Paper 2).[20]

4.2 Relevance of the ES concept for environmental policy and PES

Design of ES-based policies and presence in environmental policies

To answer the question of institutional design principles for ES-based policy, Paper 3 makes suggestions for an 'ideal' ES concept-driven policy, including (i) rules directing attention to the capacity of ecosystems to supply goods/services and focus on maintenance/enhancement of ecosystem capacity; (ii) rules for identification of economic/social values of ecosystem structures/processes as policy goals, including monetary valuation and participatory methods; (iii) rules to consider relationships/trade-offs among

[20] As described in Fn. 8, I use the institutional analysis of agricultural Cross Compliance (even if no classical PES mechanism) to present general issues of agri-environmental payments/PES that are combining environmental and social/income goals, as well as of payments' interplay with regulations and property rights distributions. Thus, problems in terms of justifying income support with environmental goals, as well as the dependence on agricultural commodity markets, are also relevant in terms of AEM. PES interplay with regulations concerns especially EU Natura 2000 payments.

environmental objectives and to foster cross-sector integration; and (iv) rules that enable financial incentive instruments, especially PES. To date, a general understanding of ecosystems as supporting economic activities and human well-being has been expressed in many public environmental policies. Yet, this understanding has only been used to describe the importance of nature ideally rather than to clearly define policy goals. Often, there are no rules that focus on ecosystem capacity, capacity thresholds or limits. In 'classic' environmental policy, few instruments exist for social and/or economic valuation. The same applies to the considerations of ES interdependencies and trade-offs (Paper 3). However, in agricultural and forest policies, there are often rules for payments, although the policies target also social and structural aspects besides environmental issues (Papers 1, 2, and 3). US Farm Bills and EU Common Agricultural Policy (CAP) are not completely ES-driven policies, but they integrate PES in a broad understanding even if payments are mainly not targeted to ES. Recently, the new CAP has focused on the delivery of public goods (equated to ES) as a main idea and explanation (Paper 3).

ES concept influence on actor preferences and values

The ES concept has generally been seen as a great influence on actor perceptions of ecosystem dynamics, preferences and values, fostering an integrated ecosystem-based resource understanding and considering different win–win and trade-off situations (Paper 3). As an example of the impact of institutionalization of concepts, ecosystem-focusing tendencies in the context of the EU WFD implementation process (even if it is not a completely ES-driven policy) have already been observed. WFD's strong focus on river basins (including ecosystem dynamics/capacity) has changed the perceptions and values of water managers in terms of spatial interrelations (Paper 5). In terms of recent ES concept influences on policy makers and administration, changes in economic and social value identification of ecosystems to supplying services have begun and been acknowledged. Furthermore, US experts understood that the concept's valuation and economic aspects will foster the importance of financial incentives and can influence individuals' mental models in terms of seeing nature in a different way. Potential dangers of expanding the ES concept for the relationship of policy and ecosystem dynamics have been observed in the lack of clear justifications for parts of biodiversity protection because not everything can be commodified (Paper 3). At the land user level, the influence of the ES concept has not yet been significant. Generally, new ecosystem encompassing ideas, such as ecosystem-based

management of the WFD, may change attitudes, although this change may be generated by social pressure as well as economic incentives in addition to understanding. At large, I see strong differences in the mental models of different sectors, which might make it more difficult to integrate cross-sectoral concepts (such as the ES concept)(Paper 5). Finally, experts have stated that people may also be concerned about the commodification of nature and scrutinize ES-based polices (Paper 3).

ES-based rules' interactions with environmental policies

To answer the question of how ES-based rules interact with environmental policies, especially existing payments schemes (defined as PES), I begin by drawing on experiences with EU WFD implementation. Implementing ecosystem-based rules through segregated and single resource-oriented policies causes functional horizontal and vertical institutional interplay with existing institutional arrangements, which requires substantial coordination activities. To achieve coordination, existing institutional arrangements have been complemented by new institutional arrangements, such as new inter-sectoral working groups (Paper 5). Similar actions have been foreseen in terms of ES institutionalization in existing policies – that is, broad horizontal and vertical interplay with other policies and broad cooperation and coordination requirements (Paper 3). So far, the ES concept is already being used intentionally by policy makers and public administrators to reinterpret and reframe existing rules to develop new or to improve existing instruments. Yet, the interviewed US experts emphasized that existing legislation is insufficient for formal ES implementation, especially methods and rules for valuation. However, with respect to the integration of an ES concept into environmental policies, EU experts understand that ES can provide a conceptual bridge. First, bridging tendencies may be observed in the latest reform of the EU CAP, where communication of economic and social values and cross-sectoral cooperation are now framed through an ES understanding. Policy guidelines have been framed using the ES concept (e.g., EU Biodiversity Strategy). The first regulations are pending, and concept-oriented organizations (USDA Office of Environmental Markets) have been founded (Paper 3). Generally, the greatest future interaction is predicted regarding climate and agricultural policies, especially where PES already exist. ES-based ideas are assumed to be increasingly merged with governmental payments in the future to explain and legitimize financial support (Paper 3). The development of ES-based governmental agri-environmental payments has the potential to foster collaboration

between the environmental and agricultural sector, for example, based on value communication as well as effectiveness and efficiency increases (Paper 3). So far, most governmental payments do not explicitly target clearly defined ES. However, the potential for ES to better focus agricultural governmental PES schemes on the outcomes of the activities by developing metrics and currencies and to translate services and indicators for monitoring were emphasized by EU experts. The main challenge regarding an ES-based payment (input- and output-oriented), from both the technical perspective and public perception, has been seen in the actual design and integration of rules for valuation and commodification (Paper 3).

Research Questions	Results
What are the relevant institutional design principles for reaching the environmental goals?	Two successful rules sets: single goal/area targeting + application flexibility + advice are important
	Multi-target approaches may be also important
	Eligibility of relevant rights holders can be relevant
	Contract lengths may be crucial
	Integration of different actors and knowledge can help
How do PES interact with other institutional arrangements?	Payments complement environmental regulations
	Functional linkages of PES to other environmental policies
	Payments may combine environmental and income support (social) goals
What are design principles of an ES-based policy and where are they found in environmental policies?	Attention to ecosystem capacity, identification of values, ecosystem structures/processes as policy goals, consideration of relations/trade-offs, rules enabling financial incentive instruments
	So far, ecosystems seen as supporting economic activities and human well-being
	Few rules focusing ecosystem capacity, thresholds, limits; few instruments for valuation
	US Farm Bills and EU CAP integrate payments/PES (often without ES quantification and valuing)
Does the ES concept influence actor's preferences and values?	General influence on actor's perceptions, preferences, values
	Perceived mind change towards economic and social valuation
	Perceived lacking clear justification for conservation of parts of the nature
	Worries about commodification of nature
How can ES-based rules interact with environmental policies, especially PES?	Foreseen broad interplay among policies, broad cooperation/coordination requirements
	So far, intentionally used to reinterpret and reframe of existing rules
	ES concepts principles can bridge policies themselves (communication, valuation)
	Usage for communication, explanation, legitimization, targeting of PES
	Main challenges: design and integration of rules for quantification and valuation

Table 2: Summary of the results

5 Discussion

My doctoral thesis contributes to the existing knowledge on governmental PES by addressing the topic from two sides. On the one hand, institutional design, performance, and interplay among existing governmental PES programs in developed countries have been examined. On the other hand, the relevance of the academic ES concept to overall environmental policy, especially to existing governmental payments, already defined as PES, and PES integration have been analyzed. Thereby, this thesis links two major perspectives on governmental PES as described previously – one perspective being strongly driven by research on agri-environmental policies in the EU and US and the other perspective being influenced by recent research on ES and PES in an international context. In my thesis, different preferred rule sets for governmental PES as well as interactions with other institutional arrangements have been shown (Papers 1, 2, 4 and 5). Furthermore, the implications of ES for environmental policy and governmental PES have been revealed (Papers 3, 5). In particular, Paper 3 notes that the ES concept is already entering national environmental and agri-environmental policies in the EU and US and that agri-environmental policies with existing payments schemes (already defined as PES) will be among the first with the ES concept integrated (Paper 3). Therefore, in the next chapter I will discuss what the ES concept offers governmental payments (defined as PES) development. Correspondingly, the results of favorable institutional arrangements and governmental PES interplay with other institutional arrangements will be first reflected on within a wider context of PES research in terms of improving governmental PES, and second, the ES concept will be added to the discussion, focusing on the potential benefits of the ES concept for governmental PES development.

5.1 Governmental PES

By taking into consideration my results on governmental PES, I argue that PES can be essential components within the overall environmental policy mix of developed countries. Generally, PES are not suited to replacing regulatory law but rather to complementing it (Matzdorf et al., 2014). They are especially important for the organization of societally required ES provision, if property rights are not allocated, or if current property rights distribution or non-enforcement of rights do not enable meeting the societal demand for ES. It has been shown that the performance of PES depends on the institutional de-

sign. Beyond the presentation of important sets of design rules for effective governmental PES, the results yield implications for further development of governmental PES design. In particular, this involves questions for the benefits of multi-targeted and output-based PES schemes and for the integration of different actors and their knowledge in terms of providing advice as well as activating actors' knowledge. Furthermore, my results reveal various advantages and disadvantages of using PES within a policy mix, for example at the nexus of regulations and PES, and through combinations of environmental and social goals. Correspondingly, I will discuss the following four major aspects in terms of governmental PES development: (i) targeting and remuneration of PES (ii) advice on PES, (iii) functional policy interaction, and (iv) intentional policy interaction.

Targeting and remuneration of governmental PES

First, the results of Paper 1 highlight the importance of targeting payments to achieve environmental effectiveness, as both presented successful rule sets promote targeting of only one environmental goal in combination with targeting a certain area/habitat. Further, I claim that Paper 1 indicates a combination of payments that are targeted to one environmental goal and an encompassing whole-farm approach with multi-targets. The results correspond to the findings of Schader et al. (2014) who demonstrate that multi-target PES can be an efficient instrument in a policy mix. As only the whole-farm measure *organic farming* is involved in our successful rule sets and no other broad extensification measures (cf. Feehan et al., 2005), I emphasize that further research is needed on the specific design of effective multi-target governmental payments, especially on whole-farm approaches.

Second, my results generally support Moxey and White (2014) who see that improvements may not require output-based PES. It does not matter for environmental effectiveness whether payment is provided for input or output, if the relevant design rules of the shown combinations, such as spatial targeting, monitoring and flexible implementation (Paper 1), will be met. However, even if our results do not show any relevance of output-based payments, I argue that the successful rule combination of targeting plus flexible application opportunities for land users, thus, making use of farmers' knowledge and abilities (Paper 1), refers to particular properties of output-based approaches (cf. Matzdorf and Lorenz, 2010). Therefore, the second success-rule set from Paper 1 can be understood as supporting the implications of recent literature

in terms of positive correlations of output-based payments with effectiveness (Schroeder et al., 2013; Klimek et al., 2008).

Overall, I see that targeting for effective schemes may take two different forms, which can be combined in a policy mix: specific single goal/area targeting and multi-targeting. Furthermore, the output- and input-basis of payments is not mutually exclusive mixed approaches may be considerable. Thus, the different targeting and remuneration possibilities can be observed as useful aspects for an overall environmental (agri-environmental) policy mix (cf. Moxey and White, 2014; Matzdorf et al., 2014). The design of the payment must be customized to the specific socio-ecological situation. The design may depend on the degree to which external influences on the provison of ES arecontrollable and foreseeable and on who will carry the risk (cf. Matzdorf et al., 2014). Both, strongly targeted input-based as well as output-based payments would need approved causal relationships and simple, reliable indicators to monitor (Uthes and Matzdorf, 2013; cf. Burton and Schwarz, 2013). To this effect, our results show great hopes for the influence of the ES concept on the future design of governmental agri-environmental PES in the EU and US. At first, the concept has been seen as useful for framing targeting. However, Paper 3 shows that the ES concept has also been noticed as generally changing the policy focus from input- toward output-based payments, which will be discussed in the following.

Advice on governmental PES

Paper 1 underlines the importance of advice for which there are three main reasons: First, I see that economic factors can be drivers of participation in governmental PES, which often depends on transaction costs, such as information gathering and ex-ante contract signing (Mettepenningen et al., 2009). Following Schomers et al. (2015), advisory services can help to lower such transaction costs and positively impact scheme uptake. Second, I recognize that new policies for more sustainable management will demand new technical knowledge and skills of land users (Ingram and Morris, 2007). Third, I argue that social reasons can play a major role as well. In this context, Moxey and White (2014) find that PES may rather depend on awareness of the purpose and judgment of success than on the actual payment. Thus, I assume that extension services and advisory support may sensitize land users to their societal role as well as help change perceptions of the environment. Moreover, this assumption corresponds with our results, which imply that despite a

measure's high effectiveness in meeting ecological goals, the impact will be small if farmers are reluctant to adopt such measures (Paper 1).

Diverse intermediaries provide advisory services, including non-governmental organizations (NGOs), private consultancies, and governmental entities (Schomers et al., 2015; Sutherland et al., 2013)[21]. Regarding Paper 4, which highlights the importance of non-governmental intermediaries for PES in general, I see a possible strong role for civil society actors in terms of governmental PES implementation. For example, due to regional knowledge, local networks, and direct contacts with farmers, these intermediaries enjoy more trust than do government actors. Moreover, they possess site-specific knowledge, may promote new approaches, and can give advice during participation (cf. Matzdorf et al., 2014). I argue that, thus far, research on advice for governmental PES remains very basic and that it must be greatly expanded. On the one hand, it could be important to examine the different functions that an advice system can accomplish to achieve protection goals or to advertise participation (see Paper 1). On the other hand, the required advisors' skills and their formal involvement in the design and implementation are relevant as well (cf. Schomers et al., 2015; Moxey and White, 2014). In this context, the ES concept needs particular consideration to determine the extend to which it can support advice activities and institutions in terms of information costs, technical support, and social reasons, such as awareness creation through a common resource understanding or changed farmer self-concept.

Functional policy interaction

As a part of the overall environmental policy framework, governmental PES schemes interact with other public regulations in various ways. Interactions may, for example, result from certain external influences and requirements. Thus, Papers 2, 3, and 5 reveal that different policies guiding resource management strongly interact because they are segregated and are not suited to socio-ecological systems. Again, this may result in the high relevance of one

[21] For a broad range of examples see Garforth et al. (2003). For example, (i) Irish Agriculture and Food Development Authority Ireland (Teagasc), a semi-state body serving as the research, advisory and training arm of the Department of Agriculture, Food and Rural Development; (ii) Farming and Wildlife Advisory Group UK (FWAG), a not-for-profit organization providing whole-farm conservation advice; (iii) DLV Adviesgroep NV The Netherlands, a private consultancy company, created from the former governmental agricultural advisory service.

policy's governmental PES for the fulfillment of another environmental policy's goal, for example, in the case of EU water policy and agri-environmental policy interaction, where PES are essential for reaching water policy goals (cf. Paper 5). I perceive that due to segregated environmental policies, effective environmental targeting requires agency collaboration, which raisesthe question of how to better integrate policy-making. One possibility is the official inclusion of different environmental sectors in PES implementation. For example, the obligatory participation of nature protection agencies in agri-environmental payment design and implementation, revealed as one rule for success in Paper 1. These results support Prager et al.'s (2012) general assumption that collaboration can enhance implementation activities with respect to environmental effectiveness.

If formal participation and collaboration among sector agencies is not yet institutionalized, functional institutional interaction can lead toward institutional change and development in terms of new formal and informal cooperation and co-management, as shown in Paper 5. I demonstrate that inter-sectoral collaboration implies high transaction costs, especially communication costs. Opposition is often created by different perspectives and mental models (cf. Galaz, 2005). Thus, the results indicate that a common understanding of the resource and its properties is crucial to collaboration among sectors and levels. The search for common denominators for communication about and understanding of ecosystem interdependencies appears to be a good starting point for improved policy integration. Therefore, the ES concept could present a considerable tool, which will be discussed in the following. Furthermore, Biddle and Koontz (2014) suggest that collaborative processes may have a beneficial effect on environmental outcomes by linking elements of collaborative processes with outputs and outcomes. The ES concept may be considerable tool for this as well.

Intentional policy interaction

I agree that regulation is often mandatory to assure long term ecosystem and biodiversity protection. However, the involvement of governmental PES may provide many opportunities and increase flexibility. Establishing a functioning interaction between regulatory environmental law and PES is extremely challenging (Matzdorf et al., 2014). Ideally, the policy mix should integrate the particular advantages of command-and-control and PES (cf. Klassert and Möckel, 2013). Thus, Paper 2 theoretically examines the thresholds for rewarding ES provision in the case of agricultural EU and US Cross

Compliance based on institutional economics ideas, especially property rights theory. I revealed that despite the general understanding that payments should only be made for ES provisions that are not legally required, in practice, payments may be directly related to compliance with environmental law and do not fulfill the additionality premises (for Natura 2000 see also Klassert and Möckel, 2013; Matzdorf et al., 2014). Various advantages and disadvantages of such policy interactions have been presented and discussed in Paper 2. I argue that further in-depth research on the reciprocal influences of governmental PES and environmental regulation is urgently required. Therefore, on the one hand, I support Rode et al.'s (2015) call for enhanced efforts in terms of the understanding of motivation crowding effects of economic incentives. On the other hand, I suggest an enhanced compliance analysis based on Similä et al.'s (2014) focus on the knowledge, motivations, and ability of the regulated. Particularly, in terms of a farmer's position at the nexus of environmental law and agri-environmental payments, the above-mentioned topics are rarely targeted, even if a general reluctance on the part of farmers to change their habits to conform to environmental law in terms of responsibility aversion and implementation resistance has been mentioned (cf. Barnes et al., 2009, 2013). Research should especially consider both issues together, which could offer fruitful insights for optimizing the command-and-control PES policy mix.

In addition to the interplay of regulations and payments, the second intentional policy interaction revealed in Paper 2 is the combination of PES with social support policies, in the EU and US, especially farm income support. The combination of environmental and social goals is a major topic in the literature on development countries' PES (cf. Bremer et al., 2014; Ingram et al., 2014; Corbera et al., 2007)[22] but it is underrepresented in research on developed countries' governmental PES. By broadly outlining and discussing related opportunities and pitfalls, Paper 2 points to two issues in particular: On the one hand, it reveals concerns regarding the creation of environmental justifications and legitimizations for income support. On the other hand, it reveals the problem of dependence of ES provision on external (agricultural) markets or

[22] Ingram et al. (2014) summarize that in developing countries PES have been understood as a potential mechanism for poverty reduction. Thereby they see that the usefulness of PES for supporting conservation and poverty reduction is especially appealing in places where both appeared incompatible and where PES may offer new and/or additional income opportunities for poor land-holders or –users who have only few other livelihood options.

other policy decisions. Both issues may only be solved when the individual goals, both environmental and social (such as income stability), are targeted more precisely. Initial, small attempts to better target the different payments have been described by Mann and Lanz (2013) for Switzerland, that is, labeling all public transfers as targeted to single societal deliveries. To sum up, I understand that for sound governmental PES design, the payment interplay with regulations (in terms of property rights distribution), the reference point for application of the 'provider gets'-principle, and any deviations therefrom should be transparent, reasoned, and communicated to improve understanding and legitimization of the payments. To this effect, it may also be considered the extent to which the ES concept could help to make explicit which payments are made for what and why. This will be discussed in particular below.

5.2 The ES concept and governmental PES

I previously discussed my results on existing governmental PES institutional design, performance, and interplay with a focus on PES improvement. Different development perspectives have been shown, regarding different forms of and needs for environmental targeting and remuneration, possible transaction cost reduction and preference changes through advice, as well as the demand for enhanced collaboration and communication rules and processes for interlinking environmental policies. At the end of each subchapter, I have briefly mentioned the extent to which the ES concept could be considered a relevant solution for the raised issues. Thus, Paper 3 shows that ES is a concept that has been understood to shape environmental policies, especially agri-environmental policies, throughout the next decade. The concept will be used for communication, design, and indicators (cf. Paper 3). Building on this, in the following, I will deepen the discussion on the relevance of the ES concept for the development of governmental PES. This corresponds to expert demands in the interviews conducted for Paper 3: policy-relevant discussions on how the ES concept could improve pre-existing environmental policies. Broadly, I see three relevant aspects of the ES concept for existing governmental payments (defined as PES): (i) communication and cooperation for policy integration and advice (ii) definition of targets and quantification for effective and integrated PES, and (iii) valuation for renumeration and PES integration. In the discussion I will refer to each aspect of PES development raised above.

Communication and cooperation for policy integration and advice

My results indicate that the ES concept has not been understood as a radical change but as a useful option for structuring thoughts, communicating goals as well as, providing a conceptual bridge, and new rationales. My findings generally support Potschin and Haines-Young's (2011) statement on the concept's encouragement to re-examine the links among ecosystems and human well-being in a pragmatic way. In terms of goal communication, Paper 3 reveals that EU and US agricultural policies, especially existing payments, as well as PES relationship to environmental policies, will initially be influenced by the ES concept. The EU CAP already implicitly uses the ES concept for communication through focusing on public goods. Thus, the question of what the influence will look like arises. I understand that the ES concept may be increasingly used to explain and legitimize financial support for farmers (Paper 3). Hereby, special attention must be paid to the nature of the explanations. If explanations involve a more precise demonstration of who pays for what, the ES concept may trigger a more transparent payment design and greater social acceptance. If, however, the concept is only used to label existing social support payments differently by generally referring to the ES-providing character of farmers' activities, current failings will be maintained.

In terms of its conceptual bridge character, I generally agree with Jax et al. (2013), who highlight the ES concept's potential to foster and guide discourses about resource use among different actor groups. This has been confirmed by certain interviewed experts and has already started in the case of higher-level national administrative cooperation. The concept has also given new impulses for more cross-sectoral collaborations (e.g., through the USDA Office of Environmental Markets, Paper 3). Thereby, the concept of ES could provide an opportunity to make conflicting goals more coherent and to realize synergies, for example, in terms of agricultural and water policies (Hauck et al., 2013). Hence, the concept may be an appropriate tool to better integrate agri-environmental payments and environmental goals. However, the advantages of the ES concept, such as complexity reduction for higher administration levels communication and cooperation, may produce problems at the regional or local levels. Hauck et al. (2013) see limits, risks, and challenges in terms of lower level complex situations and confirm our results showing the demand 'to bring the concept down to earth' (Paper 3). In terms of providing new rationales, in principle, I see a potential to change ES providers' preferences and values. Correspondingly, Matzdorf et al. (2014) argue

that the ES concept provides an opportunity to show farmers that they not only do affect ecosystems negatively, but also actively contribute to the provision of ES. Thus, they can become more than mere aid recipients by producing social benefits (cf. Plieninger et al., 2012). Thus, the concept may provide a useful tool to organize advice and initiate governmental PES uptake. In this context, furthermore, the analysis of the ES concept's possible influence on existing strong reservations between environmental NGO's and farmers (cf. Paper 5) appears a relevant future research concern.

Overall, I understand that ES based complexity reduction on the one hand, may possibly lead to more encompassing perspectives on the other hand, in terms of higher-level resource management at the resource system or landscape level. Accordingly, I principally agree with Engel and Schaefer (2013) and Schröter et al. (2014) that emphasizing multiple ES and the trade-offs between can offer a more holistic perspective of resource management. Regarding the criticism of the ES concept's anthropocentric framing, my law analyses (Paper 3) correspond partially to Hansen et al.'s (2015) findings on existing anthropocentric ideas in planning policy. Thus, I agree that the question of whether the concept builds on existing views or really changes things remains. To this effect, my results especially confirm certain practical risks of ES concept policy integration in terms of human value changes toward commercialization of nature and neglecting economically irrelavant parts of the ecosystem.[23] These risks have already been criticized in literature and must always be carefully reflected within the communication and policy-making. Accordingly, various authors, such as Potter and Wolf (2014) for agri-environmental administrations and Fisher and Brown (2014) for conservation organizations, observe market-oriented language floating into conservation debates.

[23] Schröter et al. (2014: p. 516) clearly illustrate the controversy regarding the critique that ES is used as a conservation goal at the expense of biodiversity-based conservation and conservation strategies based on the ES concept might not safeguard biodiversity. As counter-arguments he invokes, amongst others, the overlaps acknowledged in Millennium Ecosystem Assessment (MA) and The Economics of Ecosystems and Biodiversity initiative (TEEB) as major influences for science and policy makers, growing empirical evidence on Biodiversity underpinning ES provision, as well as ES-based initiatives aim at broadening biodiversity practices.

ES targets and quantification for effective and integrated PES

Our results, together with the previous discussion, indicate that existing governmental PES as well as their integration into environmental policies require better targeting. As to that, the ES concept is closely linked to rules for identification of certain ecosystem structures and processes as policy goals. I assume that quantification in biophysical units, such as liters of purified water or tons of carbon sequestered, can capture and even visualize the services provided by nature as well as its values to humans (cf. Matzdorf et al., 2014). Explicitly captured services could be used to require effective tying of payments to the delivery of the units, making them conditional. Thereby, the use of ES quantification may enhance governmental PES independently from a change to output-based PES. The visualization of the delivery of certain units can also be monitored in input-based payments schemes or used for spatial targeting of payments. Furthermore, through quantification, specific aims, value dimensions, and possible trade-offs could be explicitly expressed (Jax et al., 2013). The quantification can help to broaden the societal legitimation of payments by showing farmers' contributions to the production of public goods, preventing hidden subsidies and promoting trust in political processes (Matzdorf et al., 2014).

Potter and Wolf (2014) critically reveal that the main focus of EU and US agri-environmental policies still does not involve scientifically sound output quantifications or output-based payments. Even if certain attempts have been conducted, they emphasize continuing debates over funding levels rather than on targeting, as well as problems with knowledge gaps and methodological challenges encountered in linking payments to outcomes. However, due to the great overall emphasis of science, policy makers, and higher-level administration on ES research and usage, I argue that the ES concept's application may provide an opportunity to shake the historical relations and commitments within the existing policy community, which shaped the evolution of administrative routines described by Potter and Wolf (2014).

Assessing ES is a highly complex task and may involve uncertainties in the levels and stability of ES provision as well as in complex feedback (Engel and Schaefer, 2013). In our results, this complexity has been considered problematic because such assessments are difficult to mainstream and convey (Paper 3). Yet, Matzdorf et al. (2014) argue that nature's complexity is currently not

comprehensible by any approach and probably never will be, and everyone who is governing resources must address it (cf. Salzmann, 2005[24]). As to that, I argue that, despite the disadvantages and pitfalls of the ES concept, the political and scientific popularity as well as the increasingly specific research and vibrant discussion of various aspects, enable extensive inter- and transdisciplinary attention to these complex problems. Accordingly, the integration of the ES concept requires much effort, especially clear rules for quantification and new paths for targeting of governmental payments as well as the verification of ES delivery and goal achievements. With respect to that, Reed et al. (2014) note that exact ES monitoring is expensive, which is why they suggest new combinations of methods, such as pressure-response functions, outcomes from process-based biophysical models, and qualitative and quantitative expert-based assessment. For enhanced modeling, the integration of existing data across all relevant governmental entities as well as the development of new approaches is required (as discussed in Paper 3). Paper 5 shows that integration of modeling may be problematic in terms of land user trust and indicates strong reservations toward science. Thus, participatory modeling (Cabrera et al. 2008) or mediated modeling (van den Belt, 2004) seem particularly promising and should be taken into account. Furthermore, research and policy makers should look at new approaches to civil society participation in monitoring, as in the integration of ES quantification or monitoring and the innovative approach of citizen science (cf. Theobald et al.; 2015; Couvet and Prevot; 2014).

ES valuation for remuneration and PES integration

Finally, I will address the question of whether rules for ES valuation and monetization improve existing governmental PES. Generally, the determination of what characterizes an ES and what is quantified implies implicit judgment of what is valued (Schröter et al., 2014). Valuation has been understood as an important part of the ES concept and its implementation (Paper 3), but it is also involved in many other decisions concerning the management of scarce resources. There are different concepts of valuation: not only econom-

[24] *"Indeed, as any environmental policy course makes clear in the first class, these are the same challenges facing any policy instrument, fiscal or regulatory, designed to conserve natural resources. In other words, regardless of the policy instrument employed—whether prescription, penalty, persuasion, property, or payment—one must determine: (1) what services need to be delivered, (2) how they are to be provided, (3) who the providers and beneficiaries are to be, and (4) how much service provision is necessary"* (Salzmann, 2005: p. 899).

ic and monetary but also non-monetary, such as socio-cultural valuation and deliberative decision making (cf. Schröter et al., 2014). Correspondingly, Engel and Schaefer (2013) suggest distinguishing between the ES concept and economic valuation, as non-monetary assessments and alternative decision support methods motivate policy makers as well. There is an ongoing, very critical discussion of whether and how ES should be valued (cf. Schröter et al., 2014; Gómez-Baggethun and Ruiz-Pérez, 2011). In terms of existing governmental PES, so far, concrete valuing of single ES has nearly no impact on payments. Most payments are detached from the ES value and paid as compensation for additional costs and lost income due to induced changes in land use practices (Plieninger et al., 2012). These amounts are paid on an average and are not calculated individually. For example, in the case of the EU agri-environmental payments, a calculation on the basis of provided ES is problematic because payments exceeding opportunity costs are prohibited. Potter and Wolf (2014) describe these as examples of second-best political compromises to address different policy problems, which can, in part, be supported by our results (Paper 2).

I argue that despite all criticism, valuation approaches have the potential to improve existing governmental PES and their integration into environmental policy. Thereby, an integrative perspective of valuation (Jax et al., 2013) should be always kept in mind, complementing economic valuation with other decision criteria and approaches (Engel and Schaefer, 2013). In particular, I understand that non-economic valuation could be useful for involving different stakeholder perceptions of ES in collaborative decision making (cf. Hauck et al., 2013). Further, I see that individual ES valuation, either monetary or otherwise, can help to increase the awareness of all stakeholders on the importance of the service to society and may support new land user self-concepts as ES providers (cf. above). A monetized value can help to raise awareness about the relative importance of ES compared to man-made services, highlight the undervaluation of positive externalities, and enable trade-off comparisons (Schröter et al., 2014). In this context, I agree with Matzdorf et al. (2014) that the general criticism of PES' economic valuation of ES, which has been characterized in developing country cases, cannot be adopted on a one-to-one basis for developed country situations with long-standing governmental PES. The latter PES use a much less questioned opportunity cost approach (cf. Engel and Schaefer, 2013) that links ES provision to the prices of products of alternative resource use and makes them dependent on market developments (Matzdorf et al., 2014). ES valuation may have the potential to

disentangle PES from markets and income support (cf. Paper 2) and to initiate justification for land user profits besides opportunity costs, especially in terms of positive external effects (Matzdorf et al., 2014). Nevertheless, I agree with Potter and Wolf (2014) that it is not likely to happen in the near future, as a powerful coalition continues to resist the idea, that environmental payments should be decoupled from farming.

Finally, I argue that my results (Paper 3) supported by findings from literature (Corbera, 2015; Gomez-Baggetun et al., 2010) show that a focus on economic valuation has the potential to narrow the perception of nature in terms of commodities. Thus, the limits of monetary valuation should always to be taken into account (cf. Potschin and Haines-Young, 2011). Against this backdrop and Noorgard's (2010) general criticism that the enthusiasm for ES is blinding us to more substantial institutional changes to significantly reduce human pressure on ecosystems, exactly when we make use of economic valuation and monetarization and for what purposes must be carefully considered.

6 Conclusions

Two central objectives were formulated to guide the research conducted in this dissertation thesis. First, I aimed to understand how existing governmental payments, defined as PES, are institutionally designed and how they perform. Second, I analyzed the relevance of the ES concept for public environmental policy, especially for PES. I refined the general research objectives into specific questions framed in terms of institutional design, performance and interplay. Regarding existing governmental PES, I analyzed the relevant institutional design principles to reach environmental goals and PES interactions with existing institutional arrangements. Regarding the ES concept, I questioned the design principles of an ES-based policy, the concept's influence on actors' preferences and values, and the concept's interactions with existing environmental policies, especially in terms of PES. Addressing the first research objective, to understand the institutional design and performance of existing governmental PES, I presented institutional design rules for environmental effective governmental PES. Combinations of targeting, application feasibility for land users, and information and advice are especially relevant. Furthermore, I showed that multi-target approaches may be beneficial, and a mix of different governmental PES can be promising. Governmental PES interact with the existing institutional arrangements, such as environmental laws. Correspondingly, I demonstrated possible effects of interplay,

for example, crowding-in and crowding-out, cross-sectoral cooperation, and new formal and informal institutions. Aiming at objective two, to understand the relevance of the ES concept for public environmental policy, especially PES, I presented institutional design principles for an ES-driven policy and showed that, so far, they are not completely included in environmental policies, yet integration is proceeding. I revealed that the ES concept was awarded a large influence on actors' perceptions, preferences, and values, leading to consideration of different ES, win–wins, and trade-offs. Policy integration of the concept requires broad horizontal and vertical interplay as well as broad cooperation. The greatest future interaction is predicted for climate and agricultural policies, especially with existing governmental payment schemes, to explain and legitimize agricultural financial support. The overall contribution of my thesis is the particular analysis of developed countries' governmental PES against the backdrop of the influence of the academic ES concept. Important individual contributions are the analysis of the interplay of existing governmental payments schemes with other policies and regulations, the development of design rule sets for successful PES, and the detailed depiction of the ES concept's influence on existing agri-environmental and environmental policies. All in all, I understand that governmental PES are an essential component of contemporary developed countries' environmental policy mix. Targeting and integrating different types of PES well is important for effective environmental governance. Furthermore, to create a sound mix with command-and-control approaches and social support policies, the property rights situation, the reference point for the application of the 'provider gets' and 'beneficiary pays' principle, and any deviations should be made transparent. Different actors must collaborate based on a common denominator for the most effective PES implementation. The ES concept can generally help to enhance communication and provide new impulses for cross-sectoral cooperation. Despite being a very complex task, ES quantification offers the opportunity to enhance targeting of governmental payments. Economic valuation and monetarization is not necessary but should not be completely neglected. An application must always be carefully considered and a narrowed perception of nature must be avoided.

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8 Annex

Paper 1: Design rules for successful governmental payments for ecosystem services: Taking agri-environmental measures in Germany as an example

Paper 2: Cross Compliance as payment for public goods? Understanding EU and US agricultural policies

Paper 3: The relevance of the ecosystem services framework for developed countries' environmental policies: A comparative case study of the US and EU

Paper 4: Multi-classification of payments for ecosystem services: How do classification characteristics relate to overall PES success?

Paper 5: Institutional change in water management collaboration: implementing the European Water Framework Directive in the German Odra river basin

Paper 1

Meyer, C., Reutter, M., Matzdorf, B., Sattler, C., Schomers, S. (2015).

Design rules for successful governmental payments for ecosystem services: Taking agri-environmental measures in Germany as an example.

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Abstract

In recent years, increasing attention has been paid to financial environmental policy instruments that have played important roles in solving agri-environmental problems throughout the world, particularly in the European Union and the United States. The ample and increasing literature on Payments for Ecosystem Services (PES) and agri-environmental measures (AEMs), generally understood as governmental PES, shows that certain single design rules may have an impact on the success of a particular measure. Based on this research, we focused on the interplay of several design rules and conducted a comparative analysis of AEMs' institutional arrangements by examining 49 German cases. We analyzed the effects of the design rules and certain rule combinations on the success of AEMs. Compliance and noncompliance with the hypothesized design rules and the success of the AEMs were surveyed by questioning the responsible agricultural administration and the AEMs' mid-term evaluators. The different rules were evaluated in regard to their necessity and sufficiency for success using Qualitative Comparative Analysis (QCA). Our results show that combinations of certain design rules such as environmental goal targeting and area targeting conditioned the success of the AEMs. Hence, we generalize design principles for AEMs and discuss implications for the general advancement of ecosystem services and the PES approach in agri-environmental policies. Moreover, we highlight the relevance of the results for governmental PES program research and design worldwide.

Keywords: Common agricultural policy; Environmental policy design; Comparative institutional analysis; Qualitative comparative analysis; Management agreements

Paper 2

Meyer, C., Matzdorf, B., Müller, K. & Schleyer, C. (2014).

Cross Compliance as payment for public goods? Understanding EU and US agricultural policies.

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Abstract
Cross Compliance (CC) is a mechanism for encouraging farmers to fulfill certain environmental conditions in return for governmental support payments. Introduced to United States (US) and European Union (EU) agricultural policy from the 80s onwards, upcoming new US (Farm Bill 2012) and EU (Common Agricultural Policy after 2013) policies will include CC. Cross Compliance is seen (i) as a policy for enforcing environmental objectives or (ii) as a way to organize and reward agricultural public good production. In recent years, the instrument's effectiveness and efficiency have been criticized. To validate the deviating understandings, we drew back on an economic institutionalist perspective. We found that regarding EU CC as payment for public goods does not generally align with the existing German property rights distribution. In both the EU and US, CC standards above those contained regulatory law have characteristics of a payment for public goods but create severe problems. We conclude that CC, even if useful for triggering and broadening environmental protection efforts, may cause several long-term problems. Therefore, the rights structure should be clearly communicated, law enforcement function should be temporary, the instrument should be included in an overall concept, and payments should be better linked to the environmental output.

Keywords: Environmental policy; Ecosystem services; Direct payments; Payments for ecosystem services; CAP; Conservation compliance

Paper 3

Matzdorf, B., Meyer, C., equal contribution (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.

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http://www.sciencedirect.com/science/article/pii/S026483771300272X

Abstract
The ecosystem services (ES) framework reveals ecosystems' benefits to society and presents a fundamental natural resource management approach. In the last several decades, it has gained increasing attention from the research community, and it recently reached the political agenda. However, does the concept have the capacity to cause institutional change in environmental policy? To answer this question, we developed certain criteria for an "ideal" ES-driven policy. Based on these criteria, we analyzed the main water and biodiversity acts, current policy developments, and future trends within the US and the EU. Our analysis shows that most acts cannot be explicitly characterized as ES-driven policies, but parts of the concept are already included. The ES framework, increasingly a driver in several policy fields, can be assumed to be a major future influence for shaping existing environmental policies in the coming decades. We discussed the results based on its strengths for existing environmental policy conceptually, e.g., cross-sector cooperation and ES win-win and trade-off considerations, and its weaknesses operationally, such as measurability and governance changes.

Keywords: Environmental law; Institutional change; Ecosystem capacity; Financial incentive instruments; Trade-offs; Cross-sector cooperation

Paper 4

Sattler, C., Trampnau, S., Schomers, S., Meyer, C., Matzdorf, B. (2013).

Multi-classification of payments for ecosystem services: How do classification characteristics relate to overall PES success?

Ecosystem Services 6, 31–45.

doi:10.1016/j.ecoser.2013.09.007
http://www.sciencedirect.com/science/article/pii/S2212041613000806

Abstract

Payments for Ecosystem Services (PES) are defined in different ways and a variety of approaches is currently summarized under the PES label. This paper introduces a system for the multi-classification of PES schemes. The classification is based on different PES characteristics and their specifications. Analyzed characteristics include, amongst others: PES type, ecosystem service paid for (e.g. types of services, if the PES tries to improve the quality of the service vs. the quantity); payments specifics (e.g. funding sources, input- vs. output-based payments, etc.); involved actors (e.g. actors from the market, government or civil society sector); duration (short or long-term), and spatial scale (local to global). The classification system is then applied to 22 PES cases from Germany and the United States (US) that were assessed as successful by expert judgment. A comparative analysis (CA) is used to investigate how certain PES characteristics relate to PES success. Results of the CA indicate that characteristics such as intermediary involvement, involvement of governmental actors, contract length, co-benefits, voluntariness in entering the PES agreement, and design of PES as output-based schemes are of particular importance for the success of PES schemes.

Keywords: PES classification; PES characteristics; PES success; Comparative analysis; Germany; USA

Paper 5

Meyer, C., Thiel, A. (2012).

Institutional change in water management collaboration: implementing the European Water Framework Directive in the German Odra river basin.

Water Policy 14, 625-646.

doi:10.2166/wp.2012.011
http://www.iwaponline.com/wp/01404/wp014040625.htm

Abstract

The Water Framework Directive (WFD) is in the process of restructuring the European water policy towards river basin management (RBM). The transposition of the WFD requires institutional change in order to comply with its substantive and procedural requirements. This paper investigates changes in water management collaboration in a federally organised Member State with regard to the configuration of involved actors and the spatial scale at which issues are considered. Based on qualitative methods, the paper presents a case study of the German Odra river basin and the governance of nutrient pollution whose origins are located all along the river and which specifically impacts coastal zones. We looked at actors most relevant to this management problem, that is, public administrations operating within different administrative boundaries, the agricultural sector and environmental non-governmental organisations (NGOs). In order to capture institutional change, a conceptual framework was constructed to evaluate changes in collaboration on three interrelated levels: formal institutional change, informal institutional change and changes in actors' mental models. We explain complex institutional change as a product of multiple dynamics, which includes the content of shared mental models and a benefit–cost calculation that takes transaction costs into consideration.

Keywords: Agricultural nutrient pollution; Coordination; Integrated water resource management; Mental models; Participation; River basin management; Transaction costs; Water administration; Water governance