Payments for Ecosystem Services as a Promising Approach for Successful Nature Conservation?

Definitions, the Role of Spatial Scales and Critique: A Systematic Literature Review

Master Thesis

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Abstract

The novel conservation approach of payments for ecosystems services (PES), often described as market-based nature conservation, enjoys an increasing popularity among scientists, politicians and civil organizations alike, while others raise concerns regarding the ecological effectiveness and social justice aspects. This systematic literature review on PES addresses three main research objectives by applying specific search terminologies using Scopus. Firstly, it is investigated, which PES definitions exist and how they differ regarding their main features. Secondly, the current state of research on the influence of spatial scales on the PES scheme effectiveness is examined. Finally, various points of criticism of this policy instrument often considered as neoliberal are systematically structured. This review points out that existing PES definitions show a large variety reaching from a *Coasean* conceptualization, describing PES as conditional and voluntary private negotiations between ES providers and ES beneficiaries, to a much broader *Pigouvian* conceptualization that assigns also e.g. government-funded and (partly) involuntary schemes to the PES approach. It turns out that the scale issue, which has so far received little attention in the literature, as well as the criticism of PES must be considered in the context of the diversity of definitions, because the review reveals many contradictions in this respect. In conclusion, a new distinct PES definition is developed providing the basis for further research. This study stresses that future research should strengthen the investigation of linkages between global, regional and local scales for the development of PES programs. Additionally, focusing on common instead of private property rights could provide novel insights to enhance local and collective governance systems for a sustainable use of resources.

Key words: Payments for ecosystem services, payments for environmental services, PES definitions, spatial scales, critique on PES, neoliberalism, sustainability

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1. Introduction

The last decades are characterized by many long-term megatrends (Naisbett & Aburdene, 1990). Whether globalization, the increasing connectivity, urbanization or digitalization – all these disruptive trends are already changing social, but also environmental systems today, and will change them even more in the future. Interconnected and globalized couplings of human-environmental systems led to rapid land use changes and environmental destructions all around the world (Lambin & Meyfroidt, 2011; Meyfroidt et al., 2013). The global population increase, growing economic activities and altering consumption patterns drive these changes, while the increasing demand for resources exacerbates local, regional and international conflicts (Hostert et al., 2016). However, analyzing the various drivers of environmental destruction and drawing causal relations is challenging due to the global telecoupling system, which designates the complex system of spatial and temporal distance between causes and effects (Friis et al., 2016).

The famous planetary boundary concept by Rockström et al. (2009) illustrates the alarming impacts of human activities on the earth system (Rockström et al., 2009; Steffen et al., 2015b). One of the transgressed boundaries, the biosphere integrity, refers to the rapid biodiversity losses and ecosystem destructions. Particularly the genetic diversity is under high pressure.

This critical state of ecosystems has sparked a debate about which environmental policy instruments are best suited to establish a socially and ecologically sustainable society. The tendency is that rather market-based instruments complement or even replace the state-driven, regulatory nature conservation (Sattler et al., 2013). This is exemplified in the monetization of ecosystems and their provided services (ES) and the related policy instruments (Gómez-Baggethun et al., 2010). The *payments for ecosystem services (PES)* approach is particularly prominent here. Although there is no consensus on which instruments can be counted to the PES approach, it is common ground that all these instruments build on positive economic incentives aiming at internalizing market externalities (McElwee et al., 2014).

PES are popular in the scientific sphere as well as in politics (McElwee et al., 2014; Sandbrook et al., 2013). In recent years, scientific publications addressing PES have increased significantly. Also, national governments as well as international organizations showed a growing interest. For example, the World Bank and the UNEP support the PES approach (Cavelier & Gray, 2012; UNEP & IUCN, 2008). Additionally, also civil conservation organizations as for example the

World Wildlife Fund (WWF) or NGOs focusing on poverty reduction like Oxfam promote such market-based environmental policy instruments (Oxfam, 2014; Duncan, 2006).

This increasing popularity of PES makes it particularly interesting to investigate the current debate on this instrument more in detail. This study builds on a systematic literature review to analyze the current debate and state of research against the background of three different research objectives. Various publications indicate that PES definitions vary widely (e.g. Wunder, 2015). For this reason, the first research objective of this study is to gather existing PES definitions and to classify them according to different key features. Additionally, existing classifications addressing PES schemes are reviewed. The second research objective focuses on the role of spatial scales for the PES program effectiveness. In a globalized world, the distances between causes and effects of environmental degradation increase and complex multi-scale interactions exist. Furthermore, different ES types provide benefits at various scales. Thus, it is of particular interest, how it is dealt with scale issues in the PES literature. The last research objective brings the critique on PES programs into focus. The supposedly neoliberal nature of market-based PES schemes is heavily criticized for various reasons. This is why this study wants to gather and classify different fields of critique systematically using an inductive approach that focuses on the term *'neoliberal'* as an entrance gate for identifying PES critique.

These three research objectives can be broken down to the following key research questions forming the starting point for this literature review:

(1) Which definitions exist for PES and how can the different PES programs be classified?

(2) Which influence does the spatial and geographical scale have on the PES scheme effectiveness?

(3) Which points of critique regarding PES programs are named in the literature?

This study is structured as follows: Firstly, an overview of the current state of the natural environment, of economic viewpoints and potential environmental policy instruments as well as of the ES approach in general is given. Secondly, the overall methodological approach of this study is introduced. Thirdly, the results of the systematic literature reviews are presented in three chapters, each addressing one research question. Every result chapter starts with a detailed description of the applied methods and search terminologies. Finally, the results are discussed in order to reveal contradictions and research gaps. In this context, a new PES definition is developed that includes a sufficient number of real-world cases for further empirical research on PES, while being narrow enough to make PES distinguishable from other environmental policy instruments.

2. Setting the Scene

2.1 The Current State of the Natural Environment

Humanity faces a wide range of challenges, which are related to the great acceleration of the last decades (Steffen et al., 2015a). Since the middle of the last century many indicators show a rapid increase driven by human activities, e.g. the gross domestic product, the global energy consumption, the urban growth or the fertilizer use for agricultural use (ibid.: 84). These changes emerge at a rapid pace that has never before been observed in the history of humankind. The increasing consumption level, especially of countries in the Global North, has alarming impacts on the natural environment. Some authors argue that these human interventions open a new geological era, which they call the Anthropocene (Crutzen, 2002). The changes of our natural environment appear all over the world at different geographical scales. The famous planetary boundary concept, developed by Johan Rockström et al. in 2009, summarizes the pressure on the natural environment systematically. The boundaries represent probability thresholds for an irreversible collapse of earth system components. The update of this study stresses that three of the nine mentioned planetary boundaries have already been transgressed (Steffen et al., 2015b). Besides biochemical flows of nitrogen and phosphorus, the deterioration of the biosphere integrity, especially the genetic diversity, has also reached an alarming state. Additionally, the climate and the land system are under high pressure, even though the boundaries have not yet been crossed. All these entities are interconnected, making it even more difficult to estimate future trends.

Focusing on the world's ecosystems and the biosphere integrity, the risks and challenges are manifold (MEA, 2005). Our ecosystems come under high pressure caused by rapid land use and land cover changes (Foley et al., 2005; Ramankutty & Coomes, 2016), by climate change or by increasing biochemical flows produced by the agriculture (Steffen et al., 2015b). The land use change of the last centuries and the accelerating economic and societal changes in the last decades play a central role for the degradation of ecosystems and their provided services (Hostert et al., 2016). Whereas 300 years ago wilderness areas covered half of the terrestrial biosphere and seminatural areas 45% of the remainder, in the year 2000 more than a half of the terrestrial areas were used for agriculture or settlements (Ellis et al., 2013; Ellis et al., 2010). The approach of *Human Appropriation of Net Primary Production* (HANPP) developed by Helmut Haberl and colleagues emphasizes the increasing use of our biosphere by humans (Haberl et al., 2014). Approximately one third of the total net primary production (NPP) is recently appropriated by humans (ibid.). Additionally, land use change induces the loss and gain of forest cover. From 2000 to 2012, a forest-area of 2.3 million km^2 were lost contrasted by a gain of 0.8 million km^2 within the same period (Hansen et al., 2013: 850). Particularly tropical forests have been showing a critical rate of forest loss in the last years (ibid.). This high land use intensity pressures not only ecosystems directly, but it also triggers climate warming, since ca. 35% of the anthropogenic CO_2 emissions have been directly caused by land use since 1850 (Houghton & Hackler, 2001). Furthermore, the rising land use intensity leads to an increase of the extinction rates, thereby threatening the global biodiversity. Estimates for extinction rates are difficult to assess, e.g. due to a gap of knowledge about the current number of species (Steffen et al., 2015b). However, it is assumed that "current rates of extinction are about 1000 times the likely background rate of extinction" (Pimm et al., 2014: 988).

Thus, the land use induced modifications, losses and fragmentations of habitats push our ecosystems into a dangerous state. Yet, humanity depends on these biosphere resources on an ever-increasing share, since the earth's natural base provides us with important resources such as food, freshwater or timber (Foley et al., 2005). Additionally, the biosphere of the earth is irreplaceable for climate regulation and a good air quality (West et al., 2011).

Therefore, there is a great necessity to develop policy instruments to stop further losses of the biosphere and the genetic diversity. Otherwise, abrupt changes of our natural environment driven by the transgression of tipping points will become more likely with dangerous consequences for humanity (Schellnhuber, 2009). However, developing sustainable pathways is a challenging task in a globalized world, where the distances between production and consumption increase (Hostert et al., 2016; Lambin & Meyfroidt, 2011). Drivers of the land use changes are often located in a far distance, making it very complex to analyze connections and telecouplings (Friis et al., 2016). Additionally, leakage and displacement effects in land use complicate the development of approaches for an effective and sustainable global land use governance even further (Meyfroidt et al., 2013).

Concluding, it must be emphasized that there is an urgent need for instruments that ensure a successful environmental governance by connecting local conditions with the global environmental challenges taking social and political concerns into account.

2.2 Environmental Challenges from an Economic Viewpoint

Already decades ago economists argued that the causes for environmental problems are to be found in market failures (Baumol & Oates, 1975; Pigou, 1920). In this view, which is strongly influenced by the *Environmental Economics* school, environmental problems are market externalities, since negative, but also positive environmental effects of economic activity are not reflected in market prices (Perman, 2003). This leads to defective allocations of resources "among contemporaries and across the generations" (Dasgupta, 2010: 5025). Weakly or not defined property rights for natural capital and its provided services are considered causal for this (ibid.). Some of the natural capital is easy to commodify and is bought and sold on markets already, such as timber or minerals. However, even those resources are not necessarily privately owned and instead e.g. managed as commons (Ostrom, 1990). For other properties, the enforcement of property rights is generally difficult, if not impossible. It is distinguished between public goods, which are non-excludable and non-rival for users, and common-pool resources, which are non-excludable as well, but rival (Perman, 2003). The former category of goods includes e.g. clean air, the latter for example an open-access meadow used for grazing. Besides these two categories, there are also excludable and rivalrous private goods as well as club goods, which are excludable, but non-rivalrous.

50 years ago Garrett Hardin published his essay "The Tragedy of the Commons", which addresses the social dilemma regarding the degradation of common-pool resources (Hardin, 1968). He assumes that the users of such resources are pure profit-maximizers, leading eventually to an overuse of resources and to a collapse of the ecosystems. Hardin argues that only privatization or governmental regulations alongside his highly controversial recommendation for population control measures can guarantee a sustainable use of resources. His view is contrasted by Elinor Ostrom´s research on the governing of the commons (Ostrom, 1990). While Hardin assumes that "there is no communication and no cooperation and the commoners have no regard for the future" (Hamill & Hilbert, 2016: 216), Ostrom describes by means of different cases that many common-pool resources have been managed sustainably for centuries (Ostrom, 1990). Cooperation and the local implementation of rules and institutions play a key role for a successful resource use (Ghorbani & Bravo, 2016; ibid.).

2.3 Policy Instruments for Environmental Protection

A variety of policy instruments exists to address environmental problems. These instruments are developed to overcome market and institutional failures. James Salzman put forward a classification of environmental policy instruments, *'The Five P's'* (Salzman, 2013). Salzman's "'Five P's' include **P**rescriptive Regulation, **P**roperty Rights, [financial] **P**enalties, **P**ayments, and **P**ersuasion" (Salzman, 2013: 364) and are described as follows.

Firstly, there are **prescriptive regulations**, which are regulatory instruments that count to the traditional state-driven command-and-control instruments, "the most direct and common form of environmental law" (Salzman, 2013: 364). The state establishes prescriptions that force certain behavior by implementing laws and provisions (Swallow et al., 2007). Examples are proclamations for national parks, or statutory thresholds to limit the nitrogen oxide emissions. However, economists often see disadvantages due to inefficiencies in the minimization of costs (Goulder & Parry, 2008). These inefficiencies are caused by "information problems faced by regulators as well as limitations in the ability of these instruments to optimally engage the various channels for emissions reductions" (Goulder and Parry, 2008: 157). Notably, economic efficiency is particularly central in *Neoclassical Economics*. There are also diverging views on this topic, which will be considered later in this thesis (s. chapter 6, p. 48).

Secondly, Salzman names **property rights** as further policy instrument for environmental protection. Proponents argue that in this case "previous incentives to consume the resource as fast as possible (before everyone else does) is no longer relevant", because "to maximize profits you will safeguard your asset over the longer term" (Salzman, 2013: 366). This idea is especially connected with the *Free Market Environmentalism* aiming at the replacement of regulatory prohibitions by property rights to enhance the resource-allocation (Anderson & Leal, 2001). Yet, many obstacles are mentioned in the literature such as difficulties in commodifying public goods and common-pool resources in praxis, the ignorance of positive externalities by the landholders or equity concerns regarding the distribution of property rights (Gómez-Baggethun & Ruiz-Pérez, 2011; Kosoy & Corbera, 2010; Salzman, 2013).

Tradable permits can be seen as a hybrid instrument of prescriptive regulations and property rights (Salzman, 2013). Here, property rights address the resource use via certificates. A classic example of such tradable permits are CO_2 emission trading schemes, e.g. the *European Union Emission Trading Scheme* (Bertrand, 2012). Still, the government determines thresholds for pollution, but a market regulates the distribution of the pollution rights via the tradable permits. Thus, this instrument aims at incentivizing an over-comply of environmental protection actions for actors "who can control pollution at low cost" (Salzman, 2013: 369). However, as the case for private property instruments in general, tradable permits need well-defined goods and enough sellers and buyers to form an operating market. Additionally, there are concerns about the distribution of emissions – in some cases emission hotspots raise questions regarding the environmental justice (Kaswan, 1997).

A further environmental policy instrument is the option of **financial penalties**. They make environmentally harmful behavior more expensive and internalize negative externalities by the implementation of charges, taxes, or liabilities (Salzman, 2013). Thus, financial penalties build on the *'polluter pays principle'* (Dasgupta, 2010). Pioneer of this approach was Arthur Cecil Pigou (Pigou, 1920), who developed the Pigouvian tax ensuring "that each actor has a direct incentive to regulate her own behavior according to how valuable the polluting activities are" (Salzman, 2013: 371). However, for the regulator it is difficult to determine the right tax level to maximize social welfare (Goulder & Parry, 2008; Goulder & Schein, 2013). Furthermore, the acceptance for such instruments is generally low (Salzman, 2013).

Fourthly, governments can introduce **financial payments** to promote pro-environmental behavior, e.g. via subsidies (Salzman, 2013). Thus, environmentally positive activities get cheaper, reflecting the *'beneficiary pays principle'* (Pirard, 2012).

Finally, **persuasions** represent a soft but commonly used instrument in environmental policy (Salzman, 2013). This instrument aims at changing the behavior of individuals by providing information on opportunities for environmentally friendly actions. One example is the *Global Action Program on Education for Sustainable Development* (UNESCO, 2018). "Naming-and-shaming" campaigns can be counted to this approach, too (Lambin et al., 2014). Such approaches are often used if the political support for other instruments is low.

Box 1: Practice examples of the Five P's

Prescriptive regulations:
National park 'Bayerischer Wald' (Germany)

Property rights:
The agreement on Exclusive Economic Zones (EEZ) generated national property rights to coastal waters with previously open access (United Nations, 1982)

Financial penalties:
Introduction of a CO_2 tax as e.g. in Sweden

Financial payments:
Agricultural subsidies by the European Union

Persuasion:
Global Action Program on Education for Sustainable Development by the UNESCO

Icon source: https://www.iconfinder.com/search/

2.4 The Ecosystem Service Approach

2.4.1 What are Ecosystem Services?

Ecologists define an ecosystem as "an interacting set of plant and animal populations and their abiotic, non-living, environment" (Perman, 2003: 8). In this view, the ecosystem can be economically classified as stock or natural capital (Costanza et al., 2014). The ecosystem provides flows, the *ecosystem services* (ES). In the *Millenium Ecosystem Assessment* it is stated that "ecosystem services are benefits that people obtain from ecosystems" (MEA, 2005: V). This thinking can be illustrated by the simple example of a forest area. The biomass of a woodland forms the ecosystem and thus the nature capital. This woodland generates flows, the ES: Forests support the water and air purification, conserve plant and animal species, generate recreational values, fix CO_2 and so forth. It is important to mention that "[these] functions or processes become services if there are humans that benefit from them" (Fisher et al., 2007: 5). Thus, the concept is based on a very anthropocentric point of view.

Box 2: Example – Ecosystem services provided by non-managed humid forests

Provisioning services:
drinking water supply

Regulating services:
CO_2 sequestration, water & air purification, flood protection

Cultural services:
tourism and recreation, aesthetic values

Supporting services:
protection of biodiversity

A well-known classification for ES is provided by the Millennium Ecosystem Assessment: "provisioning services such as food, water, timber, and fiber; regulating services that affect climate, floods, disease, wastes, and water quality; cultural services that provide recreational, aesthetic, and spiritual benefits; and supporting services such as soil formation, photosynthesis, and nutrient cycling" (MEA, 2005: V; s. box 2, p. 8).

Robert Costanza suggests that the different services can also be differentiated based on their spatial characteristics. For example, forests contribute to climate regulation through carbon sequestration and storage and thus provide benefits for humans globally, "since the spatial location of carbon sequestration does not matter" (Costanza, 2008: 351). He calls such global ES *'non-proximal'*. In contrast, water regulating services are *'local proximal'* and directional flow related along the water stream. Over the last decades, many additional classification schemes have been developed (Fisher et al., 2007).

In the literature, two terms – ecosystem services and environmental services – are used. This raises the question, if there are differences between them. Some authors use both terms interchangeably, as for example Derissen & Latacz-Lohmann (2013) mention in their paper. However, there is also the interpretation "that ecosystem services is a subcategory of [environmental services], dealing exclusively with human benefits derived from natural ecosystems. Environmental services also comprise benefits associated with different types of actively managed ecosystems, such as sustainable agricultural practices and rural landscapes" (Muradian et al., 2010: 1202). Derissen & Latacz-Lohmann (2013) see them as two distinct categories without hierarchy and add that environmental services can be provided by the actively managed environment either intentionally or unintentionally. Wunder (2005: 4) states that "[the term ecosystem services] probably has a more integral interpretation, implying that multiple services cannot always be broken up into additive components". Myers (1996: 2764) uses the scale as distinction criterion and states that "[the] term environmental services […] embraces the larger-scale and often more important services". Hence, there is no clear consensus on the differences between these two terms.

Whether environmental or ecosystem services, both contribute strongly to economic and social stability. Ecosystems provide many services and contribute also to climate stability through their carbon storage capacity. The *Stern Review* provides an assessment of potential effects of climate change on the economic activity (Stern, 2006). Stern estimates that an undamped increase of the global temperature could lead to a decline of the world`s gross domestic product by at least 5% each year (Stern, 2006: vi). However, providing statistical evidence for the relationship between global temperature and economic production is challenging (Burke et al., 2015). Of course, also various other ES have direct influences on the economic activity. A study of the International Union for Conservation of Nature (IUCN) estimates that the global ES in total contributed with 125 to 145 trillion US$ to the world's economy in 2011 (Costanza et al., 2014).

Many scholars criticize that these services are insufficiently considered in the economic systems leading to an underprovision of ES "due to their lack of value in the marketplace" (Jenkins et al., 2010: 1060). Thus, ES are economically seen as externalities (Gómez-Baggethun & Ruiz-Pérez, 2011). ES can also be classified by excludability and rivalry (s. tab. 1, p. 10). Most regulatory or cultural ES are labeled as public goods and some provisioning services as open access resources respectively common pool resources. Many, but not all provisioning services are private goods.

Tab. 1: Classification of ecosystem services according to their excludability and rivalry; adaption based on Costanza, 2008: 351)

	Excludable	Non-excludable
Rival	Market goods and services (most provisioning services)	Open access resources (some provisioning services)
Non-rival	Club goods (some recreation services)	Public goods and services (most regulatory and cultural services)

Thus, environmental politics often deal with the question of how to halt further degradation of regulatory and cultural ES, when excludability is not given. The next subchapters address the development of the ES approach in the context of other environmental protection instruments (s. chapter 2.4.2, p. 10) and monetary valuation techniques of ES (s. chapter 2.4.3, p. 12).

2.4.2 Development of the Ecosystem Service Approach in the Policy Arena

The purpose behind propagating the ES approach has changed strongly in the last decades. However, basic concepts for nature capital have been existing for a long time already (Diswandi, 2017; Gómez-Baggethun et al., 2010). The term *'ecosystem service'* was introduced in the 1970s (Ehrlich & Ehrlich, 1981; Westman, 1977). The approach was first developed as a communication tool and "as a metaphor to reflect societal dependence on ecosystems" (Gomez-Baggethun & Ruiz-Perez, 2011: 1; Norgaard, 2010). Hence, at the beginning the ES approach was part of a persuasion strategy (s. chapter 2.3, p. 6). Over the next decades, the focus of this approach shifted away from purely pedagogic objectives. Instead, the ES approach became more and more connected with the promotion of market-based instruments to halt the degradation of ES (Peterson et al., 2010), even though there is no common understanding of the term *market-based* (s. chapter 4.1.2.5, p. 28). In the 1990s a mainstreaming of ES was observable including an advancement of valuation methods to assess ES in monetary terms (Costanza et al., 1997; Daily, 1997). The publication of the *Millennium Ecosystem*

Assessment in 2005 put ES on the broader policy agenda and led to a strong rise of scientific publications about this approach in the following years (MEA, 2005; Sattler & Matzdorf, 2013). On the European level the study "The Economics of Ecosystems and Biodiversity" gained attention (TEEB, 2010).

Two interacting developments within the ES debate are observable. On one hand, there is a trend to develop new and better methods to valorize and monetize ES (s. chapter 2.4.3, p. 12). On the other hand, the interest in market-based instruments taking the assessed monetary ES values as basis, has increased. Whereas in the *Classical Economics* benefits from nature had been seen as pure use values, with the rise of *Neoclassical Economics* ES have become increasingly incorporated into the economic system as exchange values (Gómez-Baggethun et al., 2010). Thereby, the benefits of ecosystems get internalized in economic markets that build on the substitutability of goods and services (ibid.). Especially the research field of *Environmental and Resource Economics* carried this neoclassical thinking into environmental policy making by promoting the internalization of environmental externalities since the 1960s (Scales, 2015; Turner et al., 1994).

In the last two decades this novel view on nature capital and its benefits has led to a new paradigm promoting market-based environmental policy instruments that "cash ecosystem services as commodities on potential markets" (Gómez-Baggethun et al., 2010: 1209).

Gómez-Baggethun and colleagues (2010: 7) summarize the development of the ES approach as follows: Firstly, from 1960s to the 1990s, an utilitarian framing of ecosystem functions as services took place. Secondly, since the 1990s an increasing monetization of ES is observable, in conjunction with the articulation of benefits from nature in exchange values. Thirdly, since the 2000s the appropriation of ES and the promotion of clear property rights on ecosystems by international organizations and politics boosted. Subsequently, the active exchange of ES was facilitated by creating institutional structures. The last step was the development of the payments for ecosystem service approach (PES), which was first mentioned at the beginning of this century (de Camino & Al, 2000).

2.4.3 Valuation Methods

Quantification and valuation techniques are important prerequisites for the development of ES-based policy instruments. The valuation of ES is mostly based on the *Total Economic Value* (TEV) approach (Heal et al., 2005). The TEV is composed of use values, including direct, indirect and option values, as well as non-use values (Pagiola et al., 2004; s. fig. 1, p. 12). Direct use values contain consumptive and non-consumptive uses. The former considers especially provisioning services often under private ownership, such as timber or agricultural products (Grunewald & Bastian, 2013). These services are relatively easy to valuate using the market price method, since there are mostly "observable quantities of products whose prices can usually also be observed in the market-place" (Pagiola et al., 2004: 10; Grunewald & Bastian, 2013). Non-consumptive values include benefits that people obtain by visiting an ecosystem and enjoying recreational and cultural activities there (Pagiola et al., 2004). The valuation of recreation refers often to the number of visitors (Grunewald & Bastian, 2013). The assessment of benefits that are received by the visitors is much more challenging and often based on surveys that query travel costs or "their stated willingness to pay to visit particular sites" (Pagiola et al., 2004: 10).

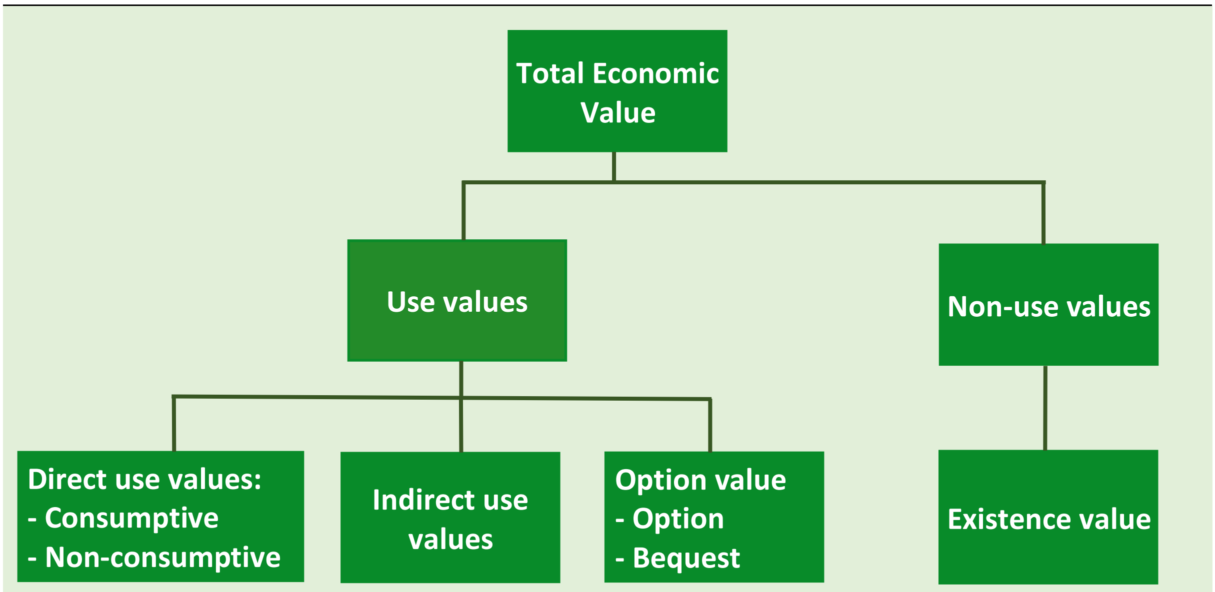

Fig. 1: Value types of ecosystem services that build the Total Economic Value; adaption based on Pagiola et al., 2004: 9.

Indirect use values can broadly be assigned to regulating services from which people obtain benefits outside the ecosystem itself, as e.g. water purification services by wetlands or carbon sequestration services by forests. These values are often more difficult to quantify. It is particularly challenging that these goods are rarely reflected in market prices and often categorized as public goods and services (s. chapter 2.4.1, p. 8). These values are often assessed by using cost-based or revealed preference methods (Gómez-Baggethun et al., 2010). Cost-based methods use for example opportunity costs as a proxy, which describe the loss of values due to the renunciation of more commercial forms of land use for reasons of ES conservation (Pagiola et al., 2004). Also replacement costs can be used as a proxy, describing the costs that accrue from applying a technical solution to provide the service instead (Grunewald & Bastian, 2013). Revealed preference methods use the substitutional relationship between traded goods and non-traded public goods – e.g. the hedonic pricing method uses often the price of real estates as indicator for the surrounding public goods (Atkinson & Mourato, 2008).

Option values are often part of provisioning, regulating and cultural services (Pagiola et al., 2004). These values "are derived from preserving the option to use in the future ecosystem goods and services that may not be used at present, either by oneself (option value) or by others/heirs (bequest value)" (Pagiola et al., 2004: 10). Here, the stated preference method is often applied, which is based on surveys on the willingness to pay for securing the ES for the future (Atkinson & Mourato, 2008).

Non-use values are assigned to existence values, which are related to the willingness to pay for protecting nature for its own sake. There are approaches to assess these values by surveys (Kost & Schönewald, 2015), but the results are highly dependent on the particular ecosystem and the target group.

The TEV adds all these different values of an ES up. However, for the reason of simplification policy instruments are often based on specific ES and values that are easy to assess. There are various points of critique regarding these simplifications and the valorization of ES in general. This topic will be addressed later in this thesis (s. chapter 6, p. 48).

3. Overview of the Methodology

The centerpiece of the methodology of this thesis are key term searches using the literature database Scopus. A summary of all methodological steps is presented in a flow chart on the next page (fig. 2, p. 15).

The first methodological step of this research procedure built on an unsystematic pre-analysis of publications that focus on the PES concept itself, the recent implementation status, the role of spatial and geographical scale and critique of the PES approach. Fifteen publications were chosen based on the author´s expert knowledge and subsequently reviewed and excerpted (s. appendix, tab I, p. 87). The number of pre-assessed publications is relatively low, because this study is designed as a pilot study and thus does not aim for a comprehensive quantity of pre-analyzed papers. Subsequently, a list of various text passages referring to the key topic of this thesis was compiled. Based on a mind mapping of these information a detailed structuring of this study was developed. The main aim of this structuring process was to develop useful search terminologies for the systematic literature review. These systematic reviews merely focused on scientific papers in English language. More information about the different search terminologies and how they were developed are given in the introducing method descriptions of each chapter and in the summarizing flow chart on the next page (fig. 2, p. 15).

As a next step, the results presented by the Scopus search engine were pre-reviewed. This means that relevant papers were identified by reviewing the abstracts or, if the search terminology implied full-text assessments, by reviewing the whole paper focusing on the search terms. This procedure follows the PRISMA guideline (Moher et al., 2009). Subsequently, relevant papers were downloaded and imported in the reference manager Mendeley. The next step was a full-text review of these publications. All relevant text sections were highlighted and transferred into an Excel sheet[1]. All the transferred text sections of each publication were collected in a row with the authors' names, the year of publication and an identification number. The result were structured lists of relevant text sections for each research question. The different sections were labeled by assigning key words or phrases describing the main content. Finally, the structure of each result chapter was developed. This included two steps: Firstly, a storyline was mapped out by bringing the key terms into a comprehensible order. Secondly, the relevant text sections were allocated using the identification numbers.

[1] All Excel sheets are accessible in the digital supplement of this thesis

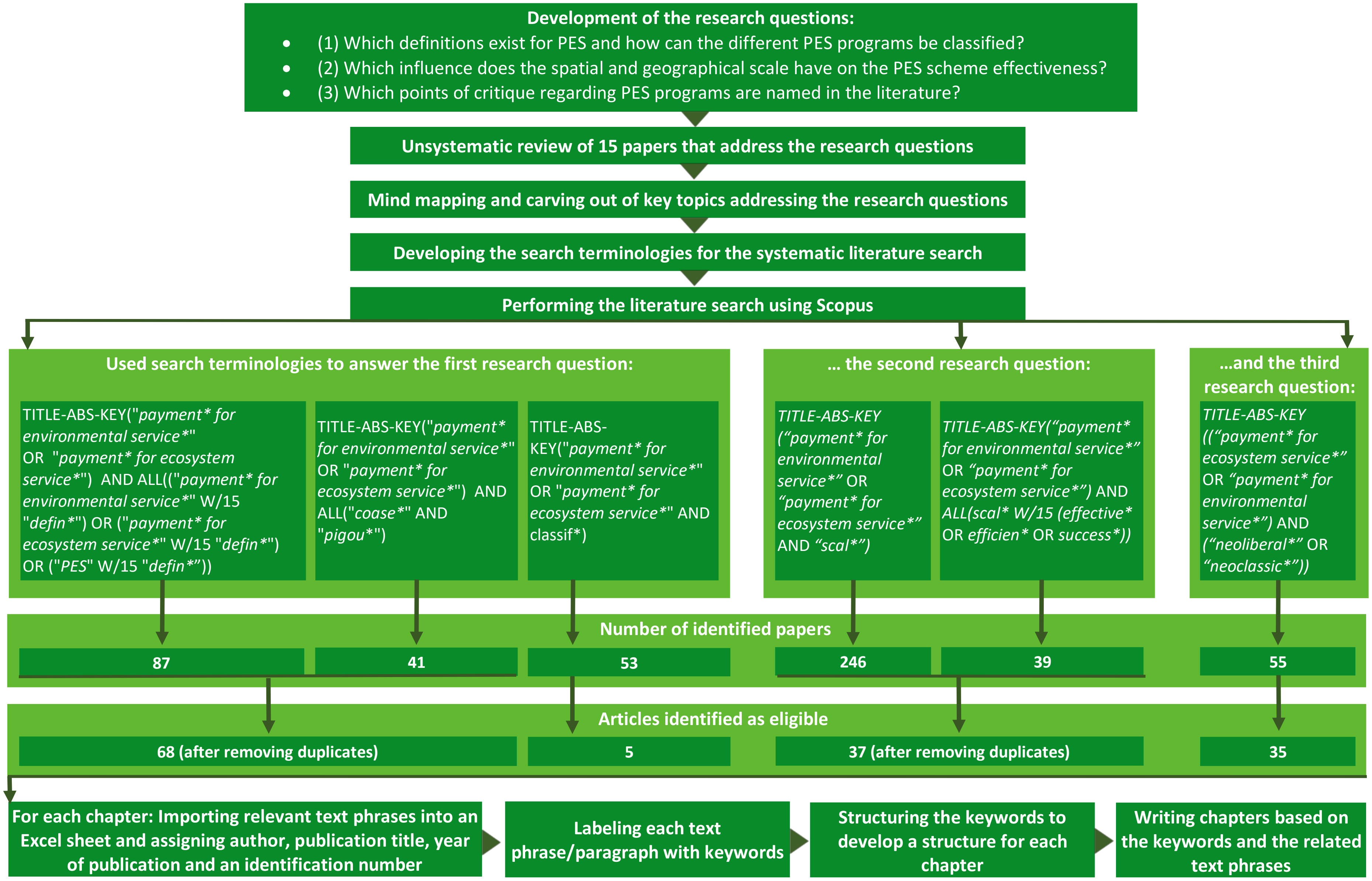

Fig. 2: Methodological steps of this study

4. Payments for Ecosystem Services: Definitions, Classifications and Status Quo of Payment Scheme Implementation

In the last 20 years, an increasing popularity of the PES concept in the scientific literature as well as among practitioners has been observable. Many scholars assign this approach to the so-called market-based instruments. However, there are debates about the market-closeness of real world PES programs and more in general, about how PES should be defined. According to Salzmans' policy instrument classification (s. chapter 2.3, p. 6), the PES approach cannot be assigned to one single instrument category explicitly. Instead, PES combine different features, e.g. financial payments and the creation of property rights. PES often build on the appropriation and commodification of ES and the translation of benefits from nature in exchange values (Gómez-Baggethun et al., 2010; Gómez-Baggethun & Ruiz-Pérez, 2011). The idea of PES was initially introduced in developing countries with weak institutions that hinder the implementation of classical command and control policies (Sattler et al., 2013). However, in the last years the instrument has become popular in countries of the Global North as well, but rather as an add-on than as a substitute for classical command and control policies (Engel et al., 2008).

This chapter aims at providing a systematic overview of existing PES definitions in the academic literature and related debates. The systematization of definitions builds the centerpiece of this thesis. Additionally, in this chapter a closer look at classifications and the status quo of existing PES programs is taken.

4.1 Defining Payments for Ecosystem Services

4.1.1 Methods

This chapter follows two approaches to systematically assess the scientific literature. On one hand, the PES term was combined with the word stem *'defin*'* to include the terms *'definition'* and *'define'* as well as further variations:

> *TITLE-ABS-KEY("payment* for environmental service*" OR "payment* for ecosystem service*") AND ALL(("payment* for environmental service*" W/15 "defin*") OR ("payment* for ecosystem service*" W/15 "defin*") OR ("PES" W/15 "defin*"))*

The distance between PES and *'defin*'* was set at a maximum of 15 words. This number is based on a statement of Elsevier, according to which an average sentence in scientific papers counts 12 to 17 words, which leads to a rounded up mean of 15 words (Elsevier, 2015). Both terms *'payments for ecosystem services'* as well as *'payments for environmental services'* are included in the search terminology due to the commonly interchangeable usage (Derissen & Latacz-Lohmann, 2013; Souza et al., 2016). Additionally, the abbreviation *'PES'* was considered.

In a second step, the Scopus search engine was used to search for publications combining PES with the terms *'Coase*'* and *'Pigou*'*, since the non-systematic pre-literature review indicated the importance of a *Cosean* as well as a *Pigouvian* conceptualization of PES:

> *TITLE-ABS-KEY(("payment* for environmental service*" OR "payment* for ecosystem service*") AND ALL("coase*" AND "pigou*"))*

Detailed information on the search terminology as well as on the number of assessed and for a detailed review selected papers are presented in figure 3 (p. 18). The paper selection was based on the PRISMA guideline and checklist (Moher et al., 2009).

The first search provided 87 papers in total, out of which 19 publications were not accessible due to paywalls. Most of them were published later than 2010. The second search terminology, combining PES with the terms *'Coase*'* and *'Pigou*'*, resulted in a total number of 41 papers, out of which 34 were downloaded, while seven papers were not accessible due to paywalls.

After removing duplicates, a total number of 93 publications provided the basis for the full-text assessment. Afterwards, 25 of them were excluded due to a lack of relevance regarding the research question. The full-text review of relevant publications followed the procedure described in the methodology chapter (s. chapter 3, p. 14). Not all these publications are cited in the result chapter due to content doublings. Furthermore, the results chapter refers to 25 additional publications, which are included based on references in the previously detected publications.

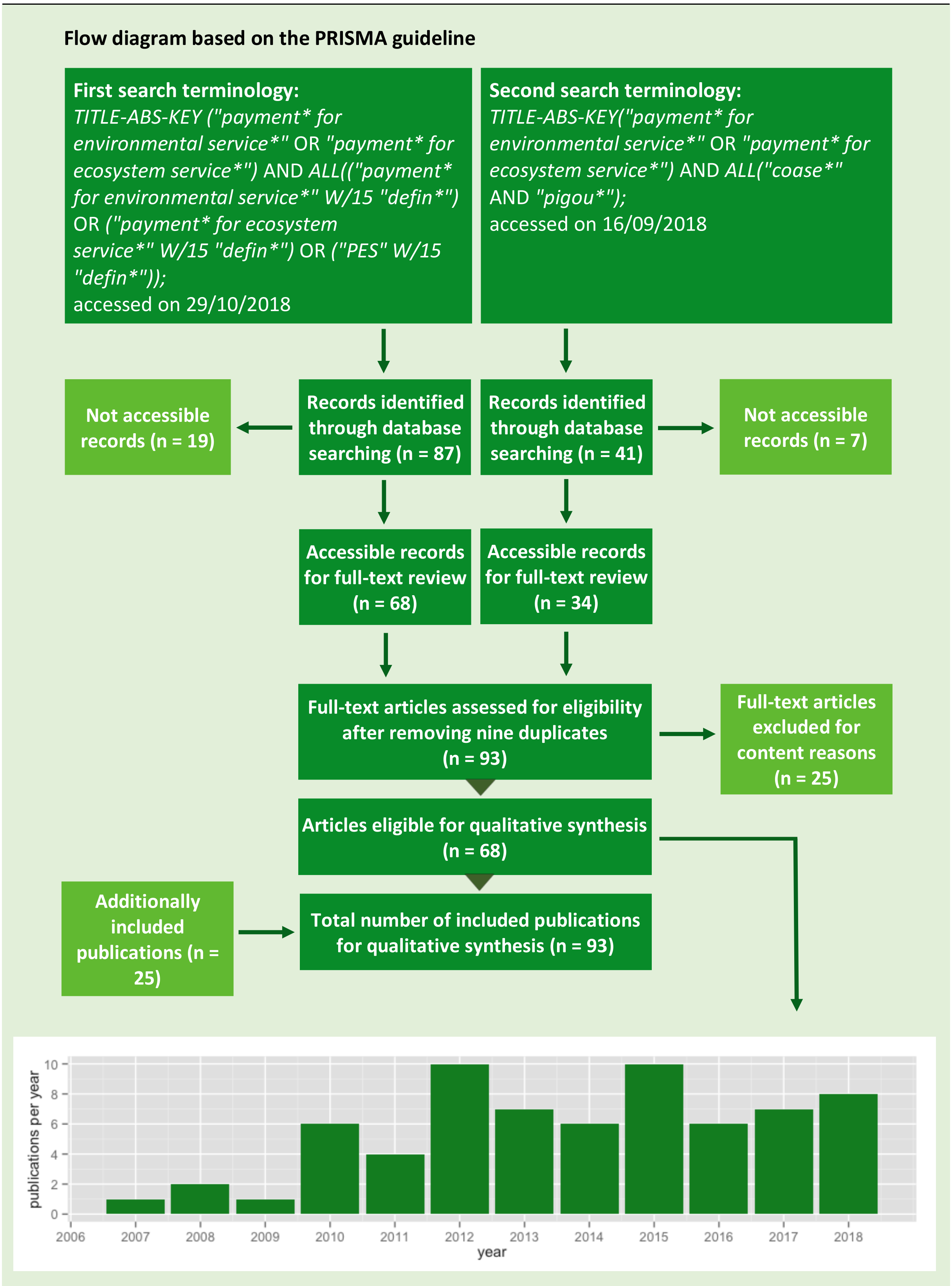

Fig. 3: Search terminologies and quantitative overview of the results: PES definitions

4.1.2 Results

Considering the different existing PES definitions is central to understanding the PES approach and its reception in science. The literature search revealed that there is an ongoing controversial debate about PES conceptualizations, as the high number of 68 eligible publications shows. By far most of these publications are published after 2009 with peaks in 2012 and 2015, even though the first precise conceptualizations had been developed years before. In the following, the key definitions, main features and important terms are summarized and systemized.

4.1.2.1 Payments for Ecosystem Services versus Payments for Environmental Services

In the scientific literature, some authors use the term *payments for ecosystem services*, while others use *payments for environmental services.* There is no consensus about the interpretation of the terms (s. chapter 2.4.1, p. 8), which is why this study includes both terms in the literature search.

Figure 4 shows the total numbers of publications that have been published each year separated by both terms. Whereas the term *payments for environmental services* was more often used until 2010, the distribution reversed later. Generally, a strong increase of publications is observable between 2006 and 2013, followed by a levelling off in recent years.

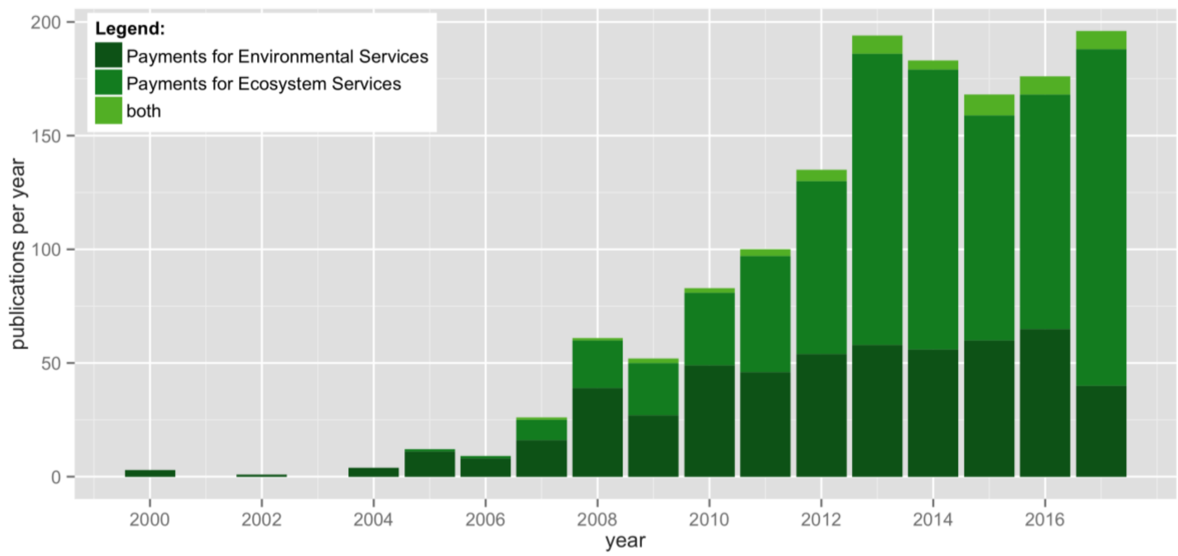

Fig. 4: Number of publications including 'Payments for Environmental Services', 'Payments for Ecosystem Services' or both terms from 2000 to 2018. Search engine: Scopus. Search in: title, abstract and keywords. Search date: 09/13/2018.

4.1.2.2 The Coasean View on PES

The literature search results evince various PES definitions. Sven Wunder (2005: 3) published the most famous definition and described PES as:

"(1) [...] voluntary transaction[s] where

(2) a well-defined service (or a land-use likely to secure that service)

(3) is being 'bought' by a (minimum one) ES buyer

(4) from a (minimum one) ES provider

(5) if and only if the ES provider secures ES provision (conditionality)."

His definition shows a market-closeness and strongly connects PES with the *Coase theorem*. The theorem recommends using direct and market-like voluntary and decentralized transactions between the involved actors to internalize externalities in the most efficient way to reach the social optimum (Coase, 1960). It implies that providers and users of ES enter private negotiations to sell respectively buy "a bundle of use rights over ES" (Matzdorf et al., 2013: 58) to realize the internalization of positive ES externalities. In his modified definition from 2015 he specifies that ES buyers are ES users (Wunder, 2015). The Vittel PES scheme in France is often mentioned as a famous *Coasean* PES program (Perrot-Maître, 2013; Thompson, 2018). The mineral water company pays upland farmers for the non-use of agrochemicals that would otherwise pollute the water (s. box 3 for details, p. 21). Conditionality is a central criterion of such private negotiations, because the transaction happens "if and only if the ES provider secures ES provision" (Wunder, 2005: 3). The whole conception of PES is very much inspired by neoclassical concepts that also play a crucial role within *Environmental Economics* – an economic school that recommends private negotiations as efficient resource allocation strategy (Gómez-Baggethun et al., 2010; Tacconi, 2012). Generally, PES are based on the *provider gets* and *beneficiary pays principle*, which separates PES schemes from e.g. environmental taxation (Pattanayak et al., 2010). These principles imply that the ES beneficiary's *willingness to pay* is equal or higher the ES provider´s *willingness to accept* for securing ES provision by applying a specific land use practice (Martin-Ortega et al., 2012). Often, the willingness to accept corresponds strongly with direct costs for ES provision as well as with opportunity costs (Ferraro, 2008). Opportunity costs are additional costs that result from the implementation of a specific ES providing alternative land-use practice, which leads to a loss of income due to neglecting more profitable land use practices (Shelley, 2011; s. chapter 2.4.3, p. 12).

However, only very few PES schemes are in accordance with the definition of Wunder (2005), e.g. the schemes are seldom fully voluntary for all parties involved (Vatn et al., 2010). Furthermore, many PES schemes face the problem of poorly defined property rights, power imbalances and high transaction costs (Grima et al., 2018). Transaction costs include costs "used to define, establish, maintain and transfer property rights" (McCann et al., 2005: 530). These costs also occur from the necessary development or adaptions of institutions, which facilitate and guarantee the transfer between ES providers and beneficiaries (Scheufele & Bennett, 2017; Wunder et al., 2008). In fact, the *Coase theorem* only works under very specific preconditions, as e.g. zero transaction costs, well-defined property rights, full access to information and no power-imbalances. Coase was fully aware of these delusive preconditions when saying: "I never liked the Coase Theorem" (Lee, 2013). And furthermore: "The world of zero transaction costs has often been described as Coasean world. Nothing could be further from the truth. It is the world of modern economic theory, one which I was hoping to persuade the economists to leave" (Coase, 1988: 174). Also Wunder is aware of these difficulties, but he aims at presenting a definition that is "consistent and precise enough for generating empirical knowledge" (Wunder, 2015: 235) and "[does not] slip between our fingers like wet soap when we try to get an empirical grip" (Wunder, 2015: 235).

In the years after the publication of his famous definition many other authors published alternative understandings of PES. Some of these can be assigned to a so called *Pigouvian* understanding of PES (Van Hecken & Bastiaensen, 2010).

Box 3: Example – The Vittel PES program in France

The Vittel PES scheme in France is often mentioned as an example for a Coasean PES program. The program, established already in 1988, was later assigned to the PES approach. The program is based on a ***voluntary and private negotiation*** *between the company Nestlé Waters and the farmers in the catchment area. Before the implementation of the program, the agricultural area had been used for maize cultivation, which led to high pesticide and nitrate contaminations of the soil and the ground water. To avoid the resulting water pollution, Nestlé Waters started paying farmers for sustainable agricultural practices.* ***Conditionality*** *builds on the requirement for farmers that extensive cattle farming is adopted including a maximum of "one cattle head per hectare" (Perrot-Maître, 2013: 3), the composting of animal wastes and the non-use of agrochemicals. In exchange, Nestlé Waters pays based on contracts over 18 to 30 years "150,000 euros per farm to cover the cost of all new farm equipment and building modernization" (Perrot-Maître, 2013: 3), 200 euros per hectare and year within the first five years to support the farmers in the transition period, the provision of additional land in compensation for income losses and further technical assistance. The provision of the ES is proved by a regular* ***monitoring*** *of the nitrate levels and the water quality.*

4.1.2.3 Widening the Concept – the Pigouvian View

While Wunder's *Cosean* definition is the most popular, the *Pigouvian* conceptualization of PES is most present in the various described case studies (Schomers & Matzdorf, 2013). Sattler & Matzdorf (2013) see the following main differences between the two conceptualizations: "While Coasean type PES are completely voluntary for both parties (ES seller and buyer) and the outcome of a private negotiation without government authority needed, *Pigouvian* type PES can be partly involuntary as the government intervenes and either pays itself or makes others pay through compliance regulation" (Sattler et al., 2013: 32). Thus, according to Wunder's definition there are differences regarding the voluntariness and the directness of transfer (s. chapter 4.1.2.4, p. 23), since in the *Pigouvian* case the buyer is not the direct user of the ES (Schomers & Matzdorf, 2013). Generally, this more on direct governmental interventions based conceptualization is influenced by Pigou's influential article "The Economics of Welfare" (Pigou, 1920). Quintessential in his article is the "philosophy of taxing negative or subsidizing positive externalities within existing product markets" (Van Hecken & Bastiaensen, 2010: 422). However, the explicit differences between *Pigouvian* and *Coasean* conceptualizations are often weakly defined. An often-mentioned definition, which is in line with a *Pigouvian* understanding of PES, was published by Muradian et al. (2010: 1205):

> *"[We] define 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 the management of natural resources. Such transfers (monetary or non-monetary) are embedded in social relations, values and perceptions, which are decisive in conditioning PES design and outcomes. The transfer may thus take place through a market (or something close to one), as well as through other mechanisms like incentives or public subsidies defined by regulatory means."*

Thus, this much more general definition implies that many more environmental policies can be associated with PES schemes. Even the central conditionality criterion in Wunder's definition is not included in the definition by Muradian and colleagues.

The notion of these two different definitions shows the importance of explicit criteria for providing a consistent understanding of what PES are. For this reason, a closer look at criteria that are used in the various definitions in the literature will be taken in the next subchapter.

4.1.2.4 Categorization of Definitions

The literature search shows a bundle of diverse definitions from *Coasean* to more *Pigouvian* conceptualizations. Overall, twelve definitions were found that aim at providing a new understanding of PES. The differing features of these definitions are systematically compiled in table 3 (p. 27). Only definitions aiming for a reconceptualization of PES are considered. Table 2 (p. 25) shows all 16 collected definitions. However, the definitions by the WWF (2007), the FAO (2007), Jack et al. (2008) and Corbera et al. (2009) are excluded in the detailed analysis, since they cannot be counted as novel PES reconceptualization due to their vagueness.
In the following, the identified criteria are divided in ex ante and ex post criteria. Ex ante criteria can be examined by studying the concept of a specific PES scheme. In contrast, the evaluation of ex post criteria is only possible in retrospect and thus only for PES programs that have been in place for a longer time already.

Ex ante criteria

Conditionality is the key criterion of most PES definitions (nine out of twelve evaluated definitions) or as Wunder states: "*Conditionality* […] is what makes PES the frontrunner of a new paradigm of contractual conservation" (Wunder, 2015: 241). *Conditionality* means that payments to ES providers are only made if the provision of ES can be secured (Engel, 2015; Wunder, 2015). For example, conditionality can be related to actions that secure these ES or related to the ES itself (Banerjee et al., 2013; s. chapter 4.2.2, p. 31). Monitoring of compliance as well as sanctions in the case of non-compliance are important to guarantee the provision of ES (Davies et al., 2018; Wunder et al., 2018). Monitoring techniques include for example on-site control instruments as well as remote-sensing technologies (Wunder et al., 2018). In practice, monitoring is often not fully implemented and especially sanctions are rarely part of PES schemes. (Reutemann et al., 2016; Wunder, 2008).
Voluntariness is another often named key feature of PES definitions and is part of eight out of twelve analyzed definitions. In the *Coasean* conceptualization *voluntariness* applies optimally to both, providers and beneficiaries of the ES (Wunder, 2005 & 2015). Like in a market, the involved parties can decide independently if they want to sell respectively buy the commodified ES. In such cases the program is *purely voluntary*. But, according to other authors, PES schemes can also be *partly involuntary*. Then PES programs are rather "driven by compliance regulation, both on the demand or the supply side" (Sattler and Matzdorf, 2013:

3). Involuntariness occurs especially on the buyers´ side due to governmental interventions (Schomers & Matzdorf, 2013; Vatn, 2010).

The ***directness of transfer*** is related to the involved actors of the transaction. Whereas in the *Coasean* conceptualization the transfer goes directly from the beneficiary of the ES to the providing actor (s. box 3, p. 21), in a more *Pigouvian view* payments can also be generated by public sources or actors that do not directly benefit from the ES provision (Schomers & Matzdorf, 2013; s. box 4, p. 37). The *directness of transfer* is often subdivided in user- versus government-financed PES schemes (Engel et al., 2008; van Hecken et al., 2012; Wunder, 2015). Unlike Wunder's definition, Corbera et al. (2007) describe PES as mostly government-funded. For schemes that are funded by private ES users they use the term *'markets for ecosystem services'* (MES). Also national and international NGOs can play a crucial role, whether as intermediary or as ES provider or buyer (Grima et al., 2016; Sattler et al., 2013; s. chapter 4.2.2, p. 31). Only three out of the twelve definitions name direct payments from ES users to providers as a key feature.

All PES definitions agree either directly or indirectly on the importance of creating ***positive incentives*** for ES providers to secure ES provision (Engel & Muller, 2016). Vice versa, negative incentives imply that ES providers get punished for the non-provisioning of ES as in the case of Pigou taxes that builds on the *polluters pay principle* (Davidson, 2012). Such negative incentives are typically not related to PES schemes.

Luca Tacconi (2012) adds ***transparency*** as further important criterion for successful and effective PES schemes. Tacconi refers to a definition by Kolstad & Wiig (2009), who define *transparency* "as the timely and reliable provision of information to all relevant stakeholders" (Tacconi, 2012: 33).

The notion of ***well-definition of ES***, as especially mentioned in Wunder's primary definition, is strongly connected with the *conditionality* criterion, since for an explicit monitoring of ES a quantification of ES is essential (Wunder, 2005). Vice versa, Corbera and colleagues (2007) point out that operating PES schemes are based on mostly ill-defined ES.

Ex post criteria

Tacconi (2012), Sommerville et al. (2009) and Davies et al. (2018) add ***additionality*** as a further criterion. *Additionality* can only be proved in retrospect and means that "ES benefits (or proxy land use practices) are over-and-above the baseline (or business-as-usual) level, and do not lead to the loss or degradation of ES elsewhere" (Davies et al., 2018: 160). Thus, *additionality* is strongly connected to conditionality. Matzdorf and colleagues make a further differentiation: "Conditionality means that with the help of PES the targeted ES are actually provided (e.g. Wunder, 2005), while additionality means that the ES would not be provided in the absence of PES" (Matzdorf et al., 2013: 59).

The ***pro-poor criterion*** puts a social perspective on PES and is brought in by Muradian et al. (2010). In this view, social justice and poverty alleviation are important goals of PES schemes besides environmental additionality (Shelley, 2011; van Noordwijk & Leimona, 2010). This criterion is very difficult to assess, both due to the normative characteristic, which depends to a large extent on the chosen principle of justice, and difficulties regarding the social impact evaluation (Wunder, 2015).

Tab. 2: Identified PES definitions

Author and year	*Definition*
Wunder (2005: 3)	"(1) […] voluntary transaction[s] where (2) a well-defined service (or a land-use likely to secure that service) (3) is being 'bought' by a (minimum one) ES buyer (4) from a (minimum one) ES provider (5) if and only if the ES provider secures ES provision (conditionality)"
Corbera et al. (2007: 366)	"MES and PES consist of transferring economic resources from providers to consumers of ecosystem services so that the former benefit economically while the latter receive the right to use the resources provided by the service in question. The difference between MES and PES resides in their underlying institutional framework. […] PES are not actual markets where ecosystem services are sold to service buyers. The commodity is ill-defined, and, in most cases, governments play an intermediary role by mobilizing resources from consumers to a government fund, which then distributes financial resources to ecosystem-service stewards at a pre-established price"
FAO (2007: 7)	"Payment for environmental services (PES) programmes are an effort to 'get the incentives right' by sending accurate signals to both providers and users that reflect the real social, environmental and economic benefits that environmental services deliver"
WWF (2007: 4)	"PES refers to the variety of arrangements through which the beneficiaries of ES pay back the providers of those services to ensure their sustainability and timely provision"
Ferraro (2008: 810)	PES "generally have two common features. First, they are voluntary. Second, participation involves a contract between the conservation agent and the landowner. The landowner agrees to manage an ecosystem according to agreed-upon rules and receives a payment (in-kind or cash) conditional on compliance with the contract"
Jack et al. (2008: 9465)	"PES schemes rely on incentives to induce behavioral change and can thus be considered part of the broader class of incentive- or market-based mechanisms for environmental policy"
Corbera et al. (2009: 745)	"new institutions designed to enhance or change natural resource managers' behavior in relation to ecosystem management through the provision of economic incentives"
Sommerville et al. (2009: 2)	"approaches that aim to (1) transfer positive incentives to environmental service providers that are (2) conditional on the provision of the services, where successful implementation is based on a consideration of (1) additionality and (2) varying institutional contexts"

Milder et al. (2010: 1)	"Payment for ecosystem services (PES) is a market-based approach to environmental management that compensates land stewards for ecosystem conservation and restoration. [...] We define PES to include direct payments from ecosystem service beneficiaries to land stewards, as well as indirect payments earned through eco-certified production (Food and Agriculture Organization 2007)"
Muradian et al. (2010: 1205)	"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 the management of natural resources. Such transfers (monetary or non-monetary) are embedded in social relations, values and perceptions, which are decisive in conditioning PES design and outcomes"
Karsenty (2011: 1)	"a payment to an agent for services provided to other agents (wherever they may be in space and time) by means of a deliberate action aimed at preserving, restoring or increasing an environmental service agreed by the parties. PES therefore result from a voluntary agreement between parties, in other words they are based on contracts that are explicit or implicit (oral agreements), and which set out the service expected and the corresponding payments, as well as for how long the service must be provided"
Porras (2012: 7)	"A transaction in which a supplier or seller of the ecosystem service is responding to the offer of compensation from a single or multiple beneficiaries (NGO, private party, local or central government entity) and/ or a beneficiary separate from the seller which is not a central government entity, compensation is conditional upon the land management practices specified by the program, and the voluntary component is only attached to the supply-side of the transaction in that the provider 'voluntarily' enters in to the contract."
Tacconi (2012: 35)	"PES scheme is a transparent system for the additional provision of environmental services through conditional payments to voluntary providers. […] PES schemes are essentially instruments to maintain or recreate the supply of ES through the provision of incentives"
Engel (2015: 133)	"a positive economic incentive where environmental service (ES) providers can voluntarily apply for a payment that is conditional either on ES provision or on an activity clearly linked to ES provision"
Wunder (2015: 241)	"(1) voluntary transactions (2) between service users (3) and service providers (4) that are conditional on agreed rules of natural resource management (5) for generating offsite services"
Davies et al. (2018: 160)	"'a transfer of resources between ES buyers and sellers that aims to improve provision of ES for the benefit of society and the environment' The following principles apply: • Voluntariness – stakeholders ideally enter into a PES agreement on a voluntary basis, however governments may act on their behalf, or regulate involvement, if necessary. • Payment source – payments are made by the beneficiaries of ES (citizens, businesses, or governments acting on their behalf). This includes those benefitting from reputational enhancement or actions that compensate for (unregulated) environmental harm. • Conditionality – payment is conditional on the delivery of quantified ES, or on the implementation of robust land use practices proven to deliver ES benefits. • Additionality – ES benefits (or proxy land use practices) are over- and-above the baseline (or business-as-usual) level, and do not lead to the loss or degradation of ES elsewhere"

Tab. 3: Overview of criteria designated in different PES definitions

	ex ante criteria						ex post criteria	
Author and year	*conditionality*	*voluntariness*	*incentive*	*transparency*	*directness of transfer*	*well-definition of ES*	*additionality*	*pro-poor*
Wunder (2005: 3)	required	buyer and providers			buyer to provider	well-definition		
Corbera et al. (2007: 366)					(often) government to provider	ill-defined		
Ferraro (2008: 810)	required	conservation agent and landowner			conservation agent to landowner			
Sommerville et al. (2009: 2)	required		positive incentive				consideration of additionality	
Milder et al. (2010: 1)					Direct payments by beneficiaries and indirect payments earned through eco-certified production			
Muradian et al. (2010: 1205)					between social actors			in the social interest
Karsenty (2011: 1)	required	beneficiary and provider			beneficiary to provider			
Porras (2012: 7)	required	only on the provider-side			NGO, private party, local or central government entity to provider			
Tacconi (2012: 35)	required	only on the provider-side	provision of incentives	required	only the ES provider as payment receiver mentioned		additional provision of ES	
Engel (2015: 133)	required	providers can voluntarily apply for a payment	positive economic incentive					
Wunder (2015: 241)	required	ES users and providers			user to provider			
Davies et al. (2018: 160)	required	ideally buyers and sellers			Beneficiaries (citizens, businesses, or governments acting on their behalf) to provider		additionality is given	

4.1.2.5 Controversies Between the Different Definitions

The compilation of various definitions and their diverse features illustrates the manifold understandings of PES. Therefore, it is no surprise that there is an ongoing controversial debate on PES conceptualizations.

Whereas a relatively broad consensus on the *conditionality* feature can be stated, this is not the case for *voluntariness* and the related *directness of transfer* and the *ex post criteria* (s. tab 3, p. 27). The *directness of transfer* particularly address the question, whether the buyer of the ES is also the direct beneficiary and whether the funding comes from private or public sources. If governments pay service providers on behalf of the direct beneficiaries, the PES scheme cannot be labeled as voluntary. Thus, the interpretation of the *directness of transfer* and the *voluntariness* feature led to the division in *Coasean* and *Pigouvian* PES conceptualizations (Engel & Muller, 2016). Another debate is related to ex post criteria, namely pro-poorness and additionality. Wunder (2015) counters these extensions by stating that the inclusion of additionality "could be problematic, since it depends on an ex post evaluation of PES schemes. […] Should we then […] [in the case of non-successful PES programs] declare to the world: 'this is actually not PES, since we now know that it was largely non-additional'?" (Wunder, 2015: 236). Regarding the pro-poor criterion he repeats that "we could get the same problems as for additionality" (Wunder, 2015). Additionally, Wunder criticizes the normative character of the criterion "with social interest" by Muradian et al. (2010: 1205).

Therefore, it is a central question how precise versus vague a definition should be (Wunder, 2015). Some definitions, especially the definition by Muradian et al. (2010), are so broad that they even include e.g. conventional *Integrated Conservation and Development Programs* (ICDPs), where the conditionality criterion is not met (Engel et al., 2008; Matzdorf et al., 2013). Many scholars are rather critical regarding such broad definitions "as it makes any discussion of PES versus other policies highly fuzzy" (Engel & Muller, 2016: 175). Furthermore, such vagueness "hinders both theoretical deduction and empirical refutation of hypotheses" (Wunder, 2015: 234). Wunder (2015) pleads for a high preciseness to allow for the generation of empirical knowledge and the separation from other positive environmental incentives. Regarding real world cases Wunder (2015) calls for a distinction in genuine programs and PES-like programs (Ezzine-De-Blas et al., 2016b). Genuine cases that follow the *'Idealtypus'* match with all five by Wunder (2005) mentioned criteria and can be described as *'canonical PES'*. All other PES-like programs can then be classified by measuring the deviations from this *Idealtypus* (Wunder, 2007). Others criticize this approach, since "dividing PES into 'genuine' (good) and PES-like (less good) may cause a mismatch between theory and practice" (Muradian et al., 2010: 1203), potentially leading to frustration by practitioners. Additionally, it must be highlighted that the discussion around PES as a policy instrument is even broader than illustrated in this review, because many scholars mention further terms apart from the classical PES term. Derissen & Latacz-Lohmann (2013: 13) list these other terms as follows:

- *"Investments for biodiversity conservation (Ferraro & Kiss, 2002).*
- *Conservation payments (Ferraro & Simpson, 2002).*
- *Rewards for ecological goods (Gerowitt et al., 2003).*
- *Agri-environmental payments (Cooper, 2003).*
- *Payment schemes for environmental services (Tomich et al., 2004).*
- *Agri-environmental subsidies (Wittig et al., 2006).*
- *Rewards for ecosystem services (Pascual & Perrings, 2007).*
- *Rewards for environmental services (Leimona et al., 2009).*
- *Compensation and rewards for environmental services (Swallow et al., 2009).*
- *Incentive Payments (Ferraro & Gjertsen, 2009).*
- *Payments for agrobiodiversity conservation services (Narloch et al., 2011)."*

This collection indicates that there is no consensus on the nature of transactions. Instead of using the term *'payment'*, some authors use terms such as *'rewards'*, *'compensation'* or *'markets'* to promote other understandings of PES (Froger et al., 2015; Shelley, 2011). For example, reward-based conceptualizations highlight fairness and pro-poor objectives (Blundo-Canto et al., 2018; Leimona et al., 2015).

It is often stated that PES are market-based instruments. However, the term *'market-based'* often remains fuzzy in the literature. In practice, classical markets for ES are rarely in place. The wetland mitigation banking in the US could be classified as a market with a trading scheme building on competition (Robertson, 2006). However, competition is not a feature of all market definitions. For example, Wunder defines a market as "an actual or nominal place where forces of demand and supply operate, and where buyers and sellers interact (directly or through intermediaries) to trade goods, services, contracts or instruments, for money or barter" (Wunder, 2013: 231). As already mentioned, Corbera and colleagues (2007), but also Vatn (2010), claim for a differentiation in *'markets for environmental services'* (MES), which contain well-defined environmental services with active demand and supply sides, and *'payments for environmental services'*, in which governments play a central role.

Therefore, due to the variety of PES understandings and the differing market-closeness a clear assignment to a specific policy instrument category is not possible (s. chapter 2.3, p. 6). Why is there such a high discrepancy regarding terms and conceptualizations? Bennett & Gosnell (2015: 172) "attribute this to the diversity of theoretical framings and disciplinary perspectives brought to the issue and the different focal points of studies that create barriers to direct comparison across the numerous existing case studies". The authors name four more or less competing views on PES: The *Coasean* perspective, the social-institutional perspective, the biophysical perspective and the critical perspective on PES (Bennett & Gosnell, 2015). In many cases, scholars from different disciplines also assign themselves to different perspectives. This is a strongly influential feature of the PES debate. The different perspectives of scholars therefore also play a role when reviewing critique on PES (s. chapter 6, p. 48).

4.2 Categorizations of Payments for Ecosystem Service Schemes

PES classification schemes are provided by different authors. However, classifying PES schemes is not an easy task due to the high diversity of operating PES programs (Sattler & Matzdorf, 2013; Vatn, 2010). To even complicate it further, the various PES definitions and conceptualizations affect classification schemes. This can be illustrated by an example: Wunder's (2005) definition implies that only fully voluntary PES schemes can be counted as PES. At the same time, e.g. the definition by Muradian et al. (2010) leads to different possible combinations – fully voluntary, partly voluntary or fully involuntary. This shows how classification schemes are based on the underlying definitions.

This chapter gives a rough overview of possible classification items based on a broad conceptual basis that includes the *Cosean* as well as the *Pigouvian* view on PES.

4.2.1 Methods

In order to find publications providing information on classification schemes, the following search terminology was performed using Scopus:

> TITLE-ABS-KEY("*payment* for environmental service**" OR "*payment* for ecosystem service**" AND "*classif**")

The literature search for PES classifications was focused only on the abstracts, because of the lesser relevance of the classification issue for this study. However, giving an overview on PES classification schemes is essential to make it possible to consider the definitions topic within a larger context.

The search terminology resulted in 53 publications. After screening all the abstracts, ten papers were assessed as eligible. The further methodology built on the procedure set out in chapter 3 (p. 14). Five papers out of ten were excluded due to missing relevance. Nine additional publications were incorporated into the literature assessment, which were referenced in the remaining five eligible papers. Thus, a total of 14 publications provided the basis for the detailed literature analysis.

Search terminology

TITLE-ABS-KEY("*payment* for environmental service**" OR "*payment* for ecosystem service**" AND "*classif**"); accessed on 16/09/2018

Flow diagram based on the PRISMA guideline

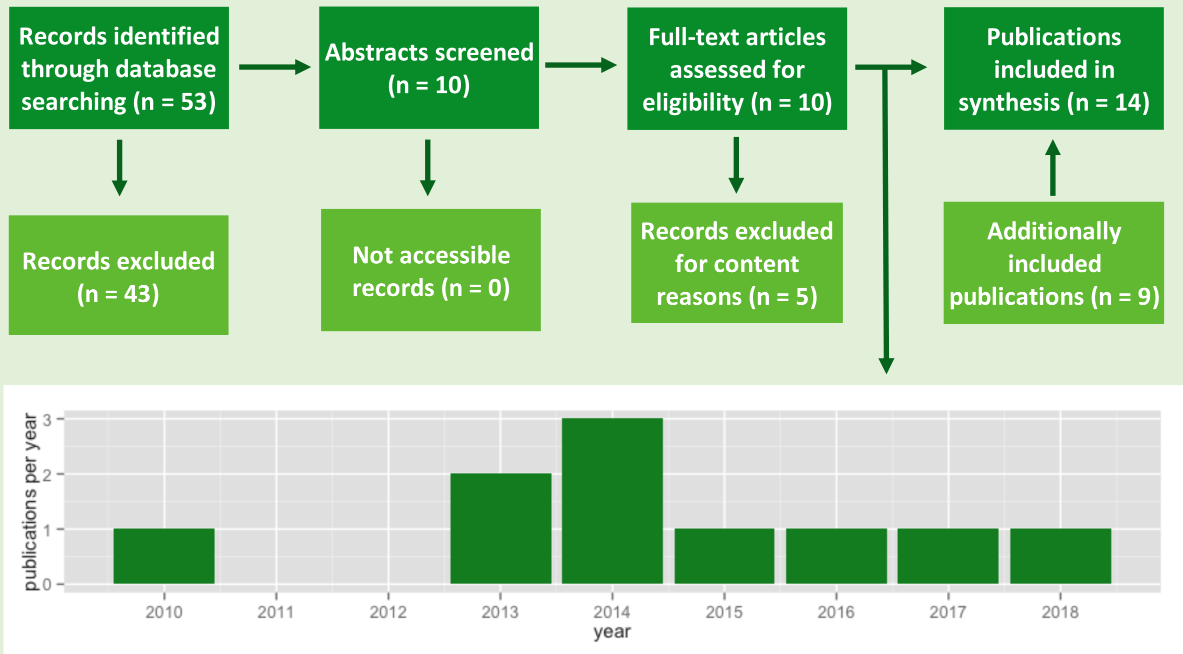

Fig. 5: Search terminology and quantitative overview of the results: PES classifications

4.2.2 Results: Overview of Classification Features for Payments for Ecosystem Service Schemes

Hereafter, the different classification items will be presented systematically. Some authors, as e.g. Sommerville et al. (2009) or Sattler et al. (2013), provide comprehensive classification schemes. Table 4 (p. 35) lists different classification items based on the modified and extended classification by Sattler et al. (2013).

The **underlying ES** builds the centerpiece of each PES scheme. ES that are incorporated in operating PES programs are distinguishable in biodiversity, landscape beauty, water and carbon ES (e.g. Kemkes et al., 2010). These ES types can be incorporated into the PES program either individually or bundled (Sattler et al., 2013). Some authors differentiate between product- and service-related ES. Whereas the former address "commodity type provisioning services, the latter [are related to] non-commodity-type regulating, supporting or cultural services" (Sattler et al., 2013: 32; Gutman, 2003). However, this subdivision mainly builds on the earlier mentioned subdivision in *environmental* and *ecosystem services* (s. chapter 2.4.1, p. 8).
Most PES definitions agree on **conditionality** as a key feature of PES programs. Here, it can be distinguished between payments that are conditional either on actions or on outcomes (Banerjee et al., 2013). Schemes that are conditional on actions can be subdivided in payments on activity reductions or on activity changes (Engel & Muller, 2016), whereas schemes focusing on outcomes are distinguishable regarding "inputs (e.g. trees planted) or outputs (e.g. carbon sequestered)" (Reutemann et al., 2016: 220). Wunder (2005) makes two further distinctions: Firstly, between area-based PES, "where contracts stipulate land- and/or resource-use caps for a pre-agreed number of units" (Wunder, 2005: 7), and product-based PES, "where consumers pay a *'green premium'* on top of the market price for a production scheme that is certified to be environmentally friendly, especially vis-á-vis biodiversity" (Wunder, 2005: 7). Here, the subdivision in environmental and ecosystem services plays a key role again. Secondly, Wunder differentiates between use-restricting PES, where providers get rewarded "for capping resource extraction and land development" (Wunder, 2005: 8), and asset-building PES, where providers get paid "to restore an area's ES, for example (re)planting trees in a treeless, degraded landscape" (Wunder, 2005: 8).
Also the for conditional PES schemes necessary **monitoring** is classifiable: Sommerville et al. (2009) subdivides the responsible actors in local agents versus hired agents and the method in on-ground versus remotely based monitoring techniques (Sommerville et al., 2009).
One often mentioned key aspect of PES schemes is the **voluntariness** criterion. However, many authors locate also not fully voluntary schemes under the PES umbrella (Muradian et al., 2010). This results in a differentiation into fully voluntary schemes, partly involuntary schemes regarding the demand side or regarding the supply side and fully involuntary schemes (Sattler et al., 2013).

Matzdorf et al. (2013) take an overall view on PES schemes regarding different **governance aspects**. One mentioned group are direct user-financed respectively non-government-financed programs that follow the *Cosean* PES conceptualization. Secondly, there are government-financed schemes based on the *Pigouvian* view on PES. Thirdly, compliant payments are mentioned, which are involuntary on the demand side, since the state "institutionalizes a 'duty to pay' as financial resources for PES" (Matzdorf et al., 2013: 61). Fourthly, compensation payments for legal restriction are schemes with involuntariness on the supply side. In this case payments are used "to compensate such legal requirements" (Matzdorf et al., 2013: 61). Regarding the market-closeness, the distinction between true market-based schemes and one-off/project-based negotiations can be made (Sommerville et al., 2009). Sattler et al. (2013) subdivide the market situation in polypoly, monopsony or oligopoly, monopoly or oligopoly and bilateral monopoly or oligopoly. The latter can be seen in line with one-off/project-based negotiations.

The participators of a PES program can also be subject of classifications. Setting the focus on the **ES provider**, different distinctions are possible, as described by Sommerville et al. (2009). Firstly, between individual and community providers. Secondly, if the providers hold a land tenure or not. Additionally, Sommerville et al. (2009) subdivides the legality of behaviors in legal versus illegal and the opportunity costs of the provider in homogenous versus variable.

The **ES buyers** can be subdivided in private actors, public actors and actors from the civil society or a combination (Sattler et al., 2013; s. chapter 4.1.2.4, p. 23). Public actors can be differentiated in local and national governmental participators (Ezzine-De-Blas et al., 2016b). Sommerville et al. (2009) furthermore distinguish in secure and insecure buyer's funding. The buyer's goals can be of further interest, e.g. whether the buyer focuses on economic efficiency, on social aspects and an equitable distribution or on ecological aspects (Sommerville et al., 2009).

Since a direct negotiation between two or more parties is only seldom existent, **intermediaries** often play a crucial role (Vatn, 2015). In the literature private and governmental entities as well as civil organizations are named as potential intermediaries (e.g. Grima et al., 2016).

Regarding the **payment** Sattler et al. (2013) distinguish between the payment source (private, public or both), the type (cash, in-kind or both), the frequency (one-off or periodically), the time (upfront or after ES delivery) and the eligibility (horizontal or targeted). "Horizontal PES are open to all potential ES providers, while targeted PES aim either in space or across agents, i.e. at a specific area or a specific type of providers" (Sattler et al., 2013: 35). Additionally, Sattler and colleagues (2013) use the payment mode as a further distinction criterion. They subdivide payments in output- versus input-based schemes based on a distinction by Wunder (2005). Output-based payments are remitted "directly for produced ES in measurable quantities (e.g. tons of carbon sequestered)" (Sattler & Matzdorf, 2013: 6). Input-based payments are "more fuzzy, based on inputs and assumptions how those relate to ES delivery, which relates to Wunder's differentiation between product- and area-based PES" (Sattler & Matzdorf, 2013: 6). This distinction criterion stays in strong connection with the *conditionality* feature and the by Muradian et al. (2010: 1206) proposed degree of commodification that "refer to the extent and clarity with which compensation received by the environmental service providers has been defined as a tradable commodity". The payment volume can be of interest, too (Ezzine-De-Blas et al., 2016b).

The **scale** is another differencing factor. Firstly, this relates to the spatial scale, since such schemes can be local, regional, national or international (Sattler et al., 2013). Secondly, a subdivision between short-, mid- and long-term PES schemes can be made (Grima et al., 2016; Sattler et al., 2013).

Sattler et al. (2013) use also the **recent status** as a classification factor, since PES schemes can be proposed, in a test respectively pilot phase, ongoing, complete or abandoned.

Furthermore, classifications can address the actual results of a PES scheme. Sattler et al. (2013) include here positive and negative side effect on the economical, ecological, societal and political/institutional level. In table 4 (p. 35) these effects are summarized under the **additionality** umbrella, even though this term is mostly used in the context of environmental/ ecological additionality.

Finally, the overall **success** of a PES program can be the subject of a classification. Sattler and colleagues (2013: 33) differentiate regarding the nominal level in successful and not successful, regarding the evaluation in self- and third-party assessed and regarding the underlying criteria in descriptive versus qualitative.

Tab. 4: **Modified and extended classification by Sattler et al. (2013: 33)**

Category	*Characteristic*	*Specification*
Ecosystem services	*ES type*	biodiversity, landscape, water, carbon (e.g. Sattler et al., 2013)
	ES commodity type	product-related, service-related (Gutman, 2003)
	ES bundling	single, bundle (e.g. Sattler et al., 2013)

Conditionality	*Targeting option 1*	(1) conditional on actions or (2) on outcomes (Banerjee et al., 2013)
		if (1): payments on activity reduction or on activity changes (Engel & Muller, 2016)
		if (2): payments based on inputs or on outputs (Reutemann et al., 2016)

	Targeting option 2	area-based PES, product-based PES (Wunder, 2005)
	Targeting option 3	conditional on use-restriction or on asset-building (Wunder, 2005)
Monitoring	*Agent*	local agent, hired agent (Sommerville et al., 2009)
	Method	on-ground or remotely-based (Sommerville et al., 2009)
Voluntariness		fully voluntary, partly involuntary regarding the demand side, partly involuntary regarding the supply side, fully involuntary (Sattler et al., 2013)
Governance aspects	*Differentiation in governance models*	user-financed, government-financed, compliant payments, compensation payments for legal restriction (Matzdorf et al., 2013)
	Market-closeness	market-based or one-off/project-based negotiations (Sommerville et al., 2009)
	Market situation	polypoly, monopsoly/ oligopsony, monopoly/oligopoly, bilateral monopoly/oligopoly (Sattler et al., 2013)
ES provider	*Type of provider*	individual vs. community (Sommerville et al., 2009)
	Property tenure	private property vs. no tenure (Sommerville et al., 2009)
	Legality of behaviors	legal vs. illegal (Sommerville et al., 2009)
	Opportunity costs	homogenous vs. variable (Sommerville et al., 2009)
ES buyer	*Type of buyer*	private actor, governmental actor (local or national), civil society (e.g. NGO), combination (Sattler et al., 2013, Ezzine-de-Blas et al., 2016)
	Buyer's funding	secure vs. insecure (Sommerville et al., 2009)
	Buyer goals to trade-off	economic efficiency vs. equitable distribution (Sommerville et al., 2009)
	Additional buyer goals to trade-off	social vs. ecological (Sommerville et al., 2009)
Intermediaries	*Type of intermediary*	No intermediaries versus public entities, private entities or organizations (Grima et al., 2016; Vatn, 2015)
Payment	*Source*	private, public, both (Sattler et al., 2013)
	Type	cash, in-kind, both (Sattler et al., 2013)
	Frequency	one-off, periodically (Sattler et al., 2013)
	Time	upfront, after ES delivery (Sattler et al., 2013)
	Eligibility	horizontal, targeted (Sattler et al., 2013)
	Mode	input- versus output-based (Sattler et al., 2013, based on Wunder, 2005)
	Volume	e.g. in monetary values (Ezzine-de-Blas et al., 2016)
Status		proposed, test/pilot, ongoing, complete, abandoned (Sattler et al., 2013)
Scale	*Spatial scale*	local, regional, national, international (Sattler et al., 2013)
	Time scale	short-term, mid-term, long-term (Grima et al., 2016)
Additionality	*Ecologic*	descriptive - qualitative (Sattler et al., 2013)
	Economic	descriptive - qualitative (Sattler et al., 2013)
	Social	descriptive - qualitative (Sattler et al., 2013)
	Political/institutional	descriptive - qualitative (Sattler et al., 2013)
Success	*Level (nominal)*	yes, no (Sattler et al., 2013)
	Evaluation	self- or third-party assessed (Sattler et al., 2013)
	criteria	descriptive, qualitative (Sattler et al., 2013)

4.3 Status Quo of Payments for Ecosystem Service Scheme Implementation

This chapter takes a closer look at the current state of the PES program implementation worldwide. The chapter builds on already reviewed papers and therein cited publications plus a very general PES scheme literature search per country. A worldwide and detailed review of currently implemented schemes would exceed the capacity of this pilot literature study.

Giving an overview of implemented PES programs around the world is a challenging task, because of (1) the definition inconsistencies, (2) the use of other terms aside from *'payments for ecosystem services'* or *'payments for environmental services'* and (3) research in other languages, as for example Spanish, which is a common language in science in many Latin American countries.

The literature search is based on the following search terminology:

> *TITLE-ABS-KEY("payment* for ecosystem service*"* OR *"payment* for environmental service*"* AND *"country name")*

Figure 6 shows the number of papers per country. However, the results can only be understood as a proxy, because not all publications describe a practice case. Nevertheless, the results point on interesting patterns across the globe, which are in line with patterns mentioned in the literature. Hotspots exist in South and Middle America plus the USA, Southeast Asia and countries in the middle and southeast of Africa. Furthermore, middle, west and north Europe as well as Australia show hits for the search terms, although at a lower level. Remarkably, China appears as the country with the by far largest number of publications.

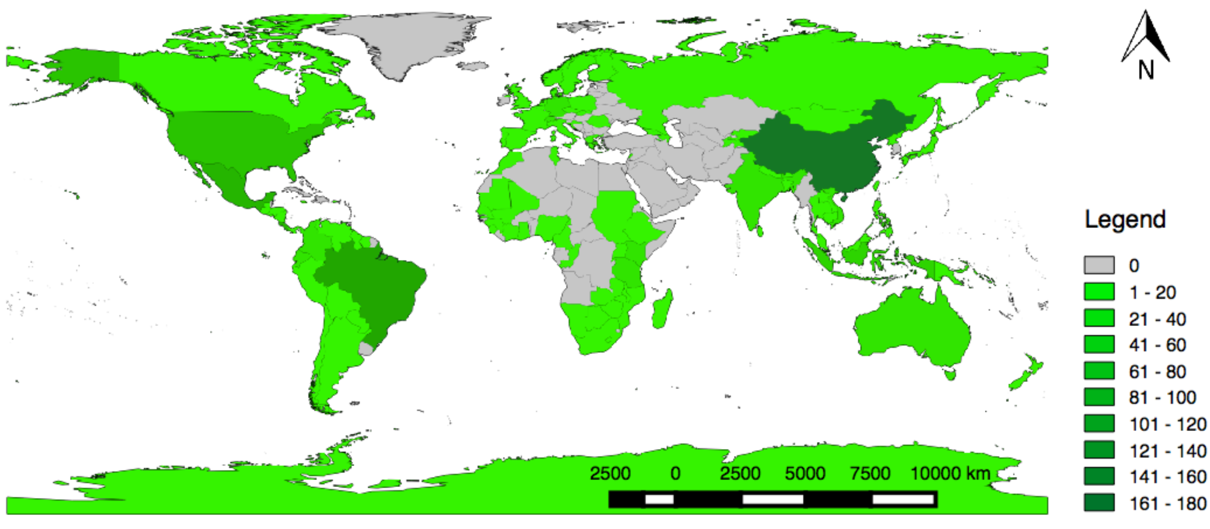

Fig. 6: Number of publications addressing PES per country based on the search terminology "payment* for ecosystem service*" OR "payment* for environmental service*" AND ">Country<"; search date: 15/09/2018; search engine: Scopus.

These results are comparable with the results of other publications. Schomers & Matzdorf (2013: 18) underline that "the majority of publications refer either to developing countries generally or to Asia, Latin America or Africa particularly". Pattanayak et al. (2010) give three reasons: "First, developing countries contain much of the world's tropical forests, which have the potential to provide many critical ecosystem services through species conservation, climate regulation, watershed protection, carbon sequestration, and pure aesthetic benefits. Second, developing countries pose a special test for market-based solutions for conservation like PES, because government and market institutions are weak. Finally, because developing countries are home to many of the world's poor, the allure of a potential win-win approach—reducing poverty and ecosystem degradation—makes PES irresistible to academics, policy makers, and program implementers alike." (Pattanayak et al., 2010: 255).

Most of the PES examples, whether in countries of the Global South or the Global North, can be assigned to the *Pigouvian* conceptualization (Schomers & Matzdorf, 2013). Accordingly, PES programs in line with the *Coasean* approach are very rare. One commonly named example is the Vittel PES scheme in France (s. box 3, p. 21), where "the company pays farmers for practices which go beyond legal requirements in terms of water quality, as excessive nitrate concentrations due to fertilizer use could lead to the (temporary or definite) closure of its water bottling plant" (Houdet et al., 2012: 42). Another in various publications described PES scheme is the since the mid-1990s nationally operating PES scheme *'Programa de Pagos de Servicios Ambientales'* in Costa Rica – a hybrid example, because the funding comes from public and private sources (Le Coq et al., 2015; s. box 4, p. 37).

There are only few publications that assess on-going PES schemes systematically. In addition to publications collecting PES cases, there are larger projects aiming at providing

Box 4: Example – The PES program 'Programa de Pagos de Servicios Ambientales' in Costa Rica

*The national PES scheme in Costa Rica counts to the most famous and largest programs worldwide. The program was established in 1996 with the passing of the 4th forestry law, which was before the PES concept was initially framed. The scheme focuses on forest plantations and natural forests and includes four **ES types**: "mitigation of greenhouse gas emissions, hydrological services, biodiversity conservation and scenic beauty" (Le Coq et al., 2015). In the first years, the program was fully government-funded based on an oil tax. Later loans and grants broadened the funding, followed by the contribution of private actors since 2007. However, public funding is still the main source. Thus, the program is **partly involuntary**. The PES are input-based with a low degree of commodification (s. chapter 4.2.2, p. 31). The contracts are **conditional** on "forest protection, reforestation and forest management" (Le Coq et al., 2015: 254) and the **monitoring** focuses on the evaluation of forested areas.*


own depiction

regularly updated data on payments schemes and markets for ES. For example, the *Forest Trends Initiative* runs the project *Ecosystem Marketplace* (www.ecosystemmarketplace.com), which lists projects worldwide.

Salzman et al. (2018: 136) mention over 550 PES programs worldwide, "with combined annual payments over US$36 billion". Wunder and colleagues (2018) published a meta-study of the global patterns of PES programs including 70 schemes. Their analysis shows that conditionality, payment differentiation and spatial targeting is seldom part of PES schemes. Furthermore, the analysis evinces that in Middle America, the Northern Andes and Southeast Asia a concentration of watershed schemes is observable, whereas African countries show a concentration of biodiversity and carbon schemes, which are typically financed from abroad. Typically, in OECD countries PES schemes with a focus on multiple ES are implemented. Ezzine-de-Blas et al. (2016b) provide a further meta-study. Based on their chosen PES criteria they systemized 55 PES schemes worldwide. They performed a principal component analysis and found three main clusters: agri-environmental public PES, NGO-led biodiversity PES and private commercial carbon/ water PES. Beside these global studies there are some quantitative-comparative studies that focus either on the regional level or on a specific ES type. For example, a study by Brouwer et al. (2011) focuses on watershed PES schemes across the globe and Sattler et al. (2013) classify and compare 22 PES programs in the USA and in Germany.

Generally, most studies and databases mention schemes reaching from the local to the national scale. For example, Latin America is the focus of a study by Grima et al. (2016), who analyze the performance of 40 PES schemes and describe that most of these examined PES programs are implemented at regional (30%) or local scales (60%), both taking into account the area of the targeted ES and the spatial scale of funding sources. In contrast, in richer countries of the Global North larger scaled PES programs are implemented, which are often funded by governments (Wünscher & Wunder, 2017). Typically, government-led schemes are larger than private-financed programs (Börner et al., 2016). International schemes are rare but existent, as described by Wunder et al. (2018) for cases in Africa. For these schemes also the term *"international payments for ecosystem services"* (IPES) is established (Farley et al., 2010). Some authors argue that the international REDD+ program, which aims at reducing emissions from deforestation and degradation, is the largest operating international PES scheme (Corbera, 2012; s. box 5, p. 47). "[There] is no clear consensus within the literature as to whether REDD+

will serve as a PES case or not" (Schomers & Matzdorf, 2013: 23), which can be explained by the inconsistencies of PES definitions.

Generalizations regarding the size of PES schemes are difficult for two reasons: Firstly, the in the fourth chapter mentioned variety of definitions raises the question which schemes can be categorized as PES, e.g. in the case of government-led programs (s. chapter 4.1.2.4, p. 23). Secondly, the consideration of the underlying ES type is central, as already mentioned before. Obviously, PES schemes that address carbon sequestration services tend to be spatially larger, since the benefits are distributed globally due to the nature of the climate (Thompson, 2018). Generally, the internationalization of PES programs is strongly connected with spatial scale effects and the addressed ES type. Whereas for example the beneficiaries of carbon schemes are globally distributed, the users of most watershed schemes are in a close distance to the ES provider (Corbera et al., 2009). This topic will be deepened in the next chapter that focuses on the influence of spatial scale for the effectiveness of PES schemes.

5. The Role of Spatial Scales for the Effectiveness of Payments for Ecosystem Service Schemes

A systematic literature review of the role of spatial scales for the effectiveness of PES schemes builds the centerpiece of this chapter. The influence of the spatial scale is particularly interesting, because in a globalized world the distances between the places of environmental destruction and the causes increase. Against this background, many scientists and politicians call for global conservation approaches and strategies. On the other hand, such globalized conservation approaches face many challenges. It is for this reason that other voices call for a local nature conservation management instead. This raises the questions, at which spatial scales environmental problems can be solved most effectively, how different scales can be linked to each other and how PES literature addresses the topic of spatial scales.

Before focusing on the role of spatial scale, an overview of the term effectiveness itself as well as of further research fields in the context of PES effectiveness is given.

In the literature, PES effectiveness is mostly associated with environmental effectiveness, which "is defined as the change in provision of services induced by the program, compared to a counterfactual without PES" (Börner et al., 2017). Thus, environmental effectiveness stays in a strong correlation with environmental additionality (s. chapter 4.1.2.4, p. 23). Generally, the environmental effectiveness "of any given PES program can be measured in terms of enrolment, conditionality, additionality, performance, and leakage" (Newton et al., 2012: 128). Nevertheless, there is also a debate about "the effectiveness of PES in achieving multiple [other] objectives simultaneously" (Blundo-Canto et al., 2018: 161), as e.g. positive impacts for poor people (Shelley, 2011; van Noordwijk & Leimona, 2010). This is particularly the case, since many proponents for PES programs see PES as a potential win-win approach contributing to environmental additionality and poverty alleviation at the same time (Muradian et al., 2013).

In practice, it becomes very difficult to assess the effectiveness of PES schemes, because programs are seldom systematically monitored and evaluated (Blundo-Canto et al., 2018). And even if a systematic evaluation exists, it remains often unclear which factors lead to effective or ineffective schemes – or in other words: "the devil is in the detail" (Engel, 2015: 131).

Many mentioned items in the chapter on PES classification schemes are potentially influencing factors on PES effectiveness (s. chapter 4.2.2, p. 31). Huber-Stearns et al. (2017) group these diverse influencing factors in biophysical, economic, governance and social-cultural enabling conditions (Huber-Stearns et al., 2017: 4). For example, **biophysical conditions** represent the requirement that the targeted ES are truly endangered, as well as the necessity that the measuring and spatial targeting of ES within well-defined boundaries is really possible (Davidson, 2012; S. Wunder et al., 2018). Furthermore, many scholars call for PES schemes that incorporate multiple, bundled ES in order to represent as many services as possible that are provided by one ecosystem (Banerjee et al., 2013). Advantageous **economic preconditions** include for instance a significant value of easily commodifiable ES within a given area (Huber-Stearns et al., 2017). Furthermore, opportunity and transactions costs should be low (Börner et al., 2017). **Governance conditions** are central for successfully working PES programs, too. Secure land tenures are essential for well-working schemes making the existence of institutions that guarantee property rights necessary (Huber-Stearns et al., 2017; Schomers & Matzdorf, 2013). In the context of governance also the role of funding actors and intermediaries is central (Engel, 2015; Vatn, 2010). It is also of importance that all parties have access to the necessary information, since hidden information and hidden action are often problems of PES programs (Banerjee et al., 2013; Pattanayak et al., 2010). Furthermore, ideally the scale of a PES scheme fits with the governance structure (Huber-Stearns et al.; 2017, s. chapter 5.2., p. 44). **Social-cultural conditions** are expected to have a crucial influence on the effectiveness of PES programs (Börner et al., 2017; Huber-Stearns et al., 2017). The influences of these conditions on PES success are particularly difficult to assess. However, the interdependencies between the local culture, the acceptance and motivation of participators and the PES program effectiveness are obvious (Vatn, 2010). Only if potential participants are highly motivated, consumers are willing to pay and the cooperation between beneficiaries and providers is possible (Pattanayak et al., 2010; Vatn, 2010). Therefore, it is also a subject of research, which factors affect the motivation to participate in PES programs. Schomers & Matzdorf (2013) mention in this context the importance of equity in access, decision and outcome.

Some of the in this chapter named factors for effective PES schemes are directly or indirectly deepened in other chapters of this thesis. Especially the chapter on critique on PES programs addresses many of these effectiveness criteria (s. chapter 6, p. 48). But first, the effects of the spatial scale on PES effectiveness are in focus.

5.1 Methods

Two key term combinations provided the basis of the literature analysis of this chapter. Both searches were performed with the Scopus search engine. The first key term search was performed as follows:

> *TITLE-ABS-KEY("payment* for environmental service*" OR "payment* for ecosystem service*" AND "scal*")*

Terms such as *'geographical'* or *'spatial'* in combination with *'scale'* were excluded in this search terminology, so that no important papers would be missed. Relevant publications addressing the role of spatial scales were identified by reading the abstracts. A number of 43 publications out of 246 results were determined as potentially useful to answer the research question. Two of these 43 papers were not accessible.

The second search was performed using the following terminology:

> *TITLE-ABS-KEY("payment* for environmental service*" OR "payment* for ecosystem service*") AND ALL(scal* W/15 (effective* OR efficien* OR success*))*

The terms *effectiveness, efficiency* and *success* were chosen based on the findings of a pre-analysis of publications explicitly addressing the effectiveness of PES schemes. Both terms, *efficiency* and *success*, are often used in the context of PES scheme effectiveness. Again, the word stem *'scal*'* was applied without connecting it to the term *'spatial'* to miss no relevant information. However, in the subsequent review of publications only content with connections to the spatial scale issue was considered. The search terminology implies that the word combination must have a distance less or equal 15 words from each other. This distance was derived from the average sentence length of scientific publications (Elsevier, 2015; s. chapter 4.1.1, p. 17). For this search terminology the Scopus search engine presented 39 results, out of which seven papers were not accessible.

After removing duplicates, a total number of 62 accessible papers provided the basis for the following text analysis. The full-text analysis followed the procedure described in chapter 3 (s. p. 14). In the final analysis 37 publications were included and 25 papers were excluded for reasons of missing relevance. Not all of these papers are cited in the result chapter due to content doublings. Additionally, eight papers were considered based on references in the 37 identified eligible publications.

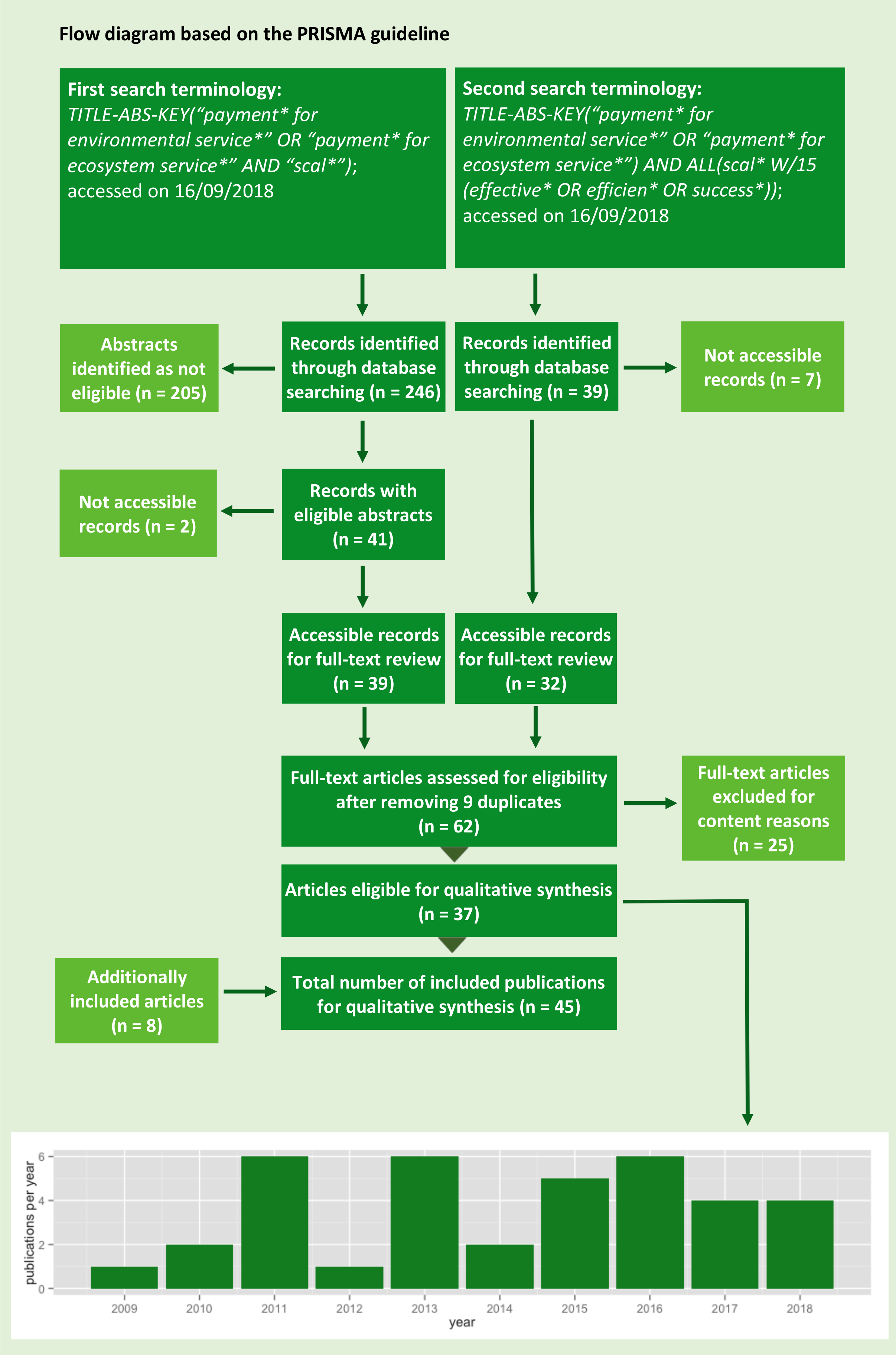

Fig. 7: Search terminologies and quantitative overview of the results: the role of spatial scales

5.2 Results: The Role of the Spatial Scales for the PES Program Effectiveness

Spatial scales play a crucial role in science and politics, since scientific analyzes that study and measure processes or objects, as well as political actions, refer to these scales (Gibson et al., 2000). "Levels, on the other hand, refer to locations along a scale […] [and] spatial scales referring to small-, medium-, and large-sized phenomena" (ibid.: 219). Observed phenomena at one level of scale are often not generalizable for other levels, making a careful consideration of scale aspects necessary.

Generally, the role of spatial scales for the PES program effectiveness appears not to be broadly examined in literature. Even though the applied search terminology resulted in 37 publications that deal with this issue, in most of them it is rather a side issue. By far most of these 37 scientific papers are published in the recent decade (s. fig. 7, p. 43). Thus, this temporal distribution shows strong similarities to the displayed patterns in the other literature searches. The results of this literature review show that most publications highlight the role of spatial scales regarding ES provision and benefits as well as regarding interconnections with political and institutional scales.

The spatial **scale of ES provision and the scale of benefits** that accrue from the provisioning ecosystems differ often substantially. Whereas ecosystems generate their services typically at a local scale, the benefits of these services are available at various scales depending on the ES type (den Uyl & Driessen, 2015). Therefore, Farley and colleagues (2010: 2075) state: "[a] serious obstacle [for conservation] […] is the fact that ecosystem services provide benefits at a variety of spatial scales, ranging from the local to the global". Pollination services usually occur locally, water-related services on local or regional scales in dependence on the watershed size, whereas the benefits of carbon sequestration services are globally distributed (Banerjee et al., 2013; Huber-Stearns et al., 2013; Kull et al., 2015). Last-mentioned climate regulating services are also called *'omni-directional services'* and water services are classified as *'directional flow related services'* (Kemkes et al., 2010: 2072). Thus, within PES programs the scale of benefits should be considered carefully, because "understanding the spatial distribution of ecosystem services is key to identifying potential beneficiaries, the institutions required to provide the service and the transaction costs associated with provision" (ibid.).

In the reviewed publications, authors emphasize **cross-scale mismatches between ecological and social processes** as "key challenge in social-ecological systems" (Cerra, 2017: 595) and highlight that "[the] collaborative provisions of ecosystem services is hampered by a mismatch between the scale at which ecosystem services are managed, the scale of the ecological processes that give rise to those services, and the scales at which most payments are made" (Reed et al., 2014: 48). These mismatches find their expression in overlapping ecosystem and private property boundaries (Reed et al., 2014). Furthermore, the sphere of managing institutions and the jurisdictional scale rarely matches the targeted environmental area (Corbera et al., 2009; den Uyl & Driessen, 2015; Meadowcroft, 2002). Thus, scholars argue that "[the] scale at which institutions and laws are established should be influenced by the scale at which the services are provided" (Loft, 2011: 207). However, also rearrangements or new formations of institutions and especially of property rights to solve these scale-mismatches can lead to problems, because it bears the potential that well functioning local governance structures get replaced by poorly functioning institutional and property rights regimes (Gibson et al., 2000; Wünscher & Wunder, 2017).

In this context, many authors argue that **local and regional schemes provide a range of advantages** compared to national or international schemes. There is evidence that local scale PES programs are more effective (Agrawal et al., 2014; Corbera et al., 2009; Grima et al., 2016; Silva et al., 2016). Scholars explain this for example with the incorporation of local and/or indigenous knowledge, which allows for a better identification of potential actors as well as of costs and benefits (Grima et al., 2016). Local knowledge eases decision and policy making and increases the motivation of local actors to participate on PES programs (Wünscher & Wunder, 2017), which creates opportunities for a collective management of resources (Grima et al., 2016). Furthermore, local scale actions "encourage social learning, coordinate resource use and conservation activities, make more efficient use of community and state resources, and avoid some of the pitfalls of centralized planning, management and regulation" (Lockie, 2013: 93). Additionally, many authors put forward that local PES programs have lower transaction costs, because it is easier to identify and match potential buyers and sellers (OECD, 2013). Generally, "the more global the service, the higher the transaction costs" (Kemkes et al., 2010: 2072). Authors argue that it is also in case of globally distributed benefits reasonable to incorporate beneficiaries as locally as possible to guarantee low transaction costs (Thompson, 2018). On the other hand, this incentivizes free-riding at the global scale (Farley et al., 2010; OECD, 2013). Another argument supports local PES schemes by underlining the importance of motivation for gaining participators. The stakeholders´ motivation and interests are often highly dependent on the distance to the location, from which the ES are provided (den Uyl & Driessen, 2015; Lopes et al., 2015; van den Belt & Blake, 2015). This is also strongly related to the valuation of ES, since "the value attributed to an ecosystem service often decreases with geographic distance from the location where it is produced" (Thompson, 2018: 923). However, this relationship exists not in all cases, as for example some threatened species are highly valued at a global scale (at least regarding their existence value), but less on-site (Dickman et al., 2011). In general, if pursuing the aim of preferably local PES schemes, it is important for the setup of programs to get the right actors involved (Lockie, 2013). This faces a trade-off of getting enough participants involved, while being as local as possible (Banerjee et al., 2013; Lockie, 2013; Sorice et al., 2018).

In practice, **most PES schemes operate at local or regional scales** anyhow and IPES are rare (s. chapter 4.3, p. 36). Nevertheless, there are also many authors, who argue for an **upscaling of PES schemes** to maximize the conservation of ES, even though "national government PES programs [and international schemes] entail large and complex governance structures involving multiple sequential implementation steps at different geographic scales" (Ezzine-De-Blas et al., 2016a: 12). Especially regarding carbon ES this upscaling tendency is existent and promoted by global institutions as for example by the World Bank (McElwee et al., 2014). This tendency finds its expression for example in the REDD+ program, which some scholars see as the largest operating PES experiment worldwide (Corbera, 2012; s. box 5, p. 47). To make national and international programs work, some authors call for cross-scale linkages between different existing organization and institutions at different scales, rather than implementing a new governance structure (Cerra, 2017; Corbera et al., 2009; den Uyl & Driessen, 2015). Cook et al. (2016: 103) "hypothesize that a coordinated but polycentric PES governance framework with environmental targets set at relatively small spatial scales and coordinated at larger scales will produce outcomes that are both important for global ecosystems and the economic development of local communities". In such polycentric governance frameworks intermediaries play a central role in connecting different scales (Schröter et al., 2018b). These intermediaries are often organizations from the civil, public, academic or private sector (Huber-Stearns et al., 2013; s. chapter 4.2.2, p. 31). However, upscaling PES schemes remains challenging, for example regarding the valuations of ES. Valuations are mostly made at a small scale. The upscaling of these valuations generates many uncertainties. Estimations by Grimaldi et al. (2014) and Le Clec'h et al. (2014) in the Amazon region revealed that the upscaling process can lead "to differences of 30 – 60% with the values measured in field-based verifications" (Kull et al., 2015: 129). Additionally, in large-scale programs private fundraising becomes very difficult, which leads to the situation that those programs are often governance-financed (den Uyl & Driessen, 2015). Furthermore, higher scale levels imply an increasing number of potential stakeholders making the consideration of various interests necessary (Schleyer et al., 2015).

The literature review shows also other scale-related aspects. **Leakage** is one of them, lowering the effectiveness of PES programs by "shifting environmentally damaging activities elsewhere" (Engel & Muller, 2016: 176). But the reversed effect is imaginable, too. **Spillovers** can enhance conservation elsewhere due to changes of social norms, increased ecotourism opportunities or the strengthening of existing laws (Pattanayak et al., 2010). On the other hand, ecotourism can also have negative consequences for the biodiversity, for example if an increasing number of tourists travels by plane (Sarkki, 2011). Generally, today's long and globally connected production chains are often complex and difficult to oversee, making it complicated to analyze the causes and drivers of land use change (Friis et al., 2016).

The review results of the assessed publications underline that the consideration of spatial scale aspects is crucial for a successful design of PES programs. Especially the implementation of national or international PES schemes faces many challenges. At the same time, the upscaling and globalization of market-based conservation approaches is promoted by many actors, making a careful discussion of challenges, advantages and disadvantages necessary.

Box 5: Example – Reducing Emissions from Deforestation and Forest Degradation (REDD+)

Some authors describe REDD+ as the largest existing PES program (Corbera, 2012). The program ***covers multiple spatial scales*** *and is part of the 'The Framework Convention on Climate Change'. The scheme aims at protecting forests in Global South countries by assigning monetary values to carbon sequestration and storage functions of these forests. Thus, the* ***quantification and monitoring*** *of carbon sequestration is important in for REDD+. Central to the mechanism is an improvement of the carbon storage capacity in relation to a previously determined baseline, which is why this program is also described as a* ***results-based and output-oriented mechanism*** *(s. chapter 4.2.2, p. 31). So far,* ***funding comes from governments*** *of Global North countries* ***and international donors****, such as the World Bank (Fatheuer, 2015). Therefore, this scheme* ***cannot be classified as a voluntary PES program****. However, there are ambitions to implement a market-based funding mechanism based on an international carbon trading scheme. Advantages and disadvantages of such a funding approach are controversially discussed.*


own depiction

6. Critique on Payments for Ecosystem Services

6.1 Methods

In its overall structure, the methodology of this chapter follows the former sections. The critique chapter is based on the following search terminology using Scopus as search engine:

> *TITLE-ABS-KEY((“payment* for ecosystem service*” OR “payment* for environmental service*”) AND (“neoliberal*” OR “neoclassic*”))*

This chapter is based on an inductive approach using the term *‘neoliberal’* as entrance gate for gathering publications that address critique on PES and the term *‘neoclassic’* as a complement to miss no relevant papers. The term *‘neoliberal’* was chosen after reviewing five papers that criticize the PES approach (s. appendix, tab. II, p. 88). This review illustrated that the terms *‘neoliberal’* or *‘neoliberalization’* are often used by scholars criticizing PES. Additionally, *‘neoclassic*’* was chosen as further search term since critique on the neoliberalism is often connected with critique on *Neoclassical Economics* approaches. The use of the term *‘critique’* and deviations from it was rejected for this literature search, because this search terminology provided too many results not containing critique specifically on PES programs. Thus, the focus on the neoliberal critique narrows the results significantly. However, this narrow selection seems useful, since, as the results show, the publications touch various fields of critique.

The search terminology resulted in 55 publications, out of which 38 papers were chosen for a detailed full-text review based on the thematic relevance of the abstract. One paper out of 38 was not accessible due to a paywall. Two publication were excluded due to content reasons, after reviewing the full texts. A total of 43 publications were additionally included in this chapter based on citations in the eligible publications and by incorporating expert knowledge of the author. The particular high number of additional publications is a result of a high share of citations in the eligible publications that refer to important aspects named by other authors.

Search terminology

TITLE-ABS-KEY(("*payment* for environmental service**" OR "*payment* for ecosystem service**") AND ("*neoliberal**" OR "*neoclassic**")); accessed on 09/10/2018

Flow diagram based on the PRISMA guideline

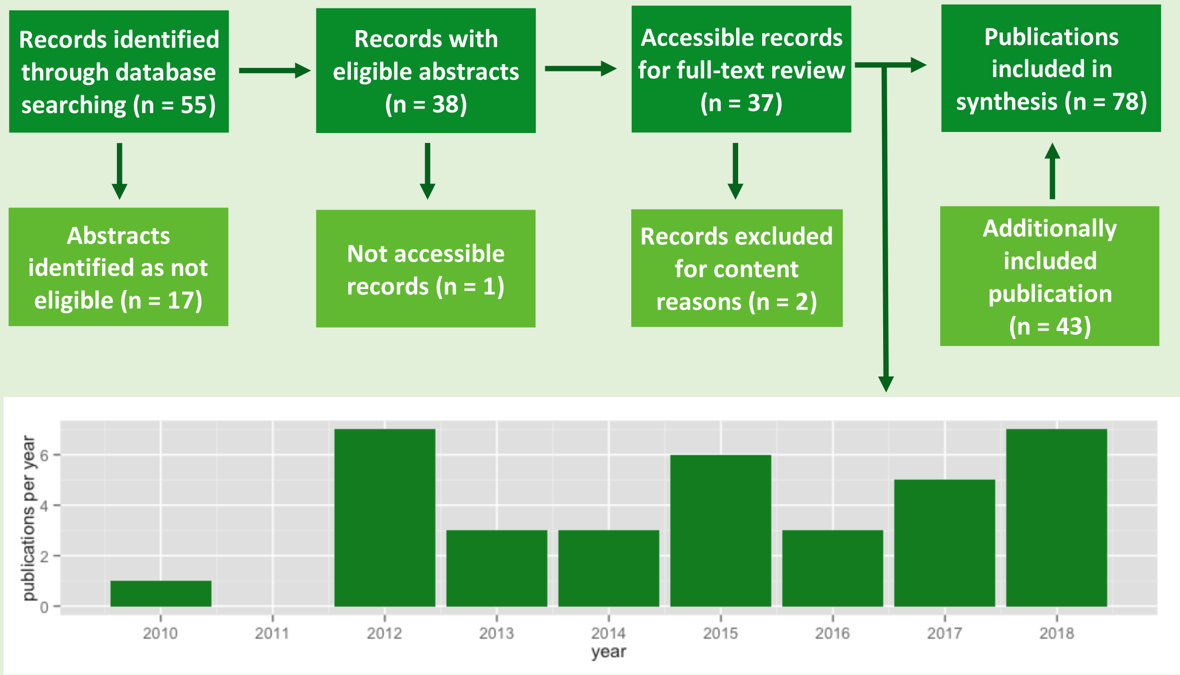

Fig. 8: Search terminology and quantitative overview of the results: critique

6.2 Results

The search terminology led to many interesting results as the high share of eligible publications indicates. These various publications show that PES are criticized by many scholars of different backgrounds regarding their school of thought. By far most of them are published after 2011, pointing out the increasing relevance of this issue. Wherever the critique comes from, it is important to keep the huge variety of PES definitions in mind when reviewing publications of authors criticizing PES (s. chapter 4.1.2.4, p. 23). While some authors reject the PES approach in its entirety, others focus on specific features of PES schemes. Particularly in the latter case a crosscheck with the diversity of PES definitions is inevitable.

This chapter is structured as follows: In the first subchapter, key actor groups criticizing the PES concept based on the reviewed publications are presented. The second subchapter focuses on critique of the supposedly neoliberal nature of PES, followed by three subchapters addressing the critique regarding the monetary valuation and ecological as well as social and institutional aspects.

6.2.1 Groups of Critics

Environmental Economics provide the theoretical grounding for the PES approach. This school of thought is strongly influenced by the neoclassical theory (s. chapter 2.4.2, p. 10) and follows the assumption that the environmental degradation is a result of market failures, which find their expression in the non-reflection of environmental costs in product prices (Scales, 2015). *Environmental Economists r*ecommend the implementation of valuation and commodification techniques to internalize externalities (Gómez-Baggethun et al., 2010).

Critics of PES programs often oppose parts of this thinking or even reject the overall approach. In the literature *Ecological Economics*, *Political Ecology*, *degrowth* and *buen vivir* are mentioned as influencing schools of thoughts respectively movements that criticize the PES approach. Characterizing these perspectives is challenging, because such classifications are prone to simplify – e.g., since clear differentiations are impossible. Moreover, there are additional influences, for example from the *Social Ecology* and the *Environmental Anthropology* that are not explicitly named in the identified literature. However, giving an overview of the in the publications detected main schools of thought seems very useful to develop a better understanding of the diversity of PES critique.

Ecological Economics must be mentioned as one famous trans- and interdisciplinary school of thought. *Ecological Economists* are especially interested in the interdependencies between ecology and economy, following the approach of strong sustainability, which is based on the assumption that natural capital cannot be substituted by any human-made capital (Gómez-Baggethun et al., 2010). Within the PES debate *Ecological Economists* stress the limited capabilities of translating nature into monetary values and call for the recognition of a greater value plurality as well as of equity aspects (Kallis et al., 2013).

The critique of **Political Ecology** addresses particularly the underlying capitalist structures of the commodification of nature. *Political Ecology* has its roots in various fields such as rural sociology, geography or anthropology and is influenced by e.g. Marx´s value theory and egalitarian thoughts (Huber, 2017; Kallis et al., 2013). Key questions for this school of thought ask "how capitalism works, how it affects human and non-human nature relationships, and why and how under capitalism there is a drive to reduce all forms of value and valuation into monetary (exchange) values" (Kallis et al., 2013: 98). Thus, compared to the *Ecological Economy* view, *Political Economists* rather focus on social aspects and power relations in the context of a capitalist system.

Thirdly, the **degrowth movement** is a clear voice within the debate on the monetary valuation and commodification of nature. This movement is very diverse, making a homogeneous definition impossible. Nevertheless, some common ground can be identified within this movement, which started with theories of *'décroissance'* by the French philosopher André Gorz (1972). Prominent representatives of this line of thought are e.g. Serge Latouche with "Farewell to Growth" (2009) or Tim Jackson with his famous book "Prosperity without Growth" (2009). These scholars' and activists' main points of critique are directed at the neoclassical growth paradigm dominating the discourse. Most representatives understand *degrowth* as an alternative concept to growth, not as the exact opposite of sustainable and green growth (D'Alisa et al., 2015). For many representatives, the aim is not primarily a shrinking economy respectively GDP. Instead, the *degrowth* concept more profoundly scrutinizes the growth paradigm and the understanding and measurement of prosperity. An absolute decoupling of economic growth and resource consumption is seen as impossible by some scholars (Jackson, 2009). Environmental problems as well as social conflicts are considered to be directly connected with the neoclassical paradigm. *Degrowth* therefore promotes an alternative understanding of welfare that differs from the current understanding that links welfare directly to income (D'Alisa et al., 2016). Key elements of a *degrowth* economy would be for example deceleration, a greater time prosperity or sufficiency to minimize the ecological footprint while considering equity aspects. Within the *degrowth* movement there is a consensus about the contra-productivity of an overflowing commercialization of nature, natural capital and ES (Goméz-Baggethun, 2016). However, there is no common sense, if market-based instruments should be rejected per se (Petschow et al., 2018).

Degrowth ideas show also linkages to the ***sumak kawsay*** concept, better known as ***buen vivir***. *Buen vivir*, developed in Latin America, can be understood as a counter concept to the current Western development narrative (Gudynas, 2016). The concept is strongly influenced by convictions brought into the debate by indigenous people. At the core of the concept stands the defense of post-capitalist as well as post-socialist alternatives besides the rejection of the widespread western understanding of development. In particular, *buen vivir* rejects a predetermined linearity of history and in this context also the current growth-based understanding of prosperity and progress. The idea of a clear dependence between well-being and material consumption is viewed critically. Additionally, a clear dichotomy between the human and the natural sphere is questioned. However, there are different understandings of *buen vivir*, since it is no coherent concept, but represents instead a set of thoughts and forms of consciousness. However, there is a common sense to reject the private appropriation of ecosystems (Goméz-Baggethun, 2016).

6.2.2 Critique of the Neoliberal Patterns of the Payments for Ecosystem Service Approach

Many authors claim that PES are part and expression of a broader neoliberal agenda. Therefore, they combine their critique of PES with the observable global diffusion of a neoliberal narrative within the last decades.

In this context some detractors criticize "that the [PES] approach implicitly accepts neoliberal capitalism as both the problem and the solution to the ecological crisis" (Fletcher & Büscher, 2017: 224). Fletcher & Büscher call this *'the PES conceit'* (ibid.). This so-called *'neoliberal conservation'* or *'green neoliberalism'* (Büscher et al., 2012; Fletcher & Büscher, 2017) pushes the valuation and commodification of nature forward and builds on the assumption that monetary incentives are the best way for governing human behavior (Allen, 2018; Fletcher, 2010).

Yet, the term *'neoliberalism'* is controversially discussed in the academic community. Some authors even deny that PES schemes are a neoliberal tool for environmental protection, since only very few PES schemes can be described as pure markets for ES (Matulis, 2017; van Hecken et al., 2018). For example McElwee and colleagues (2014: 423) put forward the view that "[PES] should not be labelled solely 'neoliberal' per se".

This raises the question, if neoliberalism finds its expression only in pure market instruments. This cannot be answered in an unequivocally clear manner, since there is no unique definition of what neoliberalism is. Some authors understand "neoliberalization as an incomplete and adapting process, rather than a monolithic ideology that is uniform across history and geography" (Matulis, 2013: 253). Büscher and colleagues (2012: 4) describe neoliberal conservation as "amalgamation of ideology and techniques informed by the premise that natures can only be 'saved' through their submission to capital and its subsequent revaluation in capitalist terms". McElwee et al. (2014) state that neoliberalism finds its expression in privatization, commodification and a minimized influence of the state. Apostolopoulou and colleagues (2014: 482) name "seven 'generic' elements of neoliberal thought and practice: privatization, marketization, state roll back or deregulation, market-friendly reregulation, use of market proxies in the residual state sector, strong encouragement of 'flanking mechanisms' in civil society, and creation of 'free', 'self-sufficient', and self-governing individuals and communities". Hahn et al. (2015) developed six degrees of commodification based on the concept of Muradian and colleagues (2010; s. chapter 4.2.2, p. 31) and are convinced that only the last two stages – namely economic instruments that build on a voluntary market trade and financial instruments such as forest bonds and biodiversity derivatives – contribute to a real neoliberalization of nature.

These different views on neoliberalization illustrate that there is no consensus about which policy instruments are neoliberal and which ones not. This is particularly evident in Fletcher's & Büscher's *'PES conceit'*. They still see PES as a neoliberal instrument, even though most PES schemes rather masquerade as markets (Matulis, 2017). They justify their conviction by drawing on Foucault's *theory of governmentality*. Governmentality describes "a process of repeated practice and inscribed procedure, though which complicit assumptions and behavioral codes become routine" (Wynne-Jones, 2014: 149). Regarding PES this means that symbolic meanings such as the monetary valuations of ES aimed at gaining attention for ES protection are often forerunners of a subsequent commodification and marketization of ES (Fletcher & Büscher, 2017). This is the case, because monetary incentives, whether based on true markets are not, introduce a neoliberal thinking in commodities and exchange values. Foucault's governmentality is strongly connected with the term *'performativity'*, which describes how language, thoughts and narratives shape concrete actions (Kolinjivadi et al., 2017). Thus, neoliberalism is rather understood as a process than as an outcome. Since most PES schemes are hybrid instruments incorporating both market-like and regulatory instruments through state intervention, some scholars use alternative terms such as *'hybrid neoliberalism'* (Higgins et al., 2014) or *'social neoliberalism'* (Cerney et al., 2005).

Generally, the debate on the hypothetically neoliberal nature of PES is mainly conducted within the *Political Ecology* discourse.

6.2.3 Critique on the Monetary Valuation of Ecosystem Services

The valuation of ES in monetary terms as well as the expression in exchange values is central to many publications criticizing PES. This major field of critique is to be seen as a cross-sectional theme touching critique fields in the ecological as well as in the social sphere.

Values describe and rank "the importance of actions" (Graeber, 2001: 49) and "are embedded in, and reproduced through social exchange" (Allen, 2018: 244). Monetary valuation is only one of many types of valuation. Monetary valuations follow a market thinking, which is based on the prioritization of exchange values over use values (Scales, 2015). Capitalism uses these exchange values as core principle that follows an understanding of weak sustainability in which ecosystem services and functions can be substituted with other ES or even human-made capital (Biely et al., 2018). The monetary valuation of nature follows an utilitarian, profit- and maximization-based rationality, which means e.g. that ES providers only conserve nature, if PES cover the opportunity costs (Kallis et al., 2013; Muniz & Cruz, 2015; s. chapter 4.1.2.2, p. 20). This utilitarian logic follows the *'homo economicus'* description of an agent purely interested in profit-maximization (McAfee, 2012; van Hecken et al., 2018).

This **utilitarian rationality** is criticized by many scholars. It is stated that the articulation of ES in exchange values "[undermines] the social complexity necessary for sustainability" (Allen, 2018: 253). Critics put forward that a monetary valorization is often difficult or even impossible and **ignores other valuation languages** such as intrinsic, fundamental, eudaemonistic and instrumental values of nature (Muniz & Cruz, 2015). Especially *Ecological Economists* stress that this simplification of values conceals the complexity and interconnectedness of ecosystems (Kallis et al., 2013). Using only one single valuation language **neglects other rationalities**, as e.g. rights-based, procedural or consequential rationalities (ibid.). Therefore, many scholars plead for a value plurality in the context of nature conservation (Kallis et al., 2013; Muniz & Cruz, 2015). If value plurality is not considered, a potential **crowding-out of intrinsic motivations** is often mentioned as barrier for a successful nature conservation (Corbera, 2012; Hahn et al., 2015; Scales, 2015). The result could be that "the willingness to accept will be more enticing than the willingness to change" (Muniz & Cruz, 2015: 10911). An alternative to pure monetary compensation is technical assistance, which could provide another incentive to change land use (ibid.). Generally, potential crowding-out effects are subject of many research projects (Corbera, 2012). Studies have shown that monetary incentives can also lead to a crowding-in. Whether PES result in crowding-in or crowding-out seems strongly dependent on the incentive type and the social and cultural background of the participating agents (Rode et al., 2015). However, in cases where PES trigger crowding-out effects, landowners only maintain the conservation of their land, if payments are long-termed (Muniz & Cruz, 2015). Thus, impermanence is seen as problematic, while many PES programs cover periods from three to five years only (McAfee, 2016).

To sum up, values are central in shaping human interactions with the natural environment. At the same time, the creation of values is strongly influenced by the role of institutions and power structures – an aspect that is much influenced by Marx's value theory and that, according to some authors, is too little considered in the PES debate (Kallis et al., 2013).

6.2.4 Critique Regarding Ecological Aspects

Many scholars argue that the monetary valuation and commodification encounters bio-physical barriers (Goméz-Baggethun, 2016), because ES are an often *'uncooperative commodity'* due to its public good or commons character (Bakker, 2003; s. chapter 2.2, p. 5).

Critics of the increasing commodification describe these tendencies for example as '**commodity fetishism**' (Kosoy & Corbera, 2010) or '**complexity blinder**' (Norgaard, 2010). They justify their critical perceptions with different arguments, whereby the monetary valuation is again central to the debate (s. chapter 6.2.3, p. 53). When commodifying ES, the problem occurs that nature "is not produced specifically for the purpose of exchange" (Scales, 2015: 228). Thus, the exchange is based on a fictitious ES commodity (Polanyi, 2001 [1944]), which is formatted "through the creation of new institutions and technologies" (Scales, 2015: 228). Necessary enabling conditions for the exchange are commodities with clear boundaries and values as well as clearly defined property rights – conditions that can rarely be guaranteed and that often differ between ES types, regions and cultures (Kosoy & Corbera, 2010; Scales, 2015). Ecosystems are very complex, comparable to a human brain, which makes **demarcations** between different ecosystem components **very difficult** (Kosoy & Corbera, 2010). In this context, the simplification and focusing on specific ES as exchange units is considered dangerous (Kosoy & Corbera, 2010; Robertson, 2006; Schröter et al., 2018a). For example, the focus on carbon ES "has already led to the planting of certain tree species over others because of their high carbon content and rapid growth rates" (Scales, 2015: 228), which leads to a lower biodiversity. Additionally, it is stated that ecosystem boundaries often mismatch with economic and political boundaries, leading to difficulties regarding land tenure and control (ibid., s. chapter 5.2, p. 44). Furthermore, some scholars mention the problem that exchange values imply full substitutability with other market goods – a thinking that is based on the concept of weak sustainability (Biely et al., 2018; Hahn et al., 2015; s. chapter 6.2.1, p. 50). Critics encounter that ES, at least in their global entirety, should be seen as a good with inherent values implying an irreplaceability by other capital (Farnworth et al., 1981). This assumption follows the concept of strong sustainability (Farley, 2012; van den Bergh, 2010).

The valuation methods are also viewed critically, since the measurement and calculation of ES is often difficult, e.g. due to **incomplete information** and **scientific uncertainties** regarding the ecosystem functioning (McAfee, 2016; Muradian et al., 2010). Scientific uncertainty applies also to the relationship between ES provision and land use practices as well as to social-ecological systems in general (de Lima et al., 2017; Schröter et al., 2018a). All these mentioned concerns regarding measurement, valuation and commodification methods are often mentioned by *Ecological Economists* (Gómez-Baggethun et al., 2010).

A further problem is related to the **additionality** of PES programs. In practice, it is very challenging to verify, if a sustainable land use practice would have been implemented in the absence of PES anyhow (McAfee, 2016). This becomes even more difficult, when considering possible **leakage** effects, which describe the shift of "[environmentally destructive activities] from the places targeted for conservation to other sites" (McAfee, 2016: 340; s. chapter 5.2, p. 44). In a globalized world, these shifts can move the destructive activity a long way off.

Rebound effects are also often mentioned next to leakage effects. Such effects are based on the theory of the so-called *Jevons' paradox*. This paradox describes how efficiency gains through new technologies do not automatically lead to a lower resource consumption, but often even to an increase of resource use due to lower product prices (Biely et al., 2018; York, 2006). This paradox is mainly mentioned by *degrowth* proponents to point on the impossibility of an absolute decoupling of resource use and GDP growth (Paech, 2013). Muniz & Cruz (2015: 10905) relate this debate around rebound effects to ES provisioning and state: "the more the provision of services is optimized, the more the services are consumed and the more their consumption is justified. Carbon and biodiversity credits and the optimization of the so-called ES in the developing and poor countries largely favor the developed and rich countries to sustain their consumption and lifestyle". Thus, there is a danger that the **compensation logic** will **lead to a trap**, because compensation schemes give consumers a *'license to trash'* (Kate et al., 2010: 237). However, such a compensation logic is not an integral part of all PES programs, but rather of specific PES(-like) schemes such as REDD+.

These concerns can be assigned to the ecological sphere, but show also close linkages to social and institutional aspects, since complex human-environmental interactions underlie the PES mechanism.

6.2.5 Critique Regarding Social and Institutional Aspects

PES proponents claim that PES offer opportunities for both environmental protection and poverty reduction turning PES into a win-win approach (Muradian et al., 2013; Pagiola et al., 2005). This view on PES is criticized by many scholars who reply that aspects of environmental justice are rarely considered (e.g. Fletcher & Büscher, 2017; Kosoy & Corbera, 2010; Muniz & Cruz, 2015; Muradian et al., 2010). This non-consideration of justice aspects might have negative effects on the effectiveness of biodiversity conservation, too (Vira, 2015).

Some authors name different dimensions of justice, which are often unaddressed by PES schemes, such as distributional, procedural and participatory justice as well as justice of recognition and of capabilities (Muniz & Cruz, 2015). Distributive justices is related to the allocation of economic goods within a society and between societies (Davidson, 2012). Procedural justice addresses the fairness of a process that shapes the allocation of goods. This type shows strong connections to the fairness of legal proceedings (McGrath et al., 2017), which includes for example justice of recognition describing recognition or non-recognition of actors in a process. This type of justice is strongly connected with the participatory justice, because "if communities are not recognized, there is a barrier to their participation" (Muniz & Cruz, 2015: 10907). The concept of justice of capabilities by Martha Nussbaum (2000) addresses the question of "how […] goods can be transformed to propitiate individuals and communities to flourish" (Muniz & Cruz, 2015: 10907).

Taking these different dimensions of justice into account, PES rather produce winners and losers (Blanchard et al., 2016), which some critics explain with the effects of a neoliberal market logic and the related consequences of *performativity* and *governmentality* (Fletcher & Büscher, 2017; s. chapter 6.2.2, p. 52).

However, it must be scrutinized how these different inequalities manifest themselves. Many scholars assume that inequalities are a result of the underlying **power structures and power imbalances**, which are paid too little attention in the implementation process of PES programs. This cluster of critique follows generally a *Political Ecology* thinking. Power imbalances find their expression already in the valuation process, because institutions and **power structures shape the monetary valuation** of ES (Kallis et al., 2013). In the case of already implemented PES programs, power imbalances find their manifestation in **inequalities between the different actors**. In many publications, the **disempowerment of local people** is considered central. A study by Cavanagh and Benjaminsen (2014) focuses on the attempted establishment of a carbon market in Uganda, which led "to the eviction of the local people, without any compensation for their loss of land, property, and livelihoods" (Matheus, 2018: 31). Such examples promote the concerns about "an **uneven distribution of costs and benefits**, with some even **losing access** to natural resources" (Scales, 2015: 229; emphasis added). Yet, the influence of experts as well as of unelected institutions as e.g. NGOs increases in such cases, which could then have an impact on decisions over the local people's heads (Apostolopoulou et al., 2014b; Corbera, 2012). Often, elite interests become dominant (Roth & Dressler, 2012) while interests of people that are disadvantaged or follow a traditional lifestyle are often ignored (McElwee, 2012; Muniz & Cruz, 2015). Additionally, since privatized land is a necessary pre-condition for the implementation of PES programs, people holding formal land titles, so people who are anyhow wealthier than others, are also advantaged within the PES program implementation process (Corbera, 2012). There is also some evidence that often large landowners profit most from PES funding resources (Muniz & Cruz, 2015; Sommerville et al., 2010). These different concerns are often accompanied by a lack of participatory and procedural justice in PES programs. Therefore, some authors call for the development of participation methods to better recognize the perceptions of local people (Bétrisey et al., 2016; Corbera, 2012; Petheram & Campbell, 2010).

It is also criticized that in a globalized world with international environmental protection schemes such as REDD+ the **disparity between participating countries has negative consequences** on the outcome of PES programs. This topic is for example addressed by "the **'lower-cost-of-conservation'** argument" (van Hecken et al., 2015a: 57; emphasis added), which is also known as **'the poor who sell cheap'** (Martínez-Alier, 2004). The theory follows the argumentation that land, labor and life costs are cheaper in countries of the Global South, which lowers opportunity- and thereby offset costs (Muniz & Cruz, 2015). In other words, the level for willingness to accept is lower in poorer world regions. Muniz & Cruz (2015: 10906) do not only relate this effect to global inequalities, when they state that "PES reinforces inequalities between urban and rural, rich and poor, among generations, and between North and South countries". Moreover, PES programs may undermine the sovereignty of countries and regions, when they are affected by the economic power of countries of the Global North and powerful international institutions, as for example the World Bank (Matheus, 2018). Thus, "global buyers [might benefit] from greater experience, knowledge and buying power" (Scales, 2015: 228), creating and reinforcing **logics of (neo-)colonialism** (Muniz & Cruz, 2015).

Additionally, scholars point out the danger of so-called **'green grabbing'**, because PES programs might lead to an increasing competition for property and disposal rights on valuable ES (Fairhead et al., 2012; Van Hecken et al., 2015a). The mentioned concerns show also strong connections to the previously mentioned challenges regarding potential rebound effects in the context of a compensation logic (Kate et al., 2010; Muniz & Cruz, 2015).

Another concern addresses the potential **weakening of democratic structures** leading to **depolitization** effects (Swyngedouw, 2016). This theory is related to questions of power imbalances and a lack of participation and recognition of people and communities, but follows another narrative of explanation. Swyngedouw assumes that the promotion of market-based instruments lowers political influence by governments and instead shifts responsibility to the market sphere. In consequence, citizens might have less influence on decisions, which leads to a *depolitization*. He calls for a *repolitization*, which consists of a strengthened political influence by citizens. Decision-making should be a task of the citizenship rather than the economic sphere, because '*governance-beyond-the-state*' pushes political exclusion and "more autocratic, undemocratic, and authoritarian (quasi-)state apparatuses" (Swyngedouw, 2000: 70). Also Muniz & Cruz (2015: 10905) stress that economic monetary valuations and rules "can […] undermine the democratic process".

On the institutional level, there are also concerns regarding the actual cost efficiency of PES schemes. **Transaction costs** for upsetting and operating PES programs are often very high, leading to a lower efficiency of PES schemes (McElwee, 2012; s. chapter 4.1.2.2, p. 20).

All in all, PES programs are viewed critically for various reasons. It is often mentioned that PES schemes neither reach ecological objectives nor social goals. Instead, PES programs can even reinforce existing injustices. Thus, some scholars claim an "actor-oriented perspective with focus on power, related to knowledge, meaning and inequality [to] help de-fetishize and re-politicize PES" (van Hecken et al., 2015b: 118).

However, critique on PES is as broad as the definitions for PES are. Therefore, it is necessary to discuss the various points of critique in the context of the former chapters on PES definitions as well as on the role of scales for PES scheme effectiveness.

7. Discussion

The results of this systematic literature review allow for drawing connections between the large variety of PES conceptualizations, the role of spatial scales for the PES scheme effectiveness and various critique of the approach, thereby opening up a novel perspective for research on PES. The results point out challenges and contradictions that make a critical discussion necessary. Hereafter, the main findings and the contradictions that have been discovered are summarized and discussed. In conclusion, the learnings are used for the development of an adapted PES definition and for opening up various research perspectives. The starting point of this chapter is a critical discussion of advantages and downsides of the methodology of this study.

7.1 Method Discussion

The methodology of this study built on systematic literature searches using specific search terminologies to answer the three key research questions. The terminologies were developed based on pre-analyses of 15 publications selected by the author that give an overview of the PES research (s. appendix, tab. I, p. 87). The low number of pre-analyzed papers is due to the pilot character of this study. This first methodological step provided a helpful entry into the topic. However, this approach could be broadened in future studies. It also guides and influences the development of search terminologies leading to the potential non-consideration of further important terms or aspects. This is especially the case against the background of the interdisciplinary character of this topic, which results in a large variety of used terms in the literature. Here, the most prominent example is the PES term itself, since scientists use diverse alternative terms such as *'rewards for ecosystem services'* or *'compensation and rewards for environmental services'* (Derissen & Latacz-Lohmann, 2013; s. chapter 4.1.2.5, p. 28). Thus, the focus on *'payments for ecosystem services'* and *'payments for environmental services'* leads to narrower results. However, these two terms are the most commonly used terms in academia, which justifies the focus on them.

Definitions for PES are identified by applying the word stem *'defin*'* for the search in the full texts. Although this search terminology gives no guarantee for completeness, many important papers dealing with PES definitions were identified and further relevant publications were referenced therein. Therefore, it can be assumed that the most relevant definitions were detected, particularly due to the application of the second terminology searching for the word stems *'coase*'* and *'pigou*'* in the full texts. These results provided very important insights into the categorization of definitions and referred to further PES definitions. Generally, the share of eligible publications combining both search terminologies was very high with ca. 70% of the identified and accessible papers (68 out of 102 papers). The analysis of the subchapter presenting PES classification schemes focused only on the abstracts by using the word stem *'classif*'*. A further subchapter addresses the current state of PES scheme implementation only using the expert knowledge of the author on existing publications. This rather superficial search strategy for both subchapters can be justified, because these issues are not central to this study. However, considering them is necessary for the understanding of the overall research subject.

The chapter on the role of spatial scales for the PES scheme effectiveness was based on a broad terminology by searching for the word stem *'scal*'* in the abstracts and additionally on a specified terminology searching for combinations of *'scal*'* with the word stems *'effective*'*, *'efficien*'* or *'success*'* in the full texts. It can be assumed, that these search terminologies in combination covered many important publications addressing this issue. However, when applying the first broader terminology most of the identified abstracts were identified as not eligible. Therefore, it was useful to perform the second search terminology, since it led to further relevant publications with more specific content.

The focus on the (supposedly) neoliberal nature of PES programs set a specific view on PES critique by using the search terms *'neoliberal*'* and *'neoclassic*'*. However, test searches using terms such as *'critique'* did not produce satisfactory results. Therefore, it is reasonable to use this inductive literature search approach, even though the term *'neoliberal'* is by no means clearly defined and often used in a politicized context. The focus on neoliberalism in the context of nature conservation was advantageous, because the literature search confirmed that the role of neoliberalism in the context of PES is controversially discussed, as the large number of publications indicated. But beyond this very specific focus, some other famous and often cited publications criticizing PES were not identified using this specific search terminology, e.g. the paper *'Payments for ecosystem services as commodity fetishism'* by Kosoy and Corbera (2010). However, these papers were easily identifiable, since they were often cited in the eligible publications.

This literature search was performed with *Scopus*. In a following analysis it could be interesting to include further databases such as *ScienceDirect* or *Web of Knowledge*. However, *Scopus* as one of the largest literature databases provides a high availability of important publications (Mongeon & Paul-Hus, 2016). But it has to be pointed out that studies indicate that *Scopus* shows biases and favors e.g. publications in natural sciences (ibid.).

Unfortunately, not all publications were accessible due to paywalls. Potentially interesting papers that are referenced in the eligible publications were included into this study as well. The selection of these papers was based on the authors' knowledge and judgment. A further limitation consists of the incorporation of only English-language publications in this study. Especially the consideration of publications in Spanish and Portuguese would be very interesting, because English is not common in academic literature in Latin American countries. However, including such publications in the research was not possible due to a lack of language skills of the author.

Overall, the applied methodology led to interesting results and followed a clear and comprehensible structure. The research questions of this study could be answered, even though there are potentials for a further development of the methodology to include further literature. However, developing search terminologies faces trade-offs regarding a maximum of included literature and time constraints.

7.2 Contradictions within the Scientific Debate on Payments for Ecosystem Services

The ES approach first strived for drawing attention to the increasing environmental destruction and thus pursued rather educational goals (Gómez-Baggethun & Ruiz-Pérez, 2011). However, in the last decades the PES approach gained increasing popularity in policy and science, pushing the quantification and commodification of ES.

The results of this literature analysis show that **PES are by no means clearly defined** and for that reason are understood quite differently. For example, there is no consensus about the difference between the terms *'ecosystem services'* and *'environmental services'*. Many authors use both terms interchangeably or without explicitly defining them, others see *'ecosystem services'* as a subcategory of *'environmental services'* and yet others see them as two systematically different categories (s. chapter 2.4.1, p. 8). Differing understandings also find their expression in the subdivision into a *Coasean* and a *Pigouvian* PES conceptualization. The former implies private negotiations and direct payments on a conditional and voluntary basis from ES beneficiaries to ES providers holding clearly defined property rights on the ES providing land (Wunder, 2005 & 2015). The latter *Pigouvian* understanding also includes (partly) involuntary schemes, in which governments often play a crucial role, e.g. as ES buyers (e.g. Muradian et al., 2010).

For reasons of clarification, this study provides a systematization of key features based on the identified PES definitions (s. tab. 3, p. 27). The features are divided in ex ante (*conditionality, voluntariness, incentive character, transparency, directness of transfer and well-definition of ES*) and ex post criteria (*additionality and pro-poor character*). The analysis shows that PES definitions differ tremendously both in terms of the features included and of the interpretation of these features. *Conditionality* – meaning that payments are only made if the ES provision can be contractually secured – is the key feature of most PES definitions, since nine of twelve compiled definitions contain this criterion. The distinction in *Pigouvian* and *Coasean* PES conceptualizations becomes particularly manifested in the *voluntariness* and the *directness of transfer*. In practice, many schemes mentioned as PES in the literature are governmentally funded and thus partly involuntary due to the "mandatory use of general taxes, rents, or user feed on all citizens" (McElwee et al., 2014: 425).

Four of twelve PES definitions include ex post criteria, which can only be evaluated after the PES scheme has been operating for some time already. This is the case for environmental *additionality*, which can only be proved retrospectively. The same problem occurs for the *pro-poor* criterion implying that only schemes reducing poverty can be counted as PES. It seems reasonable that these criteria are not be part of the definition, because the assessment of them depends strongly on normative assumptions and the retrospectivity would complication PES research severely (Wunder, 2015).

This variety of PES understandings leads to ambiguities regarding the question of which operating environmental schemes can be counted as PES. Whereas the criteria of Wunder's narrow *Coasean* definition are rarely met by operating PES schemes (Wunder, 2005 & 2015), the broad and unspecific *Pigouvian* definition by Muradian et al. (2010: 1205) makes it difficult to distinguish PES from other environmental policy instruments. This variety of definitions becomes also apparent, when reviewing existing classification schemes (s. chapter 4.2., p. 30). Many therein mentioned classification items do not fit with e.g. Wunder's narrow definitions.

Therefore, the challenge is to balance a definition in a way that the necessary broadness is given to include a sufficient number of empirical cases, while describing clearly what is distinctive about PES and thus being narrow enough to separate PES from other environmental policy instruments that also build on positive incentives. This question is central to the PES debate, which is why an extra chapter is devoted to this topic, aiming at providing such a balanced PES definition (s. chapter 7.3, p. 68).

The different PES definitions led to contradictions and obscurities when analyzing the role of spatial scales and critique of PES. This problem is even intensified as a result of the fact that not all authors clearly define their understanding of PES.

Central to the debate about **the role of spatial scales** is the differentiation in the scale of ES provision versus the scale of ES benefits. Whereas the ES accrue locally, the scale of direct benefits from the provided services is largely dependent on the ES type. For example, water-related ES often occur downstream along a river and thus cover local or regional scales. In contrast, carbon services provide benefits to humans globally by mitigating climate change. Referring to Wunder's definition (2015), the funding area depends directly on the scale of ES benefits, because payers are beneficiaries respectively service users by definition. In contrast, this is not the case for definitions that mention not directly ES-using agents as potential ES buyers. Thus, clarity regarding the underlying definition is central, when discussing scale aspects of PES programs. Only broader definitions include large international PES schemes, except for programs addressing globally distributed carbon ES. Other ES types provide only indirectly large-scaled international benefits, e.g. by securing the production of agricultural goods that are exported globally.

In practice, most schemes operate locally or regionally anyhow, especially in the Global South as for example in Latin America (Grima et al., 2016). In countries of the Global North PES programs are typically larger and more commonly government-financed (Wünscher & Wunder, 2017). The literature shows that many authors plead for local schemes due to their possibly higher effectiveness (Agrawal et al., 2014; Corbera et al., 2009; Grima et al., 2016; Silva et al., 2016). It is argued that local and regional PES schemes simplify the identification of motivated participators, lead to lower transaction costs and provide advantages by including local and/or indigenous knowledge (Grima et al., 2016; Wünscher & Wunder, 2017). Thus, PES schemes operating at the local or regional scale provide opportunities for a collective management of resources (Grima et al., 2016).

In the literature, also spatial scale related challenges are mentioned. Firstly, there are often mismatches between ecological and institutional as well as juristidirectional scales that bring serious obstacles to PES scheme implemention. Secondly, leakage effects can occur, meaning that environmentally harmful acitivities move to an area elsewhere, if one area gets protected (Engel & Muller, 2016). This example points out that environmental destruction in a globalized economy needs to be considered not only locally but globally, taking also important and complex distal social and environmental connections within the land use system into account, which are also discussed within the telecoupling framework (Friis et al., 2016).

Taking up this issue, a bundle of publications addresses the topic of up-scaling PES programs. Here, definition inconsistencies play a crucial role again. International organizations as the World Bank or the UNEP promote the implementation of international PES schemes (IPES) (Cavelier & Gray, 2012; Farley & Costanza, 2010; UNEP & IUCN, 2008). However, it can be assumed that such IPES would rarely fit with Wunder's narrow definition, except for carbon ES. REDD+ could be mentioned as an international program (s. box 5, p. 47). Even though the program aims at raising funding from private agents, it currently comes from public sources. Thus, the REDD+ program does not match exactly with the *Coasean* conceptualization, because full voluntariness is not given. Another contradiction arises, because some authors describe PES schemes as a local and decentral environmental policy instrument (McElwee et al., 2014). By contrast, IPES are settled at a global level regarding the spatial scale of funding and it is often argued that this is necessary in a globalized world. Thus, the connection of local, regional and global scales is important for IPES scheme implementation (s. chapter 7.4, p. 71).

It can be summarized that it is important to discuss the role of spatial scale in the context of the underlying definition to prevent misunderstandings. The same applies to the chapter about critique on PES programs.

Critique on PES schemes is manifold and depends largely on the authors' backgrounds. The systematic literature review pointed out different schools of thought or movements that criticize the PES approach. However, it must be said that the chosen search terms *'neoliberal'* and *'neoclassic'* narrow the view on the variety of critique (s. chapter 7.1, p. 60). Thus, there is no guarantee for completeness.

Most critics can be assigned either to the *Ecological Economics* or to the *Political Ecology*, both criticizing *Environmental Economics* approaches. *Environmental Economists* plead for an internalization of previously market-external negative environmental impacts to facilitate an efficient resource allocation (Gómez-Baggethun et al., 2010). *Ecological Economists* bring in particular the interdependencies between ecology, economy and just allocation of resources into focus and follow the approach of strong sustainability – an approach that questions the substitutability of natural capital by any human-made capital (Gómez-Baggethun et al., 2010). *Political Ecology* addresses the underlying capitalist system and the related power structures to examine human-nature interactions (Kallis et al., 2013). Furthermore, the literature search pointed on the *degrowth movement* and the *buen vivir* concept. The former scrutinizes the predominant economic growth-paradigm in economy and politics and questions that an absolute decoupling of GDP-growth and resource consumption is possible (D'Alisa et al., 2016). *Degrowth* conceives an alternative economy that is based on a new understanding of welfare as well as on deceleration, sufficiency and a greater time prosperity. *Buen vivir* provides an alternative understanding of the current Western development concept and is strongly influenced by indigenous thoughts (Gudynas, 2016). Proponents question the dichotomic view on human-nature relations and the growth-based understanding of prosperity and progress. Thus, there are some similarities to *degrowth*.

The critique of the simplifying monetary valuation of nature and its provided services is common to most critics and can be referred to all PES definitions. It is argued that the monetization supports an utilitarian rationality and a pure interest in profit-maximization (Mcafee, 2012; Van Hecken et al., 2018). Ignoring other valuation languages neglects other rationalities and blinds the complexity of ecosystems (Norgaard, 2010). Regarding the complexity of ecosystems, it is put forward that monetary valuations face a wide range of uncertainties, particularly because ecosystems and their functioning are insufficiently understood (de Lima et al., 2017; Norgaard, 2010).

Generally, the articulation of ES in exchange values is seen critical, as it "[undermines] the social complexity necessary for sustainability" (Allen, 2018: 253). This view follows the understanding of strong sustainability questioning the substitutability of nature's capital and services by human-made capital (Biely et al., 2018). Some critics even see PES as commodity fetishism (Kosoy & Corbera, 2010). However, whether PES are market-based conservation instruments that force a trade of ES commodities or not remains fuzzy in the literature. Again, this is strongly related with the variety of PES definitions. In practice, competitive markets for ES commodities are rare. Thus, the critique of the marketization of ES partly fails. However, most critics are aware of the fact that most in the literature mentioned PES schemes are no real markets based on competition (Matulis, 2017). Nevertheless, they describe PES as a neoliberal instrument that paves the way for the commercialization and commodification of ecosystems and their provided services. This thinking follows Foucault's *theory of governmentality* describing the importance of symbolic meanings such as monetization as a forerunner of a subsequent marketization (Fletcher & Büscher, 2017).

Generally, the monetization and commodification of ES is viewed critically for equity reasons, too. This is in contrast to the view on PES as a win-win solution that allows for poverty alleviation and nature conservation at the same time (Muradian et al., 2013; Pagiola et al., 2005). Authors mention that the existing often unequal power structures shape the monetary valuation of ES, which thus reinforce these inequalities (Kallis et al., 2013; Martínez-Alier, 2014). Often, local poor people are disempowered regarding the implementation process of PES programs, because different dimensions of justice as e.g. distributional and participatory justice are rarely considered (Muniz & Cruz, 2015). Moreover, there is a risk that poor people lose access to land and resources, since they rarely hold formal land titles (Corbera, 2012). Some scholars see also risks of a depolitization and a weakening of democratic structures, if responsibilities move from governments to the market sphere (Swyngedouw, 2000).

Furthermore, critics highlight the compensation logic of PES, possible increases in the North-South inequalities and potential rebound effects. However, these arguments against PES follow an understanding of internationalized PES schemes and contradict the current existence of mostly local or regional schemes. Therefore, it is once more important to consider the variety of PES definitions. Currently, this debate is particularly relevant for carbon ES, e.g. in the context of REDD+. Critics argue that PES schemes might undermine state sovereignty, if the economically powerful countries of the Global North and international organizations as the World Bank shape the implementation process, thereby leading to a reinforcement of (neo-)colonial logics (Matheus, 2018; Muniz & Cruz, 2015). Moreover, the disparities between these countries have negative consequences due to the low offset costs of poorer Global South countries, which have a lower price level. This problem is known as *'the poor who sell cheap'* principle (Martínez-Alier, 2004). Thus, the compensation logic might exacerbate North-South inequalities and lead to rebound effects in Global North countries, because compensation schemes give consumers a justification for sustaining their resource-intense lifestyle (Muniz & Cruz, 2015).

The different mentioned schools of thought highlight different points of criticism. Whereas *Ecological Economists* set a focus on the value debate, *Political Ecologists* underline the underlying power structures and inequalities – but both schools show also similarities. Interestingly, there is no consensus in the *degrowth* movement, if PES are useful or not. Whereas some authors criticize the increasing commercialization of nature (Goméz-Baggethun, 2016), others highlight the potential advantages of market-based instruments (Petschow et al., 2018).

Finally, it can be stated that PES are understood quite differently. A likely reason for this lies in the different disciplinary backgrounds of the scientists. Possibly, also the popularity of this tool in politics leads to a broadening of the concept, because there is an incentive to label different instruments as PES, e.g. to increase funding probabilities. This broadening of the concept is not only negative, because it introduces various perspectives on PES that raise interesting questions. However, for empirical analyses of PES schemes a clear conceptual basis is inevitable. For this reason, the diversity of PES definitions is discussed in the next chapter and a new PES definition is developed. In the subsequent subchapter, research perspectives are proposed based on the results of this study and the newly developed definition.

7.3 Towards a New Definition of Payments for Ecosystem Services

It can be argued that the existing PES definitions are either too narrow or too broad to provide a consistent basis for further research. As mentioned before, e.g. Wunder's *Coasean* definitions (2005 & 2015) incorporate only very few operating PES programs. For this reason, Wunder pleads for an indication, where an operating PES program deviates from the *'Idealtypus'* (Wunder, 2015; s. chapter 4.1.2.5, p. 28). For example, he describes government-funded schemes "as the highest level of user aggregation, creating a special PES case that is deviating slightly from the Coasean ideal" (Wunder, 2015: 242). However, the distinction between '*real PES'* and deviating cases can be problematic, because the theoretical expectations are rarely met in reality, which can lead to the frustration of practitioners (Muradian et al., 2010: 1203). Vice versa, e.g. the PES definition by Muradian et al. (2010) is so broad that it includes various environmental policy instruments such as "ICDPs [Integrated Conservation and Development Projects], ecocertification, subsidies, tax exemptions, 'co-investments' and co-management […], and cap-and-trade schemes" (Wunder, 2015: 238). Thus, some authors criticize this broad view on PES, since such definitions can impede an unequivocal discussion of PES versus other environmental policy instruments (Engel & Muller, 2016) and "[hinder] both theoretical deduction and empirical refutation of hypotheses" (Wunder, 2015: 234). Therefore, it is useful to develop a new PES definition that includes a reasonable number of operating PES programs. To approach a new PES understanding it is useful to initially focus on the term *'payments for ecosystem/environmental services'*. Firstly, the word **'payment'** implies that money is transferred between agents. Other authors widen the type of transfer by using for example the term *'reward'* instead of *'payment'*, intending the inclusion of non-monetary positive incentives (Leimona et al., 2015; Wunder, 2015). Starting from the original concepts this extension seems not very helpful, since it leads to a dilution of the primary meaning. Secondly, the term **'ecosystem/environmental service'** should be interpreted with caution. Many authors use both terms interchangeably respectively without stating what they exactly mean by *'ecosystem/environmental services'* (Derissen & Latacz-Lohmann, 2013; Souza et al., 2016). But being not distinct in the interpretation of these terms is dangerous, because PES are of interest for many scientists of diverse disciplinary backgrounds. The results of this literature review show that an unclear understanding of concepts can easily lead to misunderstandings. In the literature, different separations between *'ecosystem services'* and *'environmental services'* are made (s. chapter 2.4.1, p. 8). For example, Muradian et al. (2010: 1202) state "that ecosystem services is a subcategory of [environmental services], dealing exclusively with the human benefits derived from natural ecosystems. Environmental services also comprise benefits associated with different types of actively managed ecosystems, such as sustainable agricultural practices and rural landscapes". Derissen and Latacz-Lohmann (2013: 14) reply that the terms should rather be seen "as […] systematically different categor[ies]". This differentiation is reasonable, since it leads to a subdivision in payments for securing not actively managed *'natural'* ecosystems and in payments for intentionally or unintentionally providing environmental services that are produced by e.g. agricultural activities or by the creation and the active management of green spaces. Lastly, it can be asked what the term **'service'** implies. Certainly, this term has an economic touch. An economic service is usually well-defined and thus commodified and articulable in exchange values.

Putting all these interpretations for the terms *'payment'*, *'ecosystem services'* and *'service'* together leads to the following new PES definition:

> ***Payments for ecosystem services*** *are defined as* ***conditional monetary payments, voluntarily or non-voluntarily, to agents, who secure the provision of well-defined ecosystem services****.* ***Ecosystem services*** *are* ***provided by not actively managed ecosystems*** *in contrast to environmental services that are intentionally or unintentionally provided by the actively managed environment.*

This definition is very advantageous compared to the other in the literature identified definitions, because it combines the necessary preciseness, while being broad enough to include a sufficient number of operating programs, guaranteeing the possibility to generate empirical knowledge. Firstly, it focuses exclusively on *'ecosystem services',* so the conservation of more or less natural areas. Therefore, the definition excludes e.g. the Vittel scheme, because it addresses the provision of environmental services related to the management of agricultural areas (s. box 3, p. 21). Secondly, payments can be made based on private negotiations (ES provider to ES beneficiary), but also by governmental actors. Thus, this definition includes schemes that can be more or less market close and that are voluntary or partly involuntary. Additionally, payment funding can also be generated outside of ES benefiting areas. Thirdly, the payments are made for the provision of well-defined *'ecosystem services'* on a conditional basis. Fourthly, ex post criteria are not part of this definition. Thus, this novel definition includes the PES scheme in Costa Rica (s. box 4, p. 37) as well as for example the REDD+ program (s. box 5, p. 47), as long as the payments are made for protecting non-managed forests.

However, this definition shows also disadvantages. In particular, the wording *'not actively managed ecosystem'* is not distinct. Not actively managed ecosystems can be associated with natural or wilderness areas. But it is highly discussed what can be counted as *'natural'* (Crutzen, 2002; Latour, 2017). For example, can a forest with trimmed hiking trails be counted as unmanaged forest? And what about forests that are used by indigenous people for hunting purposes? These examples show that the category *'not actively managed ecosystem'* is not coherent. Furthermore, quite similar to other definitions, the questions arise, when an ES counts as *'well-defined'* and which ES can be truly quantified in separable units. Nevertheless, the proposed definition provides a basis for further empirical research.

7.4. Research Perspectives within the Framework of Payments for Ecosystem Services

In the following, the focus is put on three aspects that are related to the PES approach aiming at developing new research perspectives – namely the role of globalization, of privatization and of economic growth.

What are the **key findings** of this study that new research perspectives can build on? It is decisive that various PES definitions exist leading to inconsistencies within the debate. For this reason, a new definition was developed including privately and government-funded schemes to ES providers on a conditional but not necessarily voluntary basis to sustain not actively managed *'ecosystem services'*. Thus, *'payments for environmental services'* include also services that accrue from the actively managed environment. However, separating actively from not actively managed environment is challenging. The new definition includes also schemes that are funded by buyers outside the area of ES benefits. This is important to note, because there is an ongoing debate on how local PES programs are by definition and how local they should be. This literature review gives evidence that local schemes provide many advantages such as lower transaction costs, an easier and fairer participation of relevant actors and a higher motivation to participate, the incorporation of local and/or indigenous knowledge or better conditions for social learning. However, environmental destruction is often fuelled by drivers far away due to the globalized economy. Moreover, some ES provide direct benefits on the global scale. For that reason, some scholars and also international organizations as the World Bank call for internationalized PES schemes, which raises the question whether these two views can be brought together. Furthermore, some scholars scrutinize the PES approach, its neoliberal character and the prioritization of economic efficiency over distributional aspects more in depth. In the ecological field, it is criticized that monetary valuations disregard the plurality of values and that the articulation of complex and not sufficiently researched ecosystems in exchange values leads to simplifications. Furthermore, there are social concerns, because the monetary valuations are influenced by the underlying power structures and capitalistic logics, which potentially reinforce inequalities.

The paragraph above collects only a few import aspects of the current debate, from which interesting questions and research perspectives can be derived. Subsequently, three main perspectives are outlined.

Firstly, **the role of a globalized economy should be more considered and connected with the scale issue**. The literature review provides different entry points. Firstly, there is the debate about local versus up-scaled PES schemes. Secondly, some publications address leakage effects and thus give hints that gained environmental additionality at one place can be defeated by environmental destructions that occur elsewhere instead. Thirdly, in the case of international PES schemes negative equity aspects are mentioned that e.g. arise due to North-South disparities. However, it is rarely discussed how the local, the regional and the global scales can be linked, while considering equity and ecological aspects at the same time. One exception is a study by Farley et al. (2010) that addresses the implementation of multiscale IPES. The authors state that "mutually reinforcing institutions at local, regional and global scales over short, medium and long time scales will be required. Institutions should be designed to ensure the flow of information between scales, to take ownership regimes, cultures, and actors into account, and to fully internalize costs and benefits" (Farley & Costanza, 2010: 2061). A challenge lies in the development of just schemes guaranteeing the engagement of all stakeholders at the various scales and sustainable and fair funding structures. To refine successful multiscale PES schemes, it could be helpful to compare existing PES schemes at various scales regarding different ecological and distributional criteria. Furthermore, it would be of high interest to draw linkages between the PES and the telecoupling approach, that focuses on distal connections and feedbacks shaping the current land use change (Friis et al., 2016). In this context, but also generally other scale aspects such as temporal dimension should also be of interest in the future.

Secondly, **the role of property rights** is closely linked to this topic. Critics argue that privatizations can lead to social conflicts. Privatizations raise questions about who owns the land and to whom the payments are transferred. In the worst case, local people are displaced by wealthier people that have the money and the power to acquire land titles (Cavanagh & Benjaminsen, 2014; Scales, 2015). This phenomenon is also known as *'green grabbing'* (Van Hecken et al., 2015a). Another more general problem occurs, because ES and their providing ecosystems are often difficult to privatize due to their public good character (Bakker, 2003; s. chapter 2.4.1, p. 8). However, in the debate it falls often too short that "property rights can be common or private" (Farley & Costanza, 2010: 2064). This aspect should be more considered in PES research. There are potentials to connect PES with the commons debate. Elinor Ostrom's (1990) research on the governance of the commons describes how commons have been successfully managed for centuries. Particularly, she highlights the advantages of interlaced and complex local governmental systems that allow for a direct participation and cooperation of citizens instead of centralized state interventions or privatizations of commons. However, two and a half decades later private property rights are highly popular in the debate about environmental policy instruments. But there are great potentials, e.g. if linking local common property rights with global funding schemes instead of promoting market tools at all levels of scale. In this context, investigating the role of cooperatives could be highly interesting. Additionally, this debate should be connected to the role of monetary valuation. Currently, PES schemes often focus on specific ES. Instead, facing the complexity of ecosystems, it is advisable to bundle different partly loosely defined ES to secure social welfare (Banerjee et al., 2013).

Thirdly, it is also of great interest to discuss, whether PES can contribute to paving the way towards **sustainable economic growth.** Some political actors and scientists acclaim PES as policy instrument that allows for environmental protection, poverty alleviation and sustainable economic growth at the same time. Critics question this win-win view on PES and particularly degrowth proponents question the possibility of an absolute decoupling between economic growth and resource consumption. And indeed, the question arises, how much of the current GDP growth is driven by the expansion of environmental degradation and the intensification of land use both driven by the increasing consumption (Rosa et al., 2017), or vice versa: If PES schemes were implemented globally, and ES were successfully secured – would growth potentials then be reduced and if so, to what extent? It is not possible to give a clear answer to this question due to the high complexity of economic growth. For example, the role of qualitative growth and technological innovations is insufficiently understood. However, research about PES should also consider and discuss this question. Otherwise, the danger occurs that PES legitimize the resource-intense lifestyle, especially of Global North countries.

Summarizing, there is a great need for further research to refine PES towards multiscale instruments that include forms of common property rights, while considering also other instruments to minimize the resource-intensity, especially in the Global North.

8. Conclusion

This study aims at providing a literature review on existing PES definitions, the role of spatial scales for the PES scheme effectiveness and critique of this conservation concept. These three intertwined topics proved to be very interesting to evince contradictions in the current scientific debate and to develop research perspectives towards a new PES conceptualization.

One striking result is related to the large **variety of PES definitions and conceptualizations**. Generally, PES are either defined in a narrow *Coasean* sense or in a broader *Pigouvian* sense. Whereas the former calls for a PES understanding as conditional and voluntary private transaction between ES providers and ES beneficiaries, the *Pigouvian* conceptualization includes also government-funded programs, which are partly or fully involuntary. A total of twelve definitions were identified as PES conceptualizations, most of which agree on conditionality as a key feature of PES schemes. In practice, only very few programs labeled as PES schemes in the literature can be assigned to the narrow *Coasean* understanding.

PES research addressing **the role of spatial scales for the PES scheme effectiveness** does not appear as a key issue in the literature. Nevertheless, important notions can be derived: Firstly, whereas ES accrue locally the scale of provided benefits differs often substantially depending on the ES type. Secondly, there are often cross-scale mismatches between the ecological scale of ES provision and the scale of social institutions, making an effective implementation of PES schemes challenging. Thirdly, leakage effects are mentioned, describing the potential shift of activities harming the environment to somewhere else. Fourthly, the advantages of local programs are highlighted by several authors. It is stressed that local schemes ease the identification of motivated potential actors as well as the policy and decision making. The incorporation of local knowledge provides further advantages and amplifies the acceptance. Additionally, transaction costs are mostly lower compared to larger schemes. At the same time, some authors mention also the necessity of an up-scaling of PES programs and of multi-scale approaches to enlarge the conservation of ES. This debate is particularly held in the context of globally distributed carbon ES.

Critique on PES is manifold and assigns to different disciplines and schools of thought such as *Ecological Economics*, *Political Ecology* or *degrowth*. For example, scholars criticize the veiling of the existing value plurality by focusing on monetary exchange values, which leads to a dangerous simplification of the understanding of ecosystem functions. Furthermore, social concerns are raised. For example, it is stated that the neoliberal character of PES reinforces inequalities due to the underlying capitalistic logics and power structures, which might lead to a lack of participation of local people, with some even losing the access to resources. Thus, the role of property rights and privatizations is also central to the PES debate.

The **variety of definitions leads to ambiguities and contradictions** in the debate about the role of spatial scales for the effectiveness of PES programs as well as regarding points of critique in the PES field. For example, the different definitions lead to different conclusions regarding the questions, who can participate on PES programs – e.g., if governments can participate as ES buyers – and whether participators can be located outside the ES benefiting areas. Thus, against the background of the variety of definitions it remains fuzzy, whether internationally and governmentally funded payment programs can be counted to the PES approach. For example, such cases do not fit perfectly into the narrow *Coasean* conceptualization, except for privately funded carbon schemes. Such definition inaccuracies play also a role regarding critique on PES. For example, some authors mention that PES might reinforce North-South inequalities. This concern implies that PES schemes include participators from both sides. However, practice examples for this are rare. A general difficulty regarding PES critique relates to the question, whether PES are neoliberal and market-based. In practice, true market for ES are rare. However, some authors argue that PES still pave the way towards a commercialization and commodification of nature.

To attenuate these ambiguities, this study provides a **newly developed definition**, which aims at including a reasonable number of operating schemes, while describing clearly what is distinct about PES: "***Payments for ecosystem services*** *are defined as* ***conditional monetary payments****,* ***voluntarily or non-voluntarily, to agents, who secure the provision of well-defined ecosystem services****.* ***Ecosystem services*** *are* ***provided by not actively managed ecosystems*** *in contrast to environmental services that are intentionally or unintentionally provided by the actively managed environment"*. Starting from this definition important **research perspectives** can be drawn. Firstly, distances between causes and effects for environmental destructions increase in a globalized world and ES benefits are distributed at different scales. This calls for the development of multiscale concepts including stakeholders at various scales, while taking into account the complex global linkages. Secondly, taking a closer look at common instead of private property rights could provide interesting perspectives for a strengthening of local and collective governance systems. Thirdly, further research on the coupling of effective PES schemes and sustainable economic growth would be of interest.

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Appendix

Tab. I: Considered publications for the pre-analysis

Ezzine-De-Blas, D., Wunder, S., Ruiz-Pérez, M., & Del Pilar Moreno-Sanchez, R. (2016). Global patterns in the implementation of payments for environmental services. *PLoS ONE 11 (3)*, 1–16.
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Tab. II: Five publications that criticize PES in the context of neoliberalism

Allen, K. (2018). Why Exchange Values are Not Environmental Values: Explaining the Problem with Neoliberal Conservation. *Conservation and Society 16 (3)*, 243–256.
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Eidesstattliche Erklärung

Ich erkläre, dass ich die vorliegende Arbeit nicht für andere Prüfungen eingereicht, selbständig und nur unter Verwendung der angegebenen Literatur und Hilfsmittel angefertigt habe. Sämtliche fremde Quellen inklusive Internetquellen, Grafiken, Tabellen und Bilder, die ich unverändert oder abgewandelt wiedergegeben habe, habe ich als solche kenntlich gemacht. Mir ist bekannt, dass Verstöße gegen diese Grundsätze als Täuschungsversuch bzw. Täuschung geahndet werden.

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