UNIVERSIDADE TECNOLÓGICA FEDERAL DO PARANÁ - UTFPR
PROGRAMA DE PÓS-GRADUAÇÃO EM TECNOLOGIA E SOCIEDADE - PPGTE

NIKLAS WERNER WEINS

INSTITUTIONAL ARRANGEMENTS IN PAYMENTS FOR ECOSYSTEM SERVICES: THE CASE OF THE MIRINGUAVA WATERSHED IN THE METROPOLITAN REGION OF CURITIBA

DISSERTAÇÃO

CURITIBA
2019

NIKLAS WERNER WEINS

INSTITUTIONAL ARRANGEMENTS IN PAYMENTS FOR ECOSYSTEM SERVICES THE CASE OF THE MIRINGUAVA WATERSHED IN THE METROPOLITAN REGION OF CURITIBA

Dissertação apresentada como requisito parcial para a aprovação no Programa de Pós-Graduação em Tecnologia e Sociedade da Universidade Tecnológica Federal do Paraná.

Orientador: Christian Luiz da Silva
Co-Orientadora: Tatiana Maria Cecy Gadda

CURITIBA

2019

Dados Internacionais de Catalogação na Publicação

Weins, Niklas Werner
Institutional arrangements in payments for ecosystem services [recurso eletrônico] : the case of the Miringuava basin in the Metropolitan Region of Curitiba / Niklas Werner Weins.-- 2019.
1 arquivo texto (185 f.): PDF; 1,32 MB

Modo de acesso: World Wide Web
Título extraído da tela de título (visualizado em 15 fev. 2018)
Texto em inglês com resumo em português
Dissertação (Mestrado) - Universidade Tecnológica Federal do Paraná. Programa de Pós-graduação em Tecnologia e Sociedade, Curitiba, 2019
Bibliografia: f. 141-158

1. Tecnologia - Dissertações. 2. Curitiba, Região Metropolitana de (PR) - Recursos hídricos. 3. Meio ambiente - Aspectos econômicos e sociais. 4. Proteção ambiental - Aspectos econômicos. 5. Pagamentos por serviços ambientais. 6. Economia florestal. 7. Florestas - Conservação. I. Silva, Christian Luiz da. II. Gadda, Tatiana Maria Cecy. III. Universidade Tecnológica Federal do Paraná. Programa de Pós-graduação em Tecnologia e Sociedade. IV. Título.

CDD: Ed. 23 -- 600

Biblioteca Central da UTFPR, Câmpus Curitiba
Bibliotecário: Adriano Lopes CRB-9/1429

TERMO DE APROVAÇÃO DE DISSERTAÇÃO Nº 532

A Dissertação de Mestrado intitulada **Institutional Arrangements in Payments for Ecosystem Services - The case of the Miringuava watershed in the Metropolitan Region of Curitiba** defendida em sessão pública pelo(a) candidato(a) **Niklas Werner Weins** no dia **05 de fevereiro de 2019**, foi julgada aprovada em sua forma final para a obtenção do título de Mestre em Tecnologia e Sociedade, Linha de Pesquisa – Tecnologia e Desenvolvimento, pelo Programa de Pós-Graduação em Tecnologia e Sociedade.

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Curitiba, **05 de fevereiro de 2019.**

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Tú no puedes comprar al viento
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Tú no puedes comprar el calor
Tú no puedes comprar las nubes
Tú no puedes comprar los colores
Tú no puedes comprar mi alegría
Tú no puedes comprar mis dolores

Rafael Ignacio Arcaute / Eduardo Cabra / Rene Pérez

AGRADECIMENTOS / ACKNOWLEDGEMENTS / DANKSAGUNGEN

Esta pesquisa e a dissertação dela resultante são fruto de uma longa viagem. Agradeço primeiramente ao Augusto que sempre esteve do meu lado, ajudando com os desafios pessoais e metodológicos. Um agradecimento muito especial a Tatiana por todo o carinho e junto com Christian pelo apoio que vocês me deram e por me acolherem. Tatiana, você me fez parte integral da sua família e fico muito grato por tantas experiências que pude compartilhar com você. Christian, obrigado por ter me possibilitado tudo isto e por poder conhecer toda nossa equipe incrível do PPGTE. A Leticia por ser minha melhor amiga nesse caminho, mas também a grande parceira nas pesquisas - sem você eu não estaria nunca neste ponto! Por todos os momentos de amizade, exploração acadêmica e apoio com as mágoas da vida. Danke. A Mari por me guiar e persistir em que seria um sucesso vir para o Brasil, estudar aqui e começar uma vida acadêmica na sua família acadêmica.

Agradeço à UTFPR e ao Programa de Pós-Graduação em Tecnologia e Sociedade por me acolherem e possibilitarem esta trajetória da minha vida acadêmica como assistente técnico e depois como integrante acadêmico do Grupo de pesquisa Políticas Públicas e Dinâmicas de Desenvolvimento Territorial (PD2T). À CAPES pelo apoio financeiro da bolsa DS que possibilitou a dedicação às aulas e às pesquisas.

Meiner Familie, die mich in so unterschiedlicher, aber so wichtiger Weise auf dieser langen Reise unterstützt hat. Mama, du bist mir eine große Inspiration. Was du dir in den Kopf setzt, das schaffst du auch - und das entgegen aller Schwierigkeiten. Das macht dich zu einer bewundernswerten Frau! Du hast mir die nötigen Anstupser gegeben und mir einen Lebensweg ermöglicht, den ich mir nie hätte ausmalen können. Robin, mein kleiner großer Bruder, ich glaube du bist mir ein größeres Vorbild als du dir vorstellst. Oma und Opa, ohne euch wäre gar nicht zu denken, dass ich den Mut hätte einfach von einem Ende der Welt ans andere zu gehen. Ihr wart und seid immer für mich da, ohne Bedingungen und das seit ich klein bin. Auch Robert muss ich danken, denn, auch wenn du nicht immer präsent warst, hast du mich doch immer herausgefordert, was meine Weltanschauung angeht, was das Hinterfragen des status quo angeht und auch gewagte Positionen zu vertreten. À minha família brasileira, meus sogros, Regina e Jorge, meu cunhado Gabriel e minha concunhada Ana, vocês me acolheram tão bem e com tanto carinho que a integração no Brasil e em Curitiba ficou muito fácil. Sou muito grato por tê-los.

Aos colegas e colaboradores do Studio Cidades e Biodiversidade especialmente Leticia, Mayara (obrigado pelo apoio arquitetônico e mental!), Larissa e Giovane nosso amigo apoio técnico. Obrigado por estar junto nas horas de questionamentos, aprendi bastante com vocês todos. A Ricardo e Betina da SPVS que se colocaram siempre à

disposição e responderam com muita paciência minhas perguntas, Daisy e Maurício da SANEPAR, ao Jatobá, Celso da SEMMA, Joãozinho, Sr. Marcos, Márcio e os estagiários Mariana e Lucas do CPRA, também por fornecer material fotográfico deste trabalho, Juliana e Carlos da Fundação Grupo Boticário, e à SEMA, ao Sr. Scroccaro, à Marilia da TNC. Ao estimado professor e amigo Demian pelas orientações e discussões sobre a China nas questões ambientais.

Meinen Freunden in Deutschland, die mich trotz der großen Entfernung nicht im Stich lassen und mir mit Rat und Tat zur Seite stehen - Lisa, Lea, Fabi und die Herdecker, José und meine Bochumer Acht, Paul, Katinka, Aaron, Käthe, Matthi und all die PanamaKreis amigos.

Aos professores Felipe e Tamara por fazerem as suas críticas nas bancas, e junto a vocês à professora Leila Ferreira por aceitar me orientar na sequência nesse caminho como *Doktormutter*. À família da Tatiana e do Christian que também estiveram lá para mim durante um tempo importante. À FAPESP e a UNICAMP, pelo financiamento generoso e a organização da São Paulo Advanced School on the Water-Energy-Food Nexus, que contribuiu de forma significativa com o desenvolvimento final desta pesquisa e a preparação para uma continuação do debate dentro do WEF Nexus no meu doutorado no NEPAM.

RESUMO

WEINS, N. W. Arranjos Institucionais em Pagamento por Serviços Ambientais - O caso da bacia do Miringuava na Região Metropolitana de Curitiba. 173 p. Dissertação (Mestrado) - Programa de Pós-Graduação em Tecnologia e Sociedade, Universidade Tecnológica Federal do Paraná, 2019.

A presente pesquisa consiste em contribuir com os estudos das ciências sociais no que diz respeito à biodiversidade e aos serviços ecossistêmicos, assim como o estudo das políticas públicas e instituições voltadas ao desenvolvimento local sustentável. O Pagamento por Serviços Ambientais (PSA) tem se popularizado no mundo todo na década passada, e tem atraído grandes investimentos estatais e privados na conservação a fim de melhorar o aproveitamento de serviços ecossistêmicos. A importância do arranjo institucional e de fatores além do mero pagamento pela conservação já são reconhecidos pela literatura científica e técnica, mas precisam de mais exploração empírica. Esta pesquisa documenta o histórico do PSA hídrico na Região Metropolitana de Curitiba explorando as características dos atores envolvidos, com o objetivo de descrever e contextualizá-los, considerando as diferenças do PSA em um ambiente metropolitano brasileiro. As bases teóricas desta pesquisa se encontram nos Estudos da Ciência, Tecnologia e Sociedade (CTS), economia institucional e Teoria de Ação Coletiva em dilemas de bens comuns. Mediante uma análise da rede social e os oito princípios de robustez institucional de Elinor Ostrom analisam-se os atores e fatores institucionais no sistema socioecológico do arranjo de PSA. Esta pesquisa aponta potencial para melhorias no arranjo, enquanto à participação de atores da comunidade local e sua robustez considerando a integração de suas instituições.

Palavras-chave: Pagamento por Serviços Ambientais. Arranjos Institucionais. Participação.

ABSTRACT

WEINS, N. W. Institutional arrangements in payments for ecosystem services: The case of the Miringuava basin in the Metropolitan Region of Curitiba. 173 p. Master's thesis - Postgraduate Program in Technology and Society, Federal University of Technology - Paraná, 2019.

This research consists of a contribution to the social sciences regarding biodiversity and ecosystem services as well as the study of public policies and institutions for sustainable local development. Payment for Ecosystem Services (PES) has become popular worldwide over the past decade and has attracted large state and private investments in conservation to improve the flow of ecosystem services and human well-being. The importance of the institutional arrangement and factors beyond the mere payment for conservation are already recognized in the literature, but need more empirical exploration. This research documents the history of the watershed PES in the Metropolitan Region of Curitiba, exploring characteristics of its actors, describing and contextualizing them and considering the differences of PES in a Brazilian metropolitan environment. The theoretical bases are located in the studies of Science, Technology and Society (STS), institutional economics and the Collective Action Theory in commons dilemmas. Through a social network analysis and the eight design principles of institutional robustness of Elinor Ostrom, the actors and institutional factors are analyzed in the socio-ecological system of the PES arrangement. This research points out potential for improvements, in terms of the participation of actors from the local community and considering the integration of their institutions.

Keywords: Payment for ecosystem services. Institutional Arrangements. Participation.

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LISTA DE ABREVIATURAS E SIGLAS

ANA	National Water Agency (Brazil)
APP	Permanent Preservation Area
APA	Environmental Protection Area
APAVE	Association of Protectors of Green Areas of Curitiba and Metropolitan Region
APROMEL	Association of Organic Producers and Meliponicultores of São José
ASSOPAM	Association of Landowners, Residents, Breeders and Farmers of the Miringuava River Basin of São José dos Pinhais
CAR	Rural Environmental Registry (Cadastro Ambiental Rural)
CBD	United Nations Convention on Biological Diversity
CMDR	Municipal Council of Rural Development
CMMA	Municipal Council of the Environment
CNPq	National Council for Scientific and Technological Development (Brazil)
COALIAR	Committee of the Upper Iguaçu Basins and Tributaries of the High Ribeira
CONAMA	National Council of the Environment
CPR	Common-Pool Resources
CPRA	Paraná Reference Center in Agroecology
EMATER	Technical Assistance and Rural Extension Company
ES	Ecosystem Service
FGB	Grupo Boticário Foundation
FETAEP	Union of Rural Workers of São José dos Pinhais
FIEP	Federation of Industries of the State of Paraná
IAD	Institutional analysis and development framework
IAP	Environmental Institute of Paraná
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and ES
ITCG	Institute of Land, Cartography and Geosciences of Paraná
MRC	Metropolitan Region of Curitiba
NGO	Non-governmental organization
NIE	New Institutional Economics
PERH	State Water Resources Policy
PES	Payment for Ecosystem Services
PPGTE	Post-Graduate Program in Technology and Society
RPPN	Private natural heritage reserve
SAIC	Integrated Water Supply System of Curitiba and MRC
SANEPAR	Companhia de Saneamento do Paraná
SEGRH	State Water Resources Management System
SEMA	State Secretariat of the Environment and Water Resources (Paraná)
SEMMA	Municipal Secretariat of the Environment of São José dos Pinhais
SEMPL	Municipal Secretariat of Planning and Economic Development
SES	Socio-ecological system
SICTUR	Municipal Secretary of Industry, Commerce and Tourism (São José)
SIGPROM	Integrated management and protection system for the metropolitan region
SINTEA	Union of Agricultural Technicians of the State of Paraná
SNA	Social Network Analysis
SPVS	Sociedade de Pesquisa em Vida Silvestre (NGO)
STS	Science, Technology and Society
SUDERHSA	Superintendency for Development of Water Resources & Envir. Sanitation
TD	Technology and Development (research line)
TEEB	The Economics of Ecosystems and Biodiversity
TNC	The Nature Conservancy
UGE	Strategic Management Group (*Unidade de Gestão Estratégica*)

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1 INTRODUCTION

In view of global environmental changes and their implications for human societies, this thesis aims to contribute to the study of socioecological systems and environmental governance from a critical perspective, considering social aspects of water resource governance through Payment for Ecosystem Services (PES) in a Metropolitan area.

Ecosystem Services (ES) are commonly conceptualized as "the benefits humans obtain from nature," or "nature's benefits to the people," a concept which was used mostly by conservation biologists and natural resource economists to exemplify the connections between human well-being and nature (DÍAZ et al., 2015). Since the 1990s, the concept has received increased interest in academia and has been incorporated in many natural and social sciences through the Millennium Ecosystem Assessment (MEA, 2005; BERBÉS-BLÁZQUEZ; GONZÁLEZ; PASCUAL, 2016). Payments for such ecosystem services as a practical means for implementing this theory of conservation within a capitalist logic has become very popular in development policies to solve problems including biodiversity conservation, timber supply or water resources, as well as investment and equity. In prominent schemes at the national and local levels such as e. g. in the national program in Costa Rica and in the Water Producer (Produtor de Água) program in Brazil, and Eco-Compensations in China, the tool has shown its strengths, but also some weaknesses and risks have been pointed out (BENNETT, 2009; MURADIAN et al., 2010, GUEDES; SEEHUSEN, 2012, KUMAR; KUMAR; GARRETT, 2014).

Institutional arrangements and norms involved in environmental governance are of growing interest in academic literature and in the practical implementation of sustainable development policies worldwide. Especially when it comes to environmental issues, like the ones concerning climate change, the involvement of society is important and can help to build long-lasting "new institutionalities" that involve civil society actors (BARBIERI; FERREIRA, 2018). Studies imply that it is "both economic incentives and social norms that influence the behavior of individuals in governance of common resources" (CHEN et al., 2009). Authors such as Corbera et al. (2007), Van Hecken et al. (2015a) and Vatn (2010) base their research on the findings of Elinor Ostrom (1990; 2005) and others in institutional economics which considers this combination of economic and social factors.

Inspired by and developed with researchers in the field, this project is guided by the methodological approaches adopted by Zanella et al. (2014), Ostrom (2008) and others investigating the governance of a PES scheme (understood as a socioecological system) by the involved stakeholders. This thesis aims to discover both formal and informal institutional factors that influence the participation of landowners in a PES program in the peri-urban

sphere, by using Ostrom's Eight Design Principles. For bridging Ostrom's Commons theory's blind spot on power issues, the application of a Social Network Analysis (SNA) helps to situate the actors' connections, positions in the arrangement and evaluate these power dimensions (KOLINJIVADI et al., 2017).

1.1 CONTEXT

Humanly induced global climate change is causing immense environmental damage (BARBI; FERREIRA, 2013). It is increasingly understood as a serious problem for human development and the economy (SILVA; SCHMIDT BASSO, 2012). Solutions to the problem of the harmonization of economic development with conservation may be managed through tools such as PES, which has proven as an innovative solution and has attracted the interest of academia and practitioners alike in the last two decades (WEINS et al., 2016; GÓMEZ-BAGGETHUN; MURADIAN, 2015).

Local conservation practices in the governance of resources that are of common interest, in modern times have been discussed since the works of Ricardo, Malthus, and Stuart Mill in the 19th century. References to the origin of value in nature are found in classics of the economics literature like Smith and Marx (GÓMEZ-BAGGETHUN et al., 2010, p.1211). From the neoclassical school with works by Georgescu-Roegen (1971/75) and Herman Daly from the 1970s, the discussion about the economic value of nature evolved significantly and one of the most important contributions for advancing the PES debate was reached with the valuation of the world's ecosystems by Costanza et al. in 1997.

The theoretical framework adopted in this thesis is situated in the institutional school of thought. After Ronald Coase's contributions on the importance of institutions and transaction costs to economic theory (COASE, 1937/2013; NORTH, 1992), New Institutional Economics (NIE) has evolved "in part as a response to (and critique of) welfare economics" and has moved "from externality to interdependence" of natural and social or economic systems as its main theme of discussion (PAAVOLA; ADGER, 2005: p. 354).

In the context of discussions in the field of economics, an emerging body of literature deals with interdependent "socio-ecological systems" and tries to understand the institutional setting. In this discussion the distinction between public and private property becomes increasingly blurred. It fits more than ever to discuss common pool resources (CPR), as in the use of benefits from nature, since the idea of ecosystem benefits transcend property and political limits, a simple distinction between private or public goods is very questionable. In the approach of common-pool resource studies, political ecology issues (HAUSKNOST et al., 2017) are also commonly expressed with reference to Ostrom et al. (1990; 2002) to propose the existence of an in-between category of CPR that enable sustainable local

management of natural resources. Author like Agrawal and Gibson (1999: p. 629) also argue for a more political approach, to consider the multiple interests and actors in the communities, and how these actors influence decision-making, as well as the “internal and external institutions that shape the decision-making process.”

From these theoretical bases, the first practical policy experiments with PES in the Global South were made in Costa Rica in the 1990s, from where it was popularized throughout Latin America (PAGIOLA; VON GLEHN; TAFFARELLO, 2013, p.20). In other parts of the world, especially in Asia and Africa, it has been applied with different financing and governance methodologies. However, Latin America, particularly Brazil, is one of the most diverse places in terms of methodological approaches to PES (PRADO et al., 2015). Notwithstanding experiences with PES and other environmental policies in Brazil, they are still very recent and need a significant amount of accompanying and field research. This is especially significant in the context of recent alterations in environmental laws like the Nation Environmental Policy (BRAZIL, Nº 6.938), the recently altered Brazilian Forest Code and policy proposals for a National PES Policy (WWF-BRASIL, 2014; FGB et al., 2017).

In this study, we identified that the academic debate about PES involves mainly two aspects: a more pragmatic one discussing technical aspects of implementation (e.g. COSTANZA et al., 1997; WUNDER; ENGEL; PAGIOLA, 2008; TURNER; DAILY, 2009; FARLEY et al., 2010); and a more normative one that continues to discuss ethical, social and environmental implications (e.g. BENNETT et al., 2012; JAX et al., 2013; RODRÍGUEZ DE FRANCISCO; BOELENS, 2015; VAN HECKEN, et al., 2015a).

The baseline concept for valuation - the ecosystem service - is already widely used by academia and increasingly popular in practical applications since the Millennium Ecosystem Assessment in 2005 (DAILY et al., 2009; DÍAZ et al., 2015). However, in addition to the advances the concept has brought to environmental governance, going beyond typically dominant command and control approaches in environmental policies, many of the social benefits of PES are yet to be seen, due to the long-term nature of environmental conservation. Particularly in environments with large social and economic differences (mostly land use issues) PES might even be worsening inequalities and social problems (RODRÍGUEZ DE FRANCISCO, BUDDS; BOELENS, 2013; RUIZ, 2015). It needs to be better understood exactly why it has not delivered some of the expected results yet, and a closer look at the complex social factors involved in a PES arrangement might help answer this question (KOLINJIVADI; ADAMOWSKI; KOSOY, 2014).

For these reasons, it is of great importance to take into account aspects of the territory (HAESBAERT, 2004). The lens of territoriality, that is, the geographic space understood as a "force field, a web or network of social relations,” enables showing the “geographical, anthropological-cultural, sociological, economic, legal-political, bioecological"

dimensions in which PES is applied and that might be overlooked when supposing a level playing field in the discussion (ALBAGLI, 2004, p. 26). Analytically, this thesis is inserted in the analysis of the step of the implementation of a public policy in the policy cycle (KRAFT; FURLONG, 2010), understanding that the study object, the PES arrangement in the Miringuava basin, is still in the process of negotiation between political actors, technicians and the landowners.

1.2 RESEARCH QUESTION AND ASSUMPTIONS

The research contributes to the studies of the social sciences in environmental governance, with the general aim of discovering the relations of the actors of a PES arrangement and their possible economic and social effects. The study aims to establish a dialogue between Science, Technology and Society (STS) studies with the visions on the Tragedy of the Commons and the responding Collective Action Theory, more specifically its eight principles of institutional design. This approach promises to open a vision that can point out weaknesses of and impel adjustments to the studied arrangement, that help it to be more socially inclusive and at the same time environmentally effective. The applied SNA helps to unveil a power dimension that is not covered by the other theories.

The thematic delimitation of this research is in the greater area of interdisciplinary studies, focussing on social, economic and political sciences. Starting from the philosophical movements of the Critical Theory of Technology, the Frankfurt School and the STS on the social construction of science and technology, this research builds mainly on the thinking of NIE and political ecology. Political science techniques, namely from SNA are used, as power and trust relations between the actors are investigated (SCHUSSER et al., 2015). According to Freeman (2004) the theoretical foundation of SNA goes back to the sociologists Georg Simmel and Émile Durkheim, and first analytical methods developed by Moreno (1937) and later White (1970). In the case of this research, the influence of policies and changes in human-nature relations as well as network interactions on institutional robustness and equity of the PES arrangement are investigated (PRELL et al., 2009; ERNSTSON, 2013).

The territorial delimitation of the research is the area of the Miringuava River basin (Upper Iguaçu Basin) in the municipality of São José dos Pinhais, metropolitan region of Curitiba in the Brazilian state of Paraná. The dynamics of an already partially urbanized basin that is influenced heavily by the pressures of urban expansion and the location at the headwaters of an internationally important river, makes this case study considerably different from other applications (predominantly in rural areas) of the PES in Brazil.

This investigated PES program is under implementation, and data of the properties have been or are in the process of being registered in the national Rural Environmental

Registry (CAR) and a diagnosis of the area is being conducted by a company contracted by the sanitation company SANEPAR (PROFILL, 2017). To define the object clearly, the focus of this research is limited to the time from the beginning of the creation of the municipal PES policies in 2014, includes the study of the diagnosis in 2017, and reaches until the time of the field research application at the end of 2018. Consequently, the object of this research is the PES program in the Miringuava basin, and its current participants, managers and creators (MARCONI; LAKATOS, 2007: 203).

The research question consists in showing aspects of democratic participation in this arrangement: How do landowners participate in the creation and execution of the institutional arrangement adopted for PES in the Miringuava basin? The main hypothesis is that the creation of the program did not sufficiently consider social factors of institutional, socio economic and territorial nature (ALBAGLI, 2004), which would in the long run jeopardize the robustness of the institutional arrangement (OSTROM, 2007) of the program and the success in achieving its objectives. It is understood that the program so far follows a management pattern that is relatively closed and managed by a group of technical-administrative personnel (RAWLINS; WESTBY, 2013).

1.3 OBJECTIVES

This thesis investigates how a PES policy arrangement unfolds in a case study in a Brazilian metropolitan area, always considering the global trends of environmental changes and the continuous development of capitalism and its effects on agendas and local institutional arrangements.

1.3.1 General Objective

The general objective of this thesis is to characterize the institutional arrangement adopted for PES in the Miringuava basin.

1.3.2 Specific Objectives

The specific objectives to achieve this objective are as follows:

1. To characterize the adopted PES arrangement and identify involved actors, the relationships between them, as well as record the program's history, through documentary analysis;

2. Evaluate the institutional arrangement from the perspective of the actors involved in the program, through social network analysis (SNA);
3. Identify the potentials and restrictions of consolidating the institutional arrangement.

1.4 METHODOLOGY

This study aims to explore aspects of the institutional design of a PES arrangement. For the characterization of the arrangement, publicly accessible documents (such as reports, news, licenses, etc.) are used, as well as documentation about the process that was made available by the actors during this research (SEMA, 2017). This documentary part is complemented with a semi-structured questionnaire applied with the different actors involved in the process and based on snowball sampling.

The questionnaire allows to assess the knowledge of key stakeholders about PES and their interactions through a SNA, as well as to evaluate the institutional robustness of the arrangement, from the perspective of these actors. The use of SNA has been shown as an effective technique to point to key stakeholders and their connections in natural resource management (BODIN et al., 2011; PRELL, 2011; ERNSTSON, 2013). For a visual product of this research, the software Gephi, in its version 0.9.2 was used (BASTIAN et al., 2009).

The thoroughly tested criteria of institutional robustness defined by Ostrom (1990; 2007) are used for the institutional robustness analysis. This analysis allows to structure the potentialities as well as possible bottlenecks of the PES arrangement. The semi-structured questionnaire is based on different issues raised in the author's literature review (WEINS et al., 2017; WEINS; SILVA; GADDA, 2018) as well as Ostrom's (1990; 2008) eight design principles for institutional robustness. Before application, this questionnaire was tested with a small number of stakeholders and was consequently modified to better fit practical needs.

1.5 RELEVANCE

The theoretical background, as touched upon earlier, lies both in critical theory of science and technology, as well as the interface of social and natural sciences in the discussion of PES. Natural resources and their characteristics as well as the social systems that have evolved around them are very diverse. Institutional arrangements governing these SES, like PES solutions to fit these conditions have been developed in the most varied contexts and with multiple approaches, reaching from local to national and include individual or wholes bundles of ES. Some experiences have already gained a model character and are replicated in other cases worldwide (MARTIN-ORTEGA et al., 2013; RICHARDS et al., 2015; FIDALGO et al., 2017; GOLDMAN-BENNER et al., 2017; FENG et al., 2018).

However, especially when applied in a context with highly unequal socioeconomic conditions (HASE UETA et al., 2018) and different from the typical rural environment, as this case study - considering mainly the peri-urban environment in which it is inserted - it is not enough to simply copy ready-made solutions from the Global North or even other countries of the Global South (GÓMEZ-BAGGETHUN; PASCUAL; MARCOTULLIO, 2013; SILVA et al., 2017; MARKET, 2017; VAN HECKEN et al., 2015a).

Considering the public authorities' legal responsibility to guarantee the protection of watershed areas by planning and regulating their land use, the initial problem of the PES application as well as this research, is the non-compliance with existing environmental legislation. This includes illegal deforestation, as well as the occupation and degradation of protected areas, mainly in Areas of Permanent Preservation (APP). The study area, which is part of the Upper Iguaçu Basin, an area that provides water for downstream communities all the way to Argentina, is also part of a dam for securing the water supply of the metropolitan area of Curitiba, and is confronted with problems of urbanization pressures. PES is presented as a possible integrated solution to those challenges (BRUEL et al., 2016).

This research inquires about participation in environmental governance, questioning how this process considers socioeconomic factors and follows democratic ideals and how much local knowledge and interests of local communities and stakeholders in the PES arrangement in São José dos Pinhais are considered (ZANELLA et al., 2014: 171, PRADO et al., 2015, ADAMS et al., 2016, WAAGE et al., 2016).

While initial theoretical work on PES has mainly been concerned with transactions, opportunity costs and willingness to pay, the importance of social and political factors that better explain the case-specific varying success and failure of some applications of this tool has increasingly been considered (CORBERA et al., 2009; PASCUAL et al., 2014; HAUSKNOST et al., 2017). Both the theoretical basis in the study of territoriality, and in STS and governance of the commons influence the direction of this research that aims at a more complex description and explanation of the phenomena influencing participation in PES.

The practical background of this study lies in previous and ongoing studies on the interactions between global and local governance (GEMMILL; BAMIDELE-IZU, 2002), considering the sustainable development of natural resource uses and the valuation of ecosystem services. The foundation of this research (WEINS et al., 2016; WEINS; SILVA; GADDA, 2018; WEINS, unpublished manuscript) has been carried out in the Studio Cities and Biodiversity and has been continued in the research groups Public Policies and Development Dynamics (PD2T) and Technology and Environment, which are part of the research line Technology and Development (TD) of the Postgraduate Program in Technology and Society (PPGTE) at the Federal University of Technology - Paraná

(UTFPR). It is aligned with the research line TD's research area of territoriality, as it covers both the organization of actors, their interactions, as well as questions about production and environmental issues, a debate which is at the origins of the Frankfurt School, the STS movement of philosophy and the sociology of science.

With a focus on democratic governance, this research was influenced by social science thinkers such as Andrew Feenberg (2003), Herbert Marcuse (1992), and Christian Fuchs (2017) to understand sociotechnical constructs like green infrastructure and environmental conservation, with a focus on PES and sustainable development. These theoretical foundations converse with theories and empirical works of institutional economics, based on authors such as Douglass North (1990, 1992), Oliver Williamson (1985), Elinor Ostrom (1990), Arild Vatn (2005, 2010) and Esteve Corbera (et al., 2007; 2015) used in this thesis.

Professor Christian Luiz da Silva supervises this research due to his extensive experiences researching institutions, municipal governance and environmental legislation, which are among his current research themes from a NIE perspective. Furthermore, he coordinates the research group CNPq research group PD2T. The co-supervisor, Prof. Tatiana Gadda has guided the researcher since 2015 in various research projects in the CNPq research group Studio Cities and Biodiversity and contributes with important approaches to the discussion of global environmental change as well as urban and metropolitan governance from an urban planning perspective.

1.6 STRUCTURE

This thesis is structured as follows: after this introduction, a literature review on the different base concepts for the analysis is presented in chapter 2. Firstly (2.1) the approach NIE as guiding theory is briefly explored, to then review the main topic of analysis: PES. In sub-chapters 2.2.1 to 2.2.3 the history of PES, Coasean and critical views are explored respectively in the literature. In section 2.3 some documented PES cases from around the world are explored to situate the arrangement of cases in Brazil. Section 2.4 is based on a systematic literature review on the importance of participation in PES.

Following this, chapter 3 presents the methodology of this thesis, covering the institutional analysis of PES in section 3.1, the semi-structured stakeholder interviews in section 3.2 and lastly the Social Network Analysis (SNA) approach in section 3.3.

Chapter 4 presents the PES case study of the Miringuava watershed, characterized in section 4.1 to then describe the actors of the three spheres (public, civil society and private) in chapter 4.2. Chapter 5 contextualize the results of this research, considering the documentary analysis and the results of the interviews. In section 5.1 general results about

the interview data is explained, chapter 5.2 conducts the analysis of the eight design principles for the Miringuava case, and the results of the SNA are presented and discussed in 5.3, before concluding and summing up these results in 5.4. The thesis closes with final considerations in chapter 6.

2. LITERATURE REVIEW

The concepts of human-nature relations and their benefits have a long history, not only in Western scholarly tradition (FERREIRA, 2004a; GIDDENS, 2009; SANTOS et al., 2017). In the second half of the 20th century concepts like Environmental, Ecosystem or Ecological Services have evolved considerably and their inclusion into the capitalist economy has given rise to a wide array of discussions on the valuation of those benefits from nature to the people, as well as involving governance debates on how to achieve the promise of sustainable development within PES frameworks (WUNDER, 2005; 2015).
This thesis focuses on the social and institutional dimensions of this expanding discussion on PES. Emphasizing the critical role of the science-policy interface, this study nurtures from findings of the assessment process of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), its questioning by Berbés-Blázquez, González and Pascual (2016) and takes the question of participation in PES arrangement as a red thread. As Zanella et al. (2014: p. 167) and others have pointed out, only “few studies have analyzed the issue [of participation in PES] as a primary research objective” (CORBERA et al., 2007; KOSOY et al., 2008; PAGIOLA et al., 2008, 2010).

This chapter poses a brief exploration of New Institutional Economics (NIE) that guide the theoretical discussion on institutional aspects. Then the historical dimension of PES is explored in an attempt to better situate the affirmative or technical views that are mostly present in policy-making practice today, and then contrast these with critical views on PES, and point to alternatives. After, the applications of the policy in Brazil and other countries in the Global South are explored to better situate the arrangement of the case study of this thesis. Following this, a short review on the importance of participation in PES is made, to then reflect on Social Network Analysis (SNA) in human-nature relations.

2.1 NEW INSTITUTIONAL ECONOMICS

For better situating the research at the socio-ecological interface, this section reviews the literature on institutional economics applied to the environmental debate and lays out the theoretical groundwork of this thesis.

As an important initial point for environmental issues in economics, Ronald Coase's work on institutions needs to be recognized. In "The Nature of the Firm" (1937) the author laid the groundwork for the discussion of the externalities problem, that he later elaborates on in "The Problem of Social Cost" (1960). Besides offering an explanation to the existence of firms as "transaction-costs minimisers," which had posed a "puzzle" to neoclassical economics, this view offers a whole new "set of tools to inform institutional design" (HARRIS; HUNTER; LEWIS, 1995: p. 1). This view, which is adopted in NIE, does not see state and market solutions as dichotomous. It might even be said that it offers a "grand theory of social and economic change" (ibid.). Even though it is part of economic theory, NIE ascribes an important role to ideas and ideologies, which makes it attractive to other applied social sciences, allowing for genuinely interdisciplinary discussion on the base of this theory (HARRIS; HUNTER; LEWIS, 1995).

Classical institutional theorists like Veblen, Hamilton, Commons and Ayres had already criticized instrumental rationalism, but focussed on organizations, information, property rights, and transaction costs. The evolutionary ("objectifying") forces of technology and institutions are nowadays central for all social sciences, as well as STS. North (1992, 1995) and Williamson (1985) are recognized as more recent key figure of NIE. In his critique of neoclassical economics North made the modification of the instrumental rationality assumption a core of his theoretical argument within the emerging school of thought. This line of economic theory “builds on, modifies, and extends neo-classical theory to permit it to come to grips and deal with an entire range of issues” that neoclassical theory could not explain. Among these: "production externalities, public goods, imperfect information and the free-rider problem" (HARRIS; HUNTER; LEWIS, 1995: p. 2) all of which will be treated in one way or another in this thesis.

Neoinstitutionalism focuses on the study of social norms to understand not only formal economic organization, but also informal social rules and norms that are and have been in place for a long time, and that ultimately influence the functioning of new market institutions. Institutions in this school of thought are most commonly defined as "the rules of the game in a society" and their main function is understood as to "reduce uncertainty by providing a structure to everyday life" (North, 1990: p. 3). Espino (1999) holds that they act as "social control, restricting the actions of individuals" and that institution follow their own logic in the exercise of collective action. Helmke and Levitsky (2004: p. 727) define institutions as “rules and procedures (both formal and informal) that structure social interaction by constraining and enabling actors' behavior.”

Thus, formal institutions are “rules and procedures that are created, communicated, and enforced through channels widely accepted as official” and informal institutions by contrast are the “socially shared rules, usually unwritten, that are created, communicated,

and enforced outside of officially sanctioned channel." Some authors do point out that it is problematic to treat "all behavioral regularities as informal institutions," as the lines between institutions and general cultural practices can be quite blurry in analytical terms (HELMKE; LEVITSKY, 2004: p. 733; HAMILTON et al., 2009).

Williamson (1985, p. 17) cites Coase's (1972, p. 67) observation that "if an economist finds something - a business practice of one sort or another - that he does not understand, he looks for a monopoly explanation." This would apply to the case of PES contracts - if viewed from within the logic of neoclassical economics - could not be explained easily, and would thus urge for an explanation of a monopoly buyer (in this case the water company SANEPAR). Williamson further states that "economic institutions of capitalism have the main purpose and effect of economizing on transaction costs," which, in line with the logic of PES responds to a "condition of previous neglect and undervaluation" of a transaction, making this school of thought an important analytical tool for the case study.

The recognition of the importance of institutions goes a long way. The foundations of modern-day economics lie in Adam Smith's and David Ricardo's classical works of economics that deal mainly with the benefits of exchange and gains. The classical debates in the field lie in the problem of *use* versus *exchange* value (see FARBER et al., 2002 for a discussion on the concepts of economic versus ecological value).

Paavola and Adger (2005: p. 354) point out, however, that "ironically, environment has not been a central concern for new institutional economics which has focussed on industrial organisation, public choice, and economic history." Those authors hold that in the process of evolving the economic debate "from externality to interdependence," NIE has become a response to (and critique of) welfare economics and thus conventional environmental economics[1]. The issue of this thesis can very well be situated in this critique. In neoclassical economic thought, if PES were a pure market transaction, the landowners that offer their land, as sellers should be understood as natural monopolists, and as such should be able to dictate prices. However, what happens in reality is that with such high supply of conservation land in a small region, the price actually drops (TO et al., 2012).

Scholars like Ostrom, Vatn and Corbera have developed on the ideas of NIE, and applied them to environmental cases. In the interdisciplinary field, NIE has begun to be recognized as a valuable guideline for theories of human-nature relations, or SES. A socio-ecological (or social-ecological) system is here understood as (REDMAN; GROVE; KUBY, 2004: p. 163):

> "1. a coherent system of biophysical and social factors that regularly interact in a resilient, sustained manner;

[1] focus on profit seeking resource management

> 2. a system that is defined at several spatial, temporal, and organizational scales, which may be hierarchically linked;
> 3. a set of critical resources (natural, socioeconomic, and cultural) whose flow and use is regulated by a combination of ecological and social systems; and
> 4. a perpetually dynamic, complex system with continuous adaptation" (BURCH DELUCA 1984; MACHLIS et al., 1997, apud. REDMAN; GROVE; KUBY, 2004).

Further, Redman, Grove and Kuby affirm (based on BURCH DELUCA 1984; MACHLIS et al., 1997) that, while the social system is part of every SES, researchers need to pay attention to the components of social system themselves, which in turn are comprised of three major factors:

1. social institutions, i.e. collective solutions to universal/particular social challenges;
2. social cycles, i.e. "temporal patterns for allocating human activity";
3. social order: cultural patterns for organizing interactions among people and groups

These three patterns can include demographic and economic (growth) dimensions, technological change, political and social institutions, culture, as well as knowledge and information exchange. Redman and his colleagues (2004) define these quite broad factors in more detail. Demographic aspects include "growth, size, composition, distribution, and movement of human populations"; technological change can be understood as "accumulated store of cultural knowledge about how to adapt to, use, and act on the biophysical environment and its material resources to satisfy human needs and wants," which in the case study plays out in the dispute about the right agricultural practice (traditional, conventional, or agro ecological). The economic (growth) dimension and the institutional arrangements that facilitate it are a central theme of discussion of this thesis; they mainly break down into the production and distribution of (here agricultural) goods and (here ecosystem) services.

Also political and social institutions are a guiding theme of this thesis, which Redman et al. (2004) define as "enduring sets of ideas about how to accomplish goals recognized as important in a society." These are exemplified by the associations and the Miringuava Management Group later on. Cultural factors, generally speaking are understood as "culturally determined attitudes, beliefs, and values that purport to characterize aspects of collective reality, sentiments, and preferences of various groups at different scales, times, and places." In this case study, the European, and specifically Polish heritage and immigrant identity are identified as a defining factor in the social, political and productive organization. Lastly, the knowledge and information exchange dimensions understood as "cultural communication of instructions, data, ideas" has been pointed out by PES-specific literature by authors like Vatn (2005) or Fidalgo et al. (2017) who have dealt more specifically with the

role of information in institution of PES, but also more general problems of imperfect information and the free-rider problem in environmental problems are considered here (HARRIS; HUNTER; LEWIS, 1995).

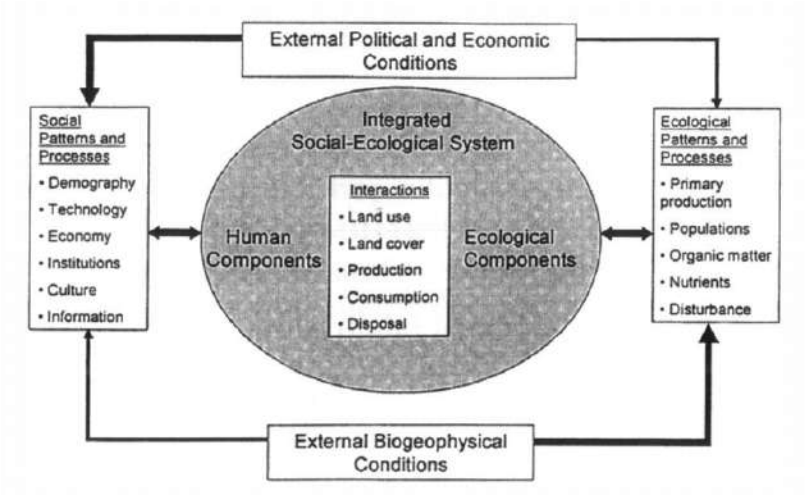


Figure 1. Conceptual framework for long-term investigations of social-ecological systems (SES). Source: REDMAN; GROVE; KUBY, 2004.

The author's (2004, p. 165) recommend that, for the application of such a SES framework, data collection on three components should be conducted (Figure 1): “1. collecting background information on "external" biogeophysical [lower box], political, and economic conditions [upper box] that set the stage;” 2. “describing and monitoring changes in both ecological and social patterns and processes that drive the system;” and 3. “investigating the nature of and monitoring changes in the interactions resulting from the operation of the patterns and processes.” These basic recommendations were considered both in the construction of the questionnaire and the later analysis of the SES.

After setting the stage with this definition of SES research, the collective action approach by Ostrom has to be understood more closely. Contesting Hardin's "Tragedy of the Commons" from 1968, Elinor Ostrom's theoretical work on robust institutional arrangements for sustainable management of CPR led to the foundation of the Collective Action Theory, which is followed by her disciples at the Workshop in Political Theory and Policy Analysis at Indiana University at Bloomington. It challenges the assumption in economic theory that the solution to this problem is simply the clarification and formalization of property rights into public or private property. With the Collective Action Theorem and the Institutional analysis and development framework (IAD), Ostrom and her colleagues have brought forth the importance of local formal and informal institutions into economic decision-making in natural resource management. Auer (2014, p. 265) states that in "Collective Action and the

Evolution of Social Norms" Ostrom defines her most important contribution to the theory, in which "people overcome self-interest and self-defeating outcomes involving things of value."

The eight design principles, first defined in this form by Ostrom in her 1990 textbook "Governing the commons: the evolution of institutions for collective action" her collaborators at Indiana University Cox, Arnold and Villamayor Tomás (2010) point out the underlying model of the individual as “fallible, norm-adopting individuals who pursue contingent strategies in complex and uncertain environments” and, following North's (1990) definitions take institutions as "mechanisms for reducing uncertainty in complex, uncertain environments." The authors further explain the idea that "reducing uncertainty, trust and norms of reciprocity may be built and sustained, and collective action may become possible." As such:

> "the primary role of the design principles is to explain under what conditions trust and reciprocity can be built and maintained to sustain collective action in the face of social dilemmas posed by CPRs. This collective action, in turn, helps prevent the deterioration of a managed CPR" (COX; ARNOLD; VILLAMAYOR TOMÁS, 2010: p. 2).

The application of the design principle in this case study is also that of a guiding function in assessing whether or not the rules defined by the different actors in the CPR of the Miringuava watershed could lead to a long-term sustainable management of its forest areas considering PES as a part of the solution, or even an impulse to such community organization. It has to be understood that the PES arrangement is still in development. However, the watershed is defined as a CPR system for the purpose of understanding the factors defined by Ostrom that have to be present in a long-lasting socio-ecological system. In such a way, the study object is not an exemplary case of CPRs, but a theoretical adoption, in order to be able to give recommendations towards building such institutional rules for the Miringuava watershed.

2.2 PES IN THE SCIENTIFIC DEBATE

The scientific debate concerning PES as a sustainable development policy solution on the local level can be traced back to the 1980s, followed by first practical applications and then growing scientific interest for the concept at the end of the 1990s. Across the world more and more "governments, NGOs, scientists, policy-makers, and resource managers are learning to speak in the language of ecosystem services" (DEMPSEY; ROBERTSON, 2012). In the following, the various concepts of PES are going to be discussed, in order to situate

the importance of the case study and the greater topic investigated here: the importance of landowner participation in PES design.

For the literature review of this thesis, a broad amount of studies has been considered that have been consulted in different research endeavours within the discussions of the *Studio Cities and Biodiversity* and *Public Policies and Dynamics of Territorial Development* research groups. Scientific peer-reviewed articles, conference proceedings, book chapters as well as reports have been considered. Due to the great diversity of the material and the relative newness of PES in scientific and practical terms, this integrative review was deemed more adequate for the exploration of the topic than a bibliometric research.

2.2.1 The concept of PES

When discussing PES, important concepts to be understood are the ones of the underlying ecological functions as well as the definition of ecosystem (or environmental) services themselves. Guedes and Seehusen (2012: p. 17) make a clear basic distinction of ecological function. Figure 2 shows the (biologically diverse) ecosystem on the one hand, in which the performance of ecological functions is possible. These functions might be e.g. the resilience that habitat has against climate change. The ecosystem services that arise from the functions, are the benefits that humans receive from the natural and efficient functioning of those ecological functions. In the example given by the authors, this would be the protection of agricultural systems against plagues.

Figure 2. Distinction between ecosystem, ecological function and ecosystem service. Source: GUEDES; SEEHUSEN, 2012. Illustration by the author.

Notwithstanding the wide acceptance of this definition, there are still some issues concerning the debate about those services. One basic one being the use of the terms ecosystem and environment, as these concepts bare a difference in meaning when applied to the sphere of PES. Bulte et al. (2008) help to differentiate accurately between payments for *ecosystem* and *environmental* services: we talk about payments for "*ecosystem* services when the emphasis is on enhancing 'nature' services," and about "payments for *environmental* services when amenities provided by the built environment are also included." That is, when specific management or treatment of areas by human agents is involved, we

talk about *environmental* services, when areas are simply conserved and no additional measures are taken, *ecosystem* services are obtained from the mere ecological functions.

As one of the starting points of the current debate surrounding valuation and payments for ES in the economic literature, Costanza et al.'s 1997 article in *Nature* "The value of the world's ecosystem services and natural capital" is certainly one of the most influential and cited ones throughout the PES literature. As of June 2018 it had been cited by 19.647 publications. The authors have reassessed the impact of this paper after 20 years of its publication and mapped how the discussion has evolved (COSTANZA et al., 2017). In the process, the concept of valuation of natural capital has become more popular among different researchers and policy institutions that have expanded and modified the concept. Some of those modifications are discussed here.

In the field of technical applications of PES, Sven Wunder from the Center for International Forestry Research (CIFOR) has certainly been one of the most influential authors, especially when it comes to scheme design and aspects surrounding the integration of poverty alleviation into the tool. Research by CIFOR has been guiding PES applications in Indonesia and Brazil, where the researcher has worked. Sven Wunder's 2005 working paper "Payments for Environmental Services: Some nuts and bolts" has set an important and much cited definition of PES. A redefined concepts after ten years of practice in PES (WUNDER, 2015: p. 241) differs somewhat in all, but the first principle, emphasizing the conditional and agreed upon nature of ES markets. Wunder redefines PES as:

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

The application of PES as a tool for internalizing environmental values into markets, has seen some advances in the industrialized world. The most famous of those application in the city of New York’s payments for watershed conservation. However, the notion of PES as an integrated development tool is quite different in industrialized countries and does not compare to most applications in the Global South, especially in Latin America (WUNDER et al., 2008; SCHOMERS; MATZDORF, 2013; EZZINE-DE-BLAS et al., 2016). For this reason this thesis focuses on the application in the developing world. The great popularity of PES as a solution to nature-related development issues and social development has lead to an immense diversity of methodologies and approaches in Latin America (MARTIN-ORTEGA, 2013; PRADO et al., 2015). Here, PES is increasingly prevalent as a tool for conservation in

poor and resource-dependent communities (KERR et al. 2014; PASCUAL et al. 2014; MURTINHO; HAYES, 2017).

An emerging body of literature has thus started to move the debate beyond economic valuation techniques and has started to include social, cultural and institutional factors. Many of these have taken institutional fit, considerations surrounding equity or institutional robustness as a central theme (GARMENDIA; PASCUAL, 2013; CORBERA et al., 2015; CHEN et al., 2015; VAN HECKEN et al., 2015b; OSTROM, 2015). Vatn (2010: 1245) suggests that institutions "can be understood as solutions to collective choice problems," which are at the core of the debate concerning the theoretical and practical debate around the governance of the commons proposed by Nobel laureate Elinor Ostrom.

When it comes to the types of arrangements, Schomers and Matzdorf (2013) made a representative selection of 457 PES cases from around the world. In their analysis they found that the greatest number of the schemes on which there are scientific publications are found in Latin America, followed by Asia, and Africa. Of those schemes, the greatest part of those schemes analyzed by the authors does not fit the original Cosean (that is, market-based) definition of PES. The greatest part of the found arrangements has most characteristics of a Pigouvian, that is state-led PES arrangement, and a significant part of the studies even goes beyond these two types (see Figure 3).

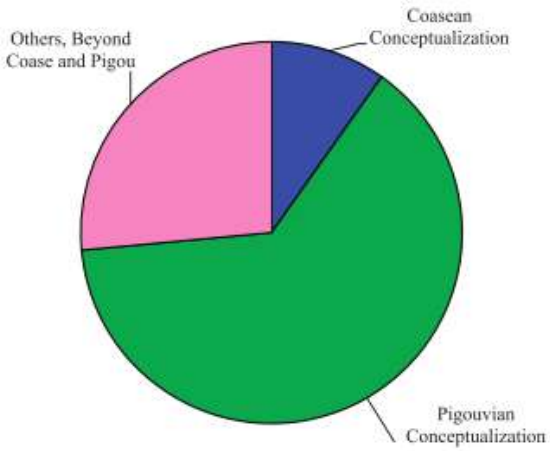


Figure 3. Economic conceptualization of PES case studies compiled by Schomers & Matzdorf (2013: p.18).

Apart from the debate about the theoretical economic basis of PES, as mentioned earlier, there are also varying terminologies. Liu et al. (2016) give a comprehensive overview of different terminologies used for some alternative conceptions of PES, like ecological compensations, payments for environmental services, ecology compensation or compensations for ecosystem services. The case of the Chinese Eco-Compensations for watershed services should be highlighted here, as it is by far one of the most significant

ones in terms of annual investments. The Asian Development Bank (2016: p. 22) included 454 PES programs in the People's Republic of China (PRC), Latin America and the Caribbean, Africa, North America, (non-PRC) Asia, Oceania and Europe and found that a total of US$ 12.3 billion were invested in watershed services in 2013. This is illustrated in Figure 3. By far, with more than US$ 6 billion in 2009 and almost US$ 12 billion in 2013, the PRC strikes out as the biggest investor in this kind of PES. This is, in part, due to China's unique approach to the integration of public policies, which in the case of its Eco Compensations has seen a long-handed integration of different conservation policies like the Natural Forest Conservation Program, the Grain to Green Program, and the Sloping Land Conversion Program (LIU et al., 2008).

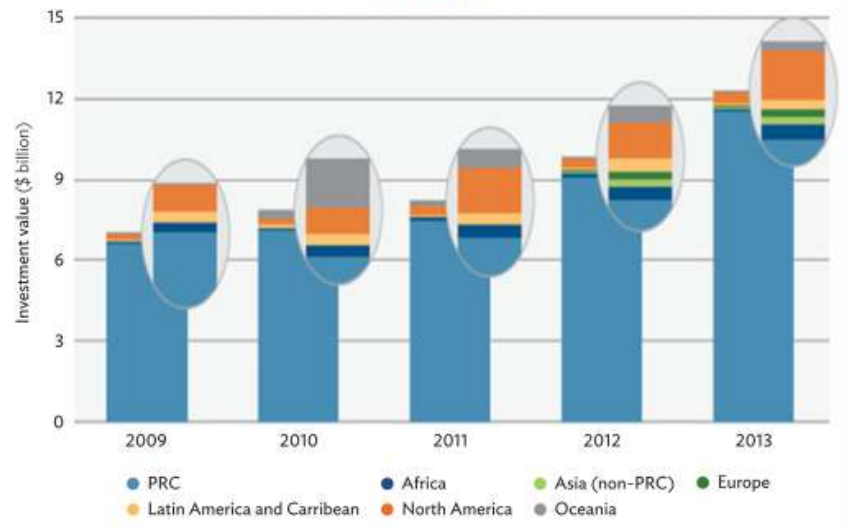


Figure 4. Value of global investment in watershed services by region, 2009-2013. Visualization by Asian Development Bank (2016) with data from Bennett and Carroll (2014).

With reference to the theoretical categorization of these investments, they do obviously fall into the realm of Pigouvian-style schemes, as the Chinese state leads and coordinates those arrangements centrally (LIU et al. 2016). This is not only due to the country's geography, but also to its political and economic history (ZHANG et al., 2009; MU, 2018). For a more detailed discussion on the Chinese case and the institutional challenges involved, Zhang et al. (2009) and Chen et al. (2015) give excellent insights into the discussion. Muradian et al. (2010) in an earlier work also point to alternative approaches like e.g. Ecological Economics to PES.

Table 1 below sums up some of the positions of the authors illustrates some of the author's used in this thesis, and their main arguments broken down into two main streams: affirmative with a technical focus, and critical with a social focus. This table will facilitate the analysis of the case study later on. It shows a dominant stream of authors on the affirmative

and technical side, like Wunder, Costanza and Daily, together with big international organizations such as WWF, WRI and above all TEEB (The Economics of Ecosystem Services and Biodiversity) that provide technical and scientific arguments for the use of PES, principally as a conservation tool and that focus on the resolution of the problem of the invisibility of nature's values, with an uncritical discussion of PES as a tool of development policies. On the other hand, the often capitalism-critical authors from what has been classified here as PES-critical and with a social focus, that stress the importance of the consideration of the contexts in which PES arrangements are inserted. This is especially in terms of inequalities and power imbalances, both in a rural-urban and a gender sense. Another strong cluster of authors in this category criticizes the commodification and technicalization of nature's functions in the service of humanity as an unethical, even commodity-fetishist approach to nature and point to the risks and negative consequences of PES as a development tool, and often criticize corporate interests in control over land and resources.

Table 1. Different lines of thought on PES & main arguments of author's used literature in this thesis. Visualization by the author (2018).

Position on PES	Main arguments	Author(s)
Affirmative *Technical focus*	PES as environmental externality solution; e.g. through inclusion in natural capital	COSTANZA; WUNDER, 2005/8; ENGEL; TURNER; DAILY, 2009
	Cost-effectiveness, innovation	TEEB, 2008; WRI, 2016; WWF-BRASIL, 2014
	(Purely as) Conservation policy instrument	SWALLOW, 2007; PAGIOLA, 2008; WUNDER, 2015
	Solution to rural poverty	GUTMAN, 2007
Critical *Social focus*	Importance of community involvement (often ignored)	COX; ARNOLD; VILLAMAYOR, 2010
	Include equity considerations and consider broader spectrum of values	GÓMEZ-BAGGETHUN et al. 2013; MURADIAN et al., 2010; MCAFEE; SHAPIRO, 2010
	Normative institutional design	VATN, 2010; NORGAARD, 2010; NORDÉN, 2014; RODRÍGUEZ DE FRANCISCO; BOELENS, 2015
	Commodity fetishism: "cultural poverty of constructing nature as service provider" (SULLIVAN)	KOSOY; CORBERA, 2010; DEMPSEY, ROBERTSON, 2012; SULLIVAN, 2009

2.2.2 History of PES

Since the strengthening of economic theory as a discipline and an increasing focus on economic development in national policies, the consideration of the value of nature has decreased in both theory and practice. Naredo (2003: p. 250, apud. GÓMEZ-BAGGETHUN et al., 2010: p. 1213) traces the initial disappearance of nature from the economic production function to the 1950s, where "the problem of [physical] scarcity was reduced to a problem of scarcity of capital, considered as an abstract category that could be expressed in homogeneous monetary units." The analysis became restricted to those goods and services that had been previously valued in monetary terms leaving outside the scope of analysis all those objects of the ecosphere bearing no exchange value (Naredo, 2003) – e.g., non-marketed cultural ecosystem services like recreational values of walking through the woods. Along with this, come optimistic views on technological innovation that would allow for increased substitutability of nature's functions (GEORGESCU-ROEGEN, 1987). However, with the rise of environmental concern at the end of the 1960s, and discussions in the literature, like Hardin's Tragedy of the Commons (1968) and Ostrom's responding theory (1990), a gradual reconsideration and valuation of nature has taken place (PASCUAL et al., 2017).

To better understand the track of nature's values in the economic system, this subchapter takes a look into the history of PES. One of the earliest explicit mentions of the dependence of human society on nature in Western scientific literature goes back to George Perkin Marsh's *Man and Nature* from 1864, where he questions the idea of infinite natural resources that are at the disposal of humans at no cost (MOONEY; EHRLICH, 1997: p. 11). Considering economic theory, Gómez-Baggethun et al. (2010) identify three main stages in the historical development of conceptualizations of nature in value systems that go back even further. The most important landmarks after this pre-classical phase, in which land is still conceived as the main source of wealth, is illustrated at the bottom of figure 5.

Following the post-physiocratic epistemological break, starting with Adam Smith's classical economic work "The wealth of nations" from 1776 that gave rise to economic theory as we know it, land and especially labor come to be seen as main sources of wealth. To some extent Thomas Malthus' concerns with population growth and David Ricardo's law on diminishing returns on land consider the limits of the "services" from nature, "but as they perform their work gratuitously, as nothing is paid for the use of the air, of heat, and of water, the assistance which they afford us, adds nothing to value in exchange" (RICARDO, 1817/2001: p. 208, apud. GÓMEZ-BAGGETHUN, 2010). Following Karl Marx's 1867 "Das Kapital: Kritik der politischen Ökonomie," the 'Marginal Revolution' gives rise to neo-classical economics, and the discussion of marginal values takes center stage in economics. Marx

contributes that the value of nature to humans comes only through the combination of human labor with nature: “Labor is not the source of all wealth. Nature is just as much the source of use values (and it is surely of such that material wealth consists!) as labor, which itself is only the manifestation of a force of nature” (MARX, 1891). And since the “exchange-value is a definite social manner of expressing the amount of labor” of an object, “nature has no more to do with it, than it has fixing the course of exchange (MARX, 1867: p. 40, apud. GÓMEZ-BAGGETHUN et al., 2010). Pigou (1920) states that “The one obvious instrument of measurement available in social life is money. Hence, the range of our inquiry becomes restricted to that part of social welfare that can be put directly or indirectly into relation with the measuring rod of money.” Thus Pigou (1920; 2006, p. 11) expanded beyond the limits of markets as a way to tackle economic externalities.

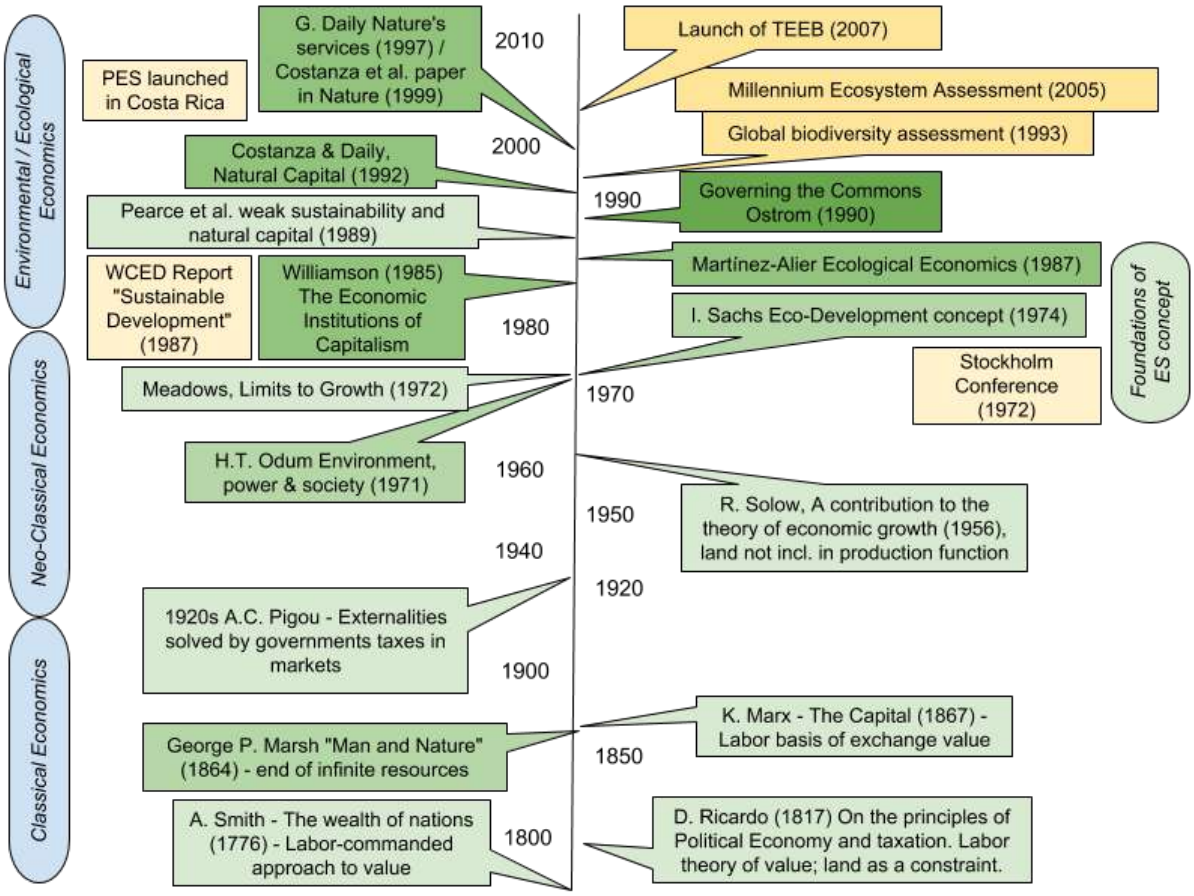


Figure 5 - Combination of early and recent landmarks in the evolving conception of nature in economic theory. Source: the author, based on two figures from Gómez-Baggethun (2010, p. 1214).

While the discipline conceptually decouples from the physical world in this period, there are some authors, like a Pigou (1920), Solow (1956) and Coase (1937/2013) who do discuss the problems of externalities (GÓMEZ-BAGGETHUN et al., 2010). These more recent debates are displayed chronologically in figure 5.

Naredo (1987) describes three ground-breaking changes that took place in the vision of nature that would lead to an increasing credo of the “substitutability of natural resources with human-made capital” and what Mayumi (1991) calls the “temporary emancipation from land." The first being a shift of focus from the land-labor relation to a labor-capital relation, the second was the move from physical to monetary analysis, and the third the increasing shift away from the actual use value towards the dominance of the exchange value in human-nature relations. Manski (2000: p. 121) affirms that the “Triumph of neoclassical economics over institutional economics in the 1920s and 1930s” resulted in the separation and creation of Sociology departments, that thus focussed on nonmarket interactions, while economics started to become the exclusive study of market-mediated interactions.

After these historical phases, nature's values have started to be taken into account in various strands of research and policy (DE GROOT; BRAAT; COSTANZA, 2017). Within the ecological movements from the beginning of the 1960s on, over the Brundtland Report, the 1992 Earth Summit in Rio, the Millennium and later the Sustainable Development Goals, there have been moves to incorporating and reintegrating nature into the economy and the value systems of our societies. Fuchs (2017) assesses some prevalent modes of seeing the economy (see figure 6) as intertwined with (M1), embedded in (M2) or complexly interlinked with (M3) the environment and society, culture and politics, challenging earlier views that see nature as a mere external factor in economic production.

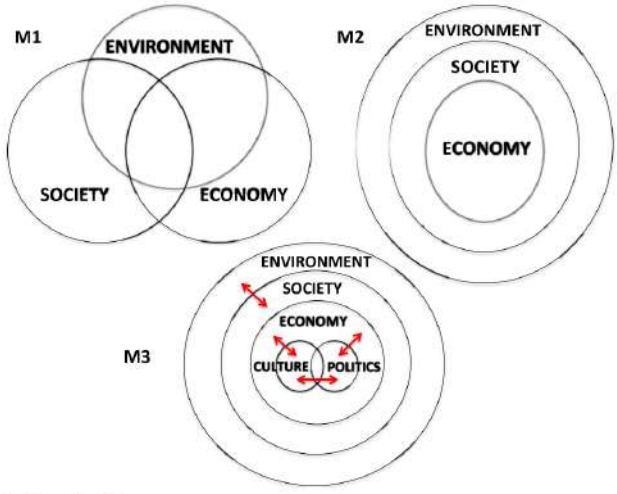


Figure 6. Three models of sustainability. From Fuchs, 2017.

Indeed, sustainable development practices have been adopted into the public policy process in the most diverse areas in recent years and they have been linked to different dimensions of sustainable development. However, Silva and Schmidt Bassini (2012) suggest that public policies in developing countries are often underfunded, and with a lack of (well-

diffused) scientific knowledge, there are great challenges to implementing policies that consider the complex needs of developing societies in the Global South.

2.2.3 Affirmative Coasean views

Most prominent in the policy realm today, after having received increasing interest by academia that has backed up the positive effects of PES on conservation, one of the main scientific discussions about PES evolves around technical aspects concerning the arrangements and policy integration of the tool to be more effective (MCAFEE, 2010). In this more technical view that often argues in a line of PES as a solution to the externalities problem that has surged with the marginalization or separation of the economy from nature (as discussed in sections 2.2.1 and 2.2.2). The main argument here is, that, bringing a measurable externality, in the form of an ecosystem service into a market interaction by creating or enabling this kind of transaction, the most effective and just solution to the externality problem would be found in such a market. This view is commonly called the Coase Theorem, which was, however, not formulated by Coase himself.

Figure 7 by Engel et al. (2008) demonstrates the logic of PES in a visual form by the example of the conversion of forest land to pasture, forest conservation and conservation with service payment(s). At the bottom half of the graph the costs (i.e. negative externalities) to downstream populations and others are exemplified with 1) reduced water services, 2) loss of biodiversity, 3) carbon emissions. The ecosystem benefits (to its managers) are shown on the top half. When comparing the three columns, the left one shows how the pasture use has more benefits to the people directly involved in working with the land, as they explore it economically, whilst the forest conservation scenario provides less benefits to them. The idea of including the negative externalities from the bottom half in the value system by stacking them onto the conservation benefits, ultimately leaves the resource system user with more benefits. Here, a minimum payment needs to be provided in order to cover basic opportunity costs. The maximum payment would include all the possible negative externalities and help mitigate them through conservation by paying the ecosystem manager with PES to compensate for conservation.

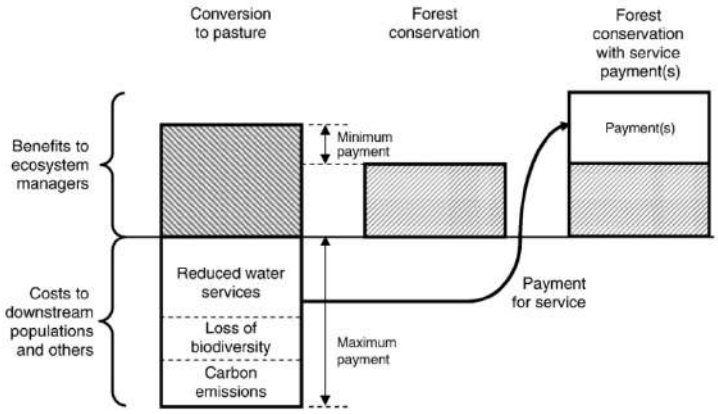


Figure 7. The logic of PES. From Engel et al., 2008.

This seemingly simple market solution to the externality problem is dealt with by many authors. Among them, the most prominent defenders that are used in this thesis, too, are Robert Costanza (1997), Engel et al., 2008: 665 and Sven Wunder (2005), as well as big international conservation NGOs like WWF and TNC (KOLINJIVADI et al., 2017).

2.2.4 Critical views

In the discussion of PES as a voluntary market solution to the protection of environmentally important areas, first practical experiences in Brazil and abroad have shown how this solution is not a *silver bullet* (LANDELL-MILLS; PORRAS, 2002). Different power concentrations and varying participation involvement have been shown to be decisive factor when it comes to arranging effective and fair PES arrangements. Kolinjivadi et al. (2017: p. 12) affirm that the “market logic not only overpowered other logics driving the work of conservationists but was more likely to be defended the larger the relative size of the organization.” This is especially relevant when looking at rural areas, where local social organization still differs significantly from the urban one, and the effect of existing protected areas might imply in the equity effects that PES promises (PASCUAL et al., 2014).

When ecosystem services are commercialised by rural farmers, those payments most often do not cover their opportunity costs, considering alternative land uses (in most cases agriculture). In general, the opportunity costs are larger than the amounts paid, which apparently contradicts the economic foundation of PES schemes and suggests that the role of “intangibles” is important in inducing participation (KOSOY et al., 2007). Payments do however act as a significant incentive for participation in most cases. The limited economic impact of many PES applications and the existing inequities in decision-making and outcomes can be explained by problems of institutional design, in particular the inability of

markets and payments for ecosystem services to account for context-related factors, such as property rights (CORBERA; KOSOY; MARTÍNEZ TUNA, 2007).

In Mexico's national PES programs "efficiency criteria have clashed with antipoverty goals and an enduring developmental-state legacy" (MCAFEE; SHAPIRO, 2010: p. 579). Like in other Latin American cases, Mexico's PES is a hybrid of market-like mechanisms, state regulations, and subsidies. The arrangements have been reshaped in an ongoing process by social movements that mobilized in opposition to this neoliberal restructuring. The activists see “ecosystem services as coproduced by nature and campesino communities,” and, rejecting the position of World Bank economists that as promoters of a more neoliberal approach, insist that the “values of ecosystems derive less from the market prices of their services than from their contributions to peasant livelihoods, biodiversity, and social benefits that cannot be quantified or sold" (ibid).

Critical voices like the above cited Kathleen McAfee (2012), or Sian Sullivan (2009) from the group Radical Anthropology completely reject the idea of creating markets for the natural environment. Sullivan (2009: p. 20) holds that “payments for the environmental services produced by nature’s labour do not go to the environment itself, but to whoever is able to capture this newly priced value,” a view that is sustained by critical historical materialism and that sees the development of PES as a logical step of the expansion of the capitalist system into the last realms of the material world. They often see substantial "contradictions within neoliberal environmental discourse based on binary categories of nature and society" in which the “commodification of nature is a leading environmental policy trend” (MCAFEE, 2010; MCAFEE; SHAPIRO, 2010). Some authors suggest the use of the term "commodity fetishism" for PES, as it is judged useful to "shed light on the relations of exchange among market actors across scales, existing power asymmetries” and that its ideas of popularizing “the idea that all ecosystem services can be marketed for the benefit of conservation and human well-being" (KOSOY; CORBERA, 2010: 1230).

These contradictions of capitalism in which “productive forces turn into destructive forces in the metabolism of nature and society” are described by Fuchs (2017: p. 14), who follows the STS and Frankfurt School lines of thought, as radical as “[depleting] and [destroying] natural resources,” while the marketization should actually help preserve them and integrated them into sustainable development policies. The same author holds that the implication of sustainable development have to be discussed more profoundly by the social sciences as “sustainability is an inherently ethical concept that poses the question ‘What is a good society?’” (see also ZIEGLER; OTT, 2015, p. 56).

The critique those authors voice, is that the control of payments would ultimately only benefit the ones who control the decision-making and that are (already) at the upper end of the power spectrum. Likewise, those authors call attention to existing power imbalances in

already existing PES arrangements and to the reproduced inequalities reproduced by them. Wunder (2005, p. 16), in a section on “pro-poor PES” of his conceptual paper points out issues concerning participation, as well as effects on sellers and non-sellers. However, the questions this author poses are of a rather economic and not social nature, e.g.:

- access to and ‘market share’ in PES schemes can potential poor ES providers compete for?
- Effects on ES sellers: To the extent poor providers do get access, how does PES participation affect their livelihood?
- Effects on non-sellers: How does PES affect poor people not selling ES (non-participating farmers, poor ES users, product consumers, landless laborers, etc.)

Berbés-Blázquez, González and Pascual (2016), formulate a structured criticism for advancing the international debate in those critical lines, pointing to the Millennium Ecosystem Assessment (MEA, 2005) and the currently ongoing assessment processes of the follow-up by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). The authors identify three main issues concerning the "blind spots" of this “sister assessment”. The current frameworks for those assessments (see figure 8) focus mainly on ES and functions and their effect on human well-being, while greatly ignoring institutions and governance structures involved in the process of producing and using these services. According to these authors, underlying power relations and their manifestations must be taken into account in order to ameliorate the inclusion of complexities in socio-ecological systems.

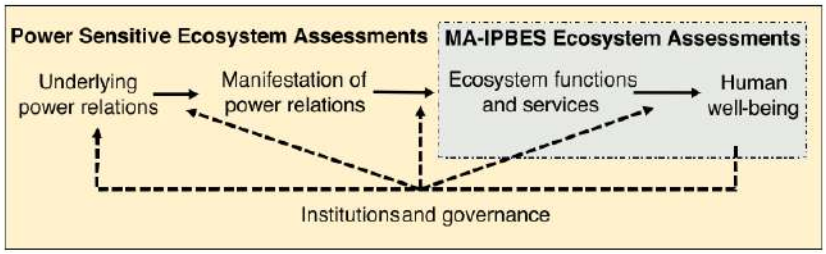


Figure 8. Current frameworks for ecosystem services assessments. Source: Berbés-Blázquez, González and Pascual (2016).

Based on their fieldwork and research on human-nature relations, the authors draw a more complete and complex picture of the social and institutional relations involved in the production of ES, which may significantly influence the creation of sustainable and fair PES arrangements (HE; SIKOR, 2015). Firstly, the author's point out that it is of great importance to analyze how power relations underpin the governance and institutions that determine the access to and control over ecosystem services; secondly, it needs to be assessed how labor

relations enter into the equation and how these relations and their co-production impact human well-being; and thirdly, the historical co-evolution of power relations and environmental change in shaping ecosystem services values needs to be recognized. Figure 9 (below) visualizes these dimensions. In principle, the embeddedness of any social systems within the biophysical system (in green) has to be recognized to understand the debate. The top layer (dark blue, 1) shows the current IPBES debates surrounding the evaluation of ES and their trade-offs. Berbés-Blázquez, González and Pascual (2016) add the second layer of systems of co-production (2) and of social and historical context (light blue, 3) to the debate. This last layer is a key element when connecting ES valuation to social-ecological conflicts and the institutions and governance involved with them.

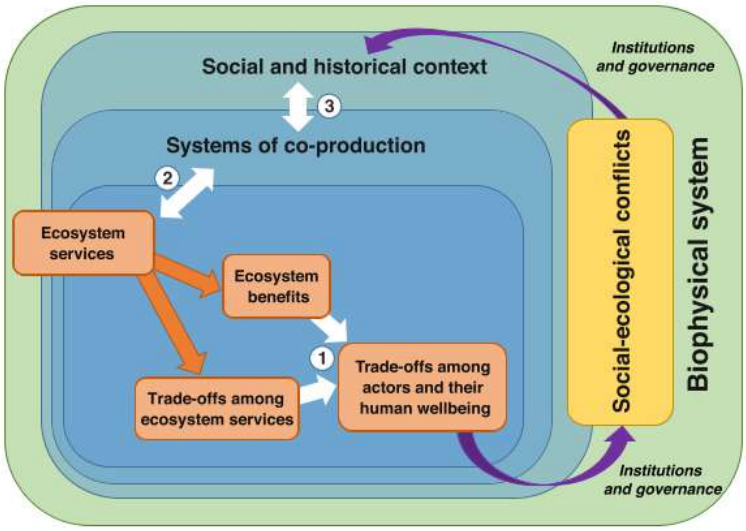


Figure 9. Conceptual model of blind spots limiting potentials of the MA-IPBES framework. Source: Berbés-Blázquez, González and Pascual (2016).

In a critical review of those dimensions in the current scientific literature, the author of this thesis identified that, while some authors consider (to some degree) historical dimensions and the co-evolution of power relations and environmental change, the suggested dimension of labor relations and co-production is a significant blind spot when it comes to the PES debate (WEINS, unpublished manuscript).

When considering effects that a given policy can have, the telecoupling framework, as applied by Liu et al. (2013) can help to reveal an array that would otherwise be invisible to decision-makers on the effects of policies. The author's point out "examples of distant interactions as telecouplings and actual/hypothetical relationships to sustainability in sending, receiving, and spillover systems," as depicted in figure X. They further affirm that "only some attributes of telecouplings have been studied in the past and most attributes remain unknown." Specifically on the telecouplings involving conservation policies like PES Liu et al. (2013) write that they "may conserve and restore environmental sustainability in

receiving systems, may or may not compromise sustainability in the sending systems, and may influence spillover systems in various ways." This approach is particularly helpful when assessing risk involved in those policy decisions, which is outside of the scope of this thesis.

2.3 PES APPLICATIONS IN BRAZIL AND THE WORLD

Since the United Nations Convention on Biological Diversity (CBD) first signed at the Earth Summit in Rio de Janeiro in 1992, the consideration of biodiversity issues in policies have taken place. The consideration of the different types of benefits from nature, i.e. ecosystem services has taken significant steps with the Millennium Ecosystem Assessment (MA) and have been commonly divided into four categories: 1. Provisioning services; 2. Regulatory services; 3. Cultural services; and, 4. Support services (MEA, 2005).

2.3.1 PES applications in Brazil

As in many countries of the Global South, “Brazil shares a schizophrenic tradition in [terms of conservation]: there is rhetorical glorification of nature on the one hand, but its complete ransacking on the other, including the massive deforestation that is taking place today (SACHS; SILK, 1990: w/o page). In Brazil, PES policies have emerged since the early 2000s and were inspired by many other pioneer experiences from all over Latin America. The first PES program "Conservador de Águas" was launched in 2001 in the municipality of Extrema in the state of Minas Gerais (JODAS, 2015; ALARCON et al., 2016). For this, the National Water Law (Law #9.433) from 1997 with the establishment of defined usage rights and the National Water Management System, formed the legal base for this experience. Other early experiences include the state-wide “ProdutorES de Água” program in the state of Espírito Santo, the “Projeto Pipiripau” in the capital Brasília; "Projeto Apucarana" in the state of Paraná, "Projeto Guandu" in the state of Rio de Janeiro (see RUIZ, 2015 for a more detailed description), Projeto Camboriú in Santa Catarina and "Projeto Guariroba" in the agricultural state of Mato Grosso do Sul (JODAS, 2015: p. 146). Altmann and Silva Stanton (2018: p. 292) affirm that “the concept of ecosystem services has grown in normativity in Brazil, contributing to the improvement of environmental law - and the law itself.”

Guedes and Seehusen (2012: p. 17) compiled one of the most complete review reports for PES in the Brazilian Atlantic Forest biome, in which the case of this thesis is located. They list all PES arrangements and relevant legislations that are connected to this tool. In the case of watershed PES in Brazil, along with the water legislation mentioned above, the Forest Code (Federal Law 4.771/1965 and 12.651/2012) and the Tax on the Circulation of Goods and Services (ICMS) are the most important legal instruments at the federal level that influence the arrangements governing PES (DA SILVEIRA, 2015; FARIA, 2018). The authors name eight Brazilian states with PES legislation, the one of Paraná is Law #16.436 from 2010. Furthermore, there are many municipal laws, e.g. the 2005 municipal law of Extrema (MG) or of Apucarana (PR). Among them is also a legislation

project for a national PES policy from 2007 (PL #792) which has been passing review status for more than ten years now. An initiative by several NGOs has been an attempt to lobby policy makers in Brasília for a unifying framework (FGB et al., 2017). This process has been without success so far though.

Veiga Neto (2008: p. 242) points out some experiences in which municipalities and NGOs or civil society associations, and in some cases research institutions, companies and watershed committees have cooperated to form stable arrangements to establish common goals concerning watershed protection, complying with legislation, but also to negotiate their different needs concerning the watershed. For example, Da Silveira (2015) discusses some of the difficulties of landowners in complying with National Conservation Unit System (SNUC) requirements and PES in private areas with a Legal Reserve (a kind of conservation category). In an unprecedented case study, one local NGO in the state of Paraná documented lessons from a PES case for biodiversity conservation in business practices (SPVS, 2015).

However, Jodas (2015: p. 148) points out that many PES programs in Brazil still lack "publicity" about those PES programs and cases. Fidalgo et al. (2017: p. 80) confirm the importance of making information on existing PES experiences publicly available. While there have been initiatives by private or NGO actors, these efforts will continue to be scattered and unaligned, if there is no national directive and a better communication strategy by public organs.

One important aspect to consider are the different conditions and characteristics of the urban, the rural space and their interfaces. In the case of Brazil, “ruralities” (*ruralidades*) have been discussed in the scientific literature, especially in urban and spatial planning, as Brazil has witnessed an extremely quick, extreme, but also disordered urbanization. Today South America, and ahead of all Brazil is one of the most urbanized regions of the world, reaching almost 90%, while the world average is at 55% (WORLD BANK, 2018). Chiodi, Marques and Muradian (2018) for instance, point to the heterogeneity of “ruralities,” where rural spaces are closer to certain infrastructures and actually resemble urban lifestyles and characteristics much more than typical Latin American rural space. This consideration is of great relevance to the peri-urban case study of this thesis.

2.3.2 PES applications around the world

Also in other parts of the world, PES has become a strong tool for conservation. In an analysis of 457 PES case studies from all over the world, Schomers and Matzdorf (2013: p. 18) identified an overwhelming majority of scientific publications on PES with case studies are situated in the Global South, with Latin America being a strongly studied region (see

Figure 10). Even though the study included PES schemes following certain defined criteria, the picture given by this result is seen as relatively representative.

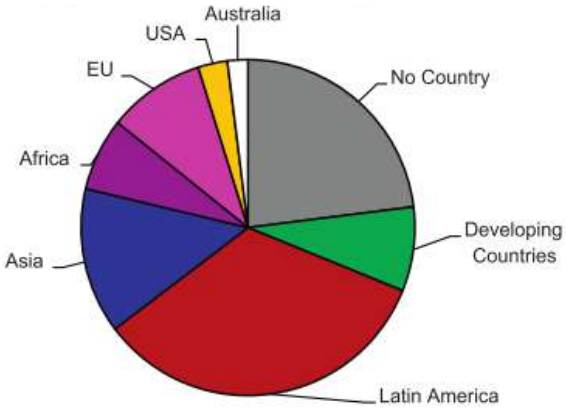


Figure 10. Geographic distribution of overall PES publications (n = 457).
Source: Schomers; Matzdorf, 2013.

As explained earlier, this thesis focuses on PES as a development policy tool in the Global South, so, prominent cases from the Global North will not be discussed here, as they differ significantly in context. Furthermore, as discussed in section 2.2.1, Brazil, as well as prominent cases from China and Mexico represent overwhelmingly Pigouvian, i.e. state-intermediated, and not free market Coasean conceptions more commonly found in the EU or the US (SCHOMERS; MATZDORF, 2013).

Costa Rica's pioneer experience of expanding conservation policies and developing them into a national framework has been "one of the conservation success stories of the last decade" (PAGIOLA, 2008: p. 722) and has inspired many others, most notably the Mexican national program (MUÑOZ et al., 2006 apud. PAGIOLA, 2008). Some of the difficulties faced in this case, have shown the importance of considering e.g. the situation of formal land titles and their effect, especially considering poverty alleviation effects (KOSOY et al., 2008: p. 2074). Other authors point to the imposed (bureaucratic) costs, as well as pressure on land, once it is valued (FRANCO; PRADO, 2014, p. 74). According to Fletcher and Breitling (2012, p. 407-8) studies have shown how PES “tends to go to wealthier landowners, in part because FONAFIFO finds it more efficient given limited staffing to work with fewer large parcels than numerous small ones” which means that revenues from PES go to “the already wealthy” which is problematic, “given the program’s intention to function as a poverty alleviation mechanism.” Similarly, experiences in Colombia and Ecuador have highlighted the importance of territorial aspects ("hydrosocial territories") and control over resources by local and indigenous communities (ALBAGLI, 2004; RODRÍGUEZ DE FRANCISCO; BOELENS, 2015/2016; VAN HECKEN et al., 2015b).

Mexico's "Pagos por Servicios Ambientales Hidrológicos" have been developed since 2003 in a national effort to combat over exploitation of water resources (CORBERA, 2015; SCHOMERS; MATZDORF, 2013). In 2006 several other PES programs (carbon sequestration, biodiversity conservation and agroforestry) were merged into the "Pro-Árbol" framework to facilitate the management of additionality. However, Alix-Garcia et al. (2009) criticize that the programs lack sufficient targeting, and Saenz et al. (2016) point to the importance of the inclusion of existing social organizations in order to include societal views on conservation that will impact the programs' success.

The Chinese approach to PES is a strongly nationalized and integrated approach, referred to by the government as Eco-Compensations. Xiong and Wang (2010: p. 380) describe these as a "fiscal transfer compensation mechanism," which would enter into the definition of Muradian et al. (2010). However, Eco-Compensation might be seen as contradictory to the PES logic, as payments are for legal land-use restrictions and not economic incentives to foster land use changes (MULLAN et al., 2011; SCHOMERS; MATZDORF, 2013). Chen et al. (2015) provide an institutional analysis of the challenges of the principal programs, the Natural Forest Conservation Program and the Sloping Land Conversion Program. The disproportionately high investments by the Chinese government are shown in Figure 3 (chapter 2.2.1).

South Africa's Working for Water Program dates back to 1995, when a quite different approach to PES practices was proposed: unemployed individuals are contracted to work in watershed restoring work, which is then funded not only through water tariffs, but also through social policies, thus representing a fiscal transfer (SWALLOW et al., 2010; SCHOMERS; MATZDORF, 2013).

Apart from those country-specific discussions, on a more general note, Gutman's (2007) noteworthy thesis is that PES could provide the "foundations for a new rural-urban compact." This theme in the context of human-nature and especially city-nature relations is of great relevance to the case study of this thesis, as the resources consumed within the city are in most cases produced outside of its political boundaries and, with the historical development of the economic understanding of nature discussed above, have become less visible at the place of consumption. As the trend towards urbanization in the Global South continues, PES could be an interesting solution to solving and changing this dichotomous or even invisible relations towards more sustainable ones, integrating urban lifestyles with connectedness and responsibility for the rural space (GÓMEZ-BAGGETHUN; PASCUAL; MARCOTULLIO, 2013). Gutman holds that the role of governments, development agencies and international negotiations might actually be strengthened and not weakened, as more negotiation will be needed in this process.

2.4 THE IMPORTANCE OF PARTICIPATION IN PES

Participation in public policies in democratic systems is an elemental part of the legitimacy of many environmental policy initiatives (PASCUAL et al., 2010) and it contributes significantly to the consolidation of democratic process in young democracies, as is the case of Brazil. PES is no exception to this case. This issue becomes of particular importance when considering the effects of global climate change on man and the environment (FERREIRA, 2000). Based on an ongoing literature review on commons in the three spheres urban, peri-urban and rural, a significant lack of conceptual research in the extremely diverse peri-urban space of developing countries was found (WEINS et al., 2018).

2.4.1 Policy Effectiveness Motivations

In the case of conservation on private land and the change of human attitudes, which PES often tackles, participation has proven to be of even greater importance. This is not only to justify the chosen institutional arrangement and the responsibilities of the political forces involved, but greatly due to the ecological effectiveness that will be influenced by the degree of inclusion of local populations. For this reason, this chapter of the thesis is built on a literature review of the PES literature concerning participation.

When looking at the role of participation in environmental policies, it is important to understand underlying behavioral models. In classical economics, a rational benefit-maximizing individual is assumed, and markets are understood as the most cost-effective way of allocating resources in a pareto optimal way. Since there are no perfect and completely unregulated markets in the real world, state intervention is needed in order to balance out socially undesirable (unfair) resource distribution. North (1990) has pointed out that there are usually steep transaction costs and learning costs involved in major institutional change in those institutions. Actors may be very reluctant to abandon investments in and adaptations to existing institutions, providing positive feedback that helps to perpetuate status quo institutions. The longer an institution exists, the greater are the investments and adaptations in the institution, and the more difficult it is to undertake major institutional change (PIERSON, 2004: p. 22–23).

Gemmill and Bamidele-Izu (2002) discuss the role of NGOs and general civil society involvement in achieving international agreements and environmental policy goals. The authors point out the increasing role those organizations have played, especially since the 1992 Earth Summit and how they have managed to secure a more and more formalized representation in international decision-making, as well as the execution and monitoring of environmental goals (among others).

Other authors also highlight the benefits of participation in the policy process, as policies end up being more cost efficient in the long run, when participation is managed correctly. This can be shown, e.g. through the application of a Cost Benefit Analysis (CBA). This methodology "consists of a restrictive set of rules concerning what counts as data, i.e. prices" and the exact role of participants, as they are often considered as consumers rather than as citizens (SAGOFF, 1988; NIEMAYER; SPASH, 2006; ADAMS; ZULU, 2015). Furthermore, it is important to assess how data is produced, and if it is compiled by merely aggregating information on individual preferences indiscriminately (VATN, 2005). For instance, stakeholders who define environmental problems differently, e.g. as citizens and through collective deliberation, or are unfamiliar with market institutions, may therefore be left out of the decision process. In this sense, CBA in environmental decision making can lead to politics of exclusion" (MARTÍNEZ-ALIER, 2002; GARMENDIA; PASCUAL, 2013). Andrade and Simões (2013) document some cases in which insufficient participation has lead to reduced achievements in environmental programs and policies in Brazil.

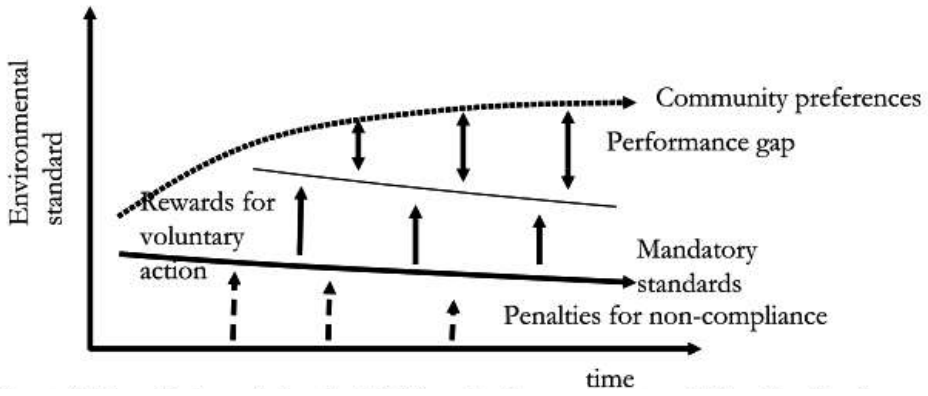


Figure 11. The widening window for CRES mechanisms and the possibility of a widening performance gap. Source: Swallow et al., 2007.

Horning, Bauer and Cohen (2016) point out that most water governance experts agree that the failure of water governance is one of implementation and that there is an "acute knowledge gap associated with the network of relationships underpinning water decision making." Furthermore, continued and centralized structures as well as the isolation of peripheral actors, demand bridging actors. Similarly, Green et al. (2015) in their case study of water governance in Canada, find that the "nested nature of social-ecological systems across scales requires a multi-scale approach for monitoring and response," in which NGOs or intermunicipal forums play a crucial role for disseminating information and enabling civil society engagement. Even so, Horning, Bauer and Cohen (2016) argue that, in order to solve those challenges, senior government levels have to take a decisive role in

sustainable watershed planning and address the continuing disconnectivity of water-resource-related issues. Swallow et al. (2007) in their performance analysis point out that Compensation and Rewards for Environmental Services (CRES) mechanisms (see figure 11 above) are likely to be most effective where governments allow space for voluntary mechanisms. But they do also show that those compensations will be less effective where governments expect CRES mechanisms to replace regulations. This, for the case of PES, which is often communicated as a voluntary "successor" or command and control policies, shows a risk, if policy makers do not understand the policy as a complementary vehicle to achieve environmental policy goals.

2.4.2 Social Justice and Sustainability Motivations

Contesting the pure market logic and the resulting dilemma for the exploration of natural resources, Ostrom (1990:185) relies on a model of society that consists of "fallible, norm-adopting individuals who pursue contingent strategies in complex and uncertain environments." The institutional design principles that Ostrom constructs, follow North's (1990) conception of institutions as mechanisms for reducing uncertainty in complex, uncertain environments. By reducing uncertainty, trust and norms of reciprocity may be built and sustained, and collective action may become possible. In this context, the primary role of the design principles is to explain under what conditions trust and reciprocity can be built and maintained to sustain collective action in the face of social dilemmas posed by Common Property Rights (CPR). This collective action, in turn, helps prevent the deterioration of a managed CPR (COX; ARNOLD; VILLAMAYOR, 2010).

In the context of policy innovations that involve capital, Johnson & Lundvall (2000) point out that social natural capital are territorially bound, while economic capital is infinitely reproduced and mobile. This influences the discussion around the purely economic nature of PES, as ignoring social and natural capital factors will significantly alter the dynamics of the policy outcomes. This becomes especially relevant when discussing power and inequality issues concerning participation. It should be mentioned here, that power imbalances and assumptions about socioeconomic characteristics should always be understood in their broader context. Considering critiques like that of French economist Thomas Piketty, inequality is a base issue that needs to be considered, and this has to be taken to discussions like the ones concerning socio ecological arrangements like PES. If else, social inequalities threaten to hinder these development issues at their base (HASE UETA et al. 2018).

For this reason, the deeply political nature of water management and conservation policies has to be recognized. Pascual et al. (2010: 1238) point out:

> "water-related PES programs might contribute to changing historical inequities between the upper and lower areas of a catchment increasing the bargaining power and status of poor providers of environmental services in the upland areas. On the other hand, it may also legitimise large-scale water consumption downstream through a payment scheme."

Ferraro (2008) highlights the importance of information asymmetries, especially in PES contract choices, are an important challenge in which policy makers have to balance the complexities of institutional, informational and technical matters. Communication with participants in this case is of great importance, while posing additional costs.

Krott et al. (2014), Schusser et al. (2015), Maryudi (2011) and Bach (2016) in a complex research project on community forest management, have shown the importance of powerful local and regional stakeholders in several case studies around the world. The interactions between organizations and networks in common-pool resource governance are another aspect to be considered and gives a fertile base for discussing finding of the CPR discussion with the tools of SNA (AGRAWAL, 2013).

Bruns (2001: p. 3) suggests that anthropological concepts of *legal pluralism* offer a rich source of ideas that can help build better intellectual foundations for analysing complexity of water rights and their negotiation and holds that existing users and potential new users need to negotiate before water resources are developed (BRUNS, 2001). For this reason, Clement, Suhardiman and Bharati (2017) propose to use discourse analysis as it can help to scientifically point out that institutional panaceas “operate a discursive closure in a way that supports apolitical visions of water management, *excludes certain actors and views*, and supports existing power distribution” (CLEMENT; SUHARDIMAN; BHARATI, 2017, highlighted by the author).

The policy-making process and the involvement in it becomes" a site of cultural politics, leading people to reflect on who they are and what they want" and for that a “greater diversity of views, values and meanings can support institutional bricolage that is perceived to be fair, socially embedded and culturally acceptable” (HAJER; VERSTEEG, 2005 apud. CLEMENT; SUHARDIMAN; BHARATI, 2017; HE; SIKOR, 2015). For instance, Nordén (2014) in a choice experiment analysis of different PES schemes in Kenya, Costa Rica and Bolivia finds that in-kind incentives are often perceived as a more permanent benefit in many communities and that cash payments are often not the best solution for those rural communities, and actually motivate landowners to participate in PES. Their findings have only been possible through the incorporation of questionnaires and close assessment of the local conditions and with participation of the communities. One author holds that benefits from proposed infrastructure development do not only "need to be shared more equitably;

their costs also need to be weighed in relation to the livelihood strategies and options of local communities" (SUHARDIMAN et al., 2015 apud. CLEMENT).

Similar to the the findings of Berbés-Blázquez, González and Pascual (2016) mentioned in chapter 2.2.4, Ernstson (2013) concludes that in the end, because ecosystem services are socially produced, the social values and practices involved in their production and usages need to be understood as a “nested set of political socio-cultural processes expressed as actor-networks in which certain actors are more influential than others” and “local changes can have effects elsewhere” (ERNSTSON, 2013: 13). Figure 12 shows the framework Ernstson proposes to understand the impacts of ES production, that illustrates the social and ecological network connections indicated above and discussed in the following.

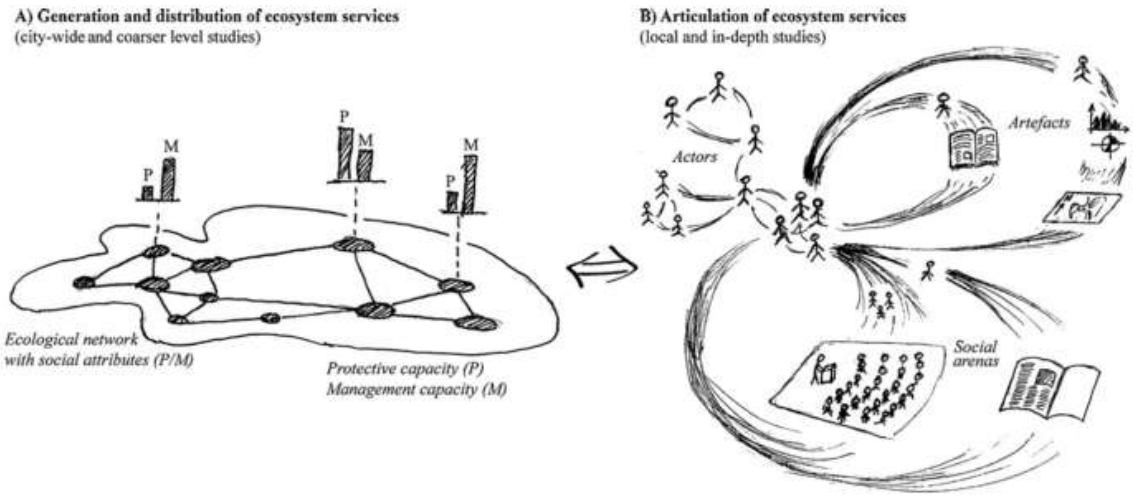


Figure 12. Framework for studying the social production of ecosystem services, showing A) the generation and distribution of ES, and B) the articulation of ES. Source: ERNSTSON, 2013: 11.

Such a framework in combination with a SNA could help illustrate the varying degree of importance of certain stakeholders and help to visually perceive the role not only formal and public institutions play in the production of ES, but also how the actual producers of ecosystem benefits play a crucial role in the process that is often not considered due to less formal inclusion and due to their greatly differing logic.

2.5 SOCIAL NETWORK ANALYSIS

For the study of socio-ecological systems, Social Network Analysis (SNA) has been used by both natural and social scientists to analyze patterns of interactions and has helped to understand complex lasting social arrangements (CARLSSON; SANDSTRÖM, 2008; BORGATTI et al. 2009; RATHWELL; PETERSON, 2012). Here, the varying degrees of connections between different nodes that are involved in the system provides a view on social organization that revolutionized the social sciences (FREEMAN, 2012; DE PUPPI, 2015).

Scott (2017) as well as Freeman (2004) describe the history of social network analysis and classify the research into three main areas. The earliest research was founded in and motivated by quantifying human relations through sociometric analysis, focussing on the formation of small groups; secondly, interpersonal relations and cliques were at the heart of research in the 1930s; third, social anthropologists built on both of these in their research on tribal and village societies. Jacob Moreno together with Helen Jennings are considered to have done the first important contributions to the sociometric strand of social network theory. In Moreno's 1941 article "Foundations of sociometry," he proposes that human interrelations have an underlying central structure and that "one day [this would] be considered as the cornerstone of all social science" (p. 15). In his classic work *Le Suicide*, Émile Durkheim argues that the likeliness of suicide is dependent on social structure and with this points to the importance of social networks (DE PUPPI, 2015). Freeman (2004) claims that the "small world" phenomenon discussed by Watts and Strogatz (1998) was a decisive point in modern (digital) SNA. This discussion had its roots in the first article on "Contacts and influence" by Pool and Kochen (1978) that was published as the lead article in the first edition of the *Social Networks* journal. Watts and Strogatz's starting point here is the clustering of social relations, i.e. "the universal tendency of friends of friends to be friends."

It is important to understand the phenomena mentioned above in order to undertake the endeavour of a SNA. Freeman (2004) provides a description of the four defining properties of a social network analysis as:

1. involving intuition that links among social actors are important.
2. being based on collection and analysis of data recording social relations.
3. drawing on graphic imagery to reveal and display the patterning of those links.
4. developing computational models to describe and explain those patterns.

Recuero (2017) provides an overview of the applications of SNA, which can reach from the analysis of the elements of a given phenomenon's structure, the structural mapping of a research object, or studies in which SNA helps to focus on a central set of data that is

more viable and promising to analyze. Figure 13 by Recuero (2017) shows a connection between two actors representing their interaction, which serves three or four other nodes in the system. Recuero points out (in red) that there is a structural gap, in which two nodes could benefit from a direct link. Such visualization can help to identify important missing links. The classification of nodes and connections used in this thesis is based on the models and classification of this author.

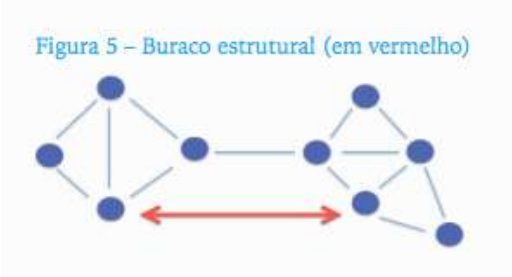


Figure 13 - Structural gap in a social network (in red). Source: Recuero (2017: p. 45).

According to Marin and Wellman (2010) a network approach involves formally viewing social networks as sets of individual or collective actors that are linked through one or more relationships. De Puppi (2015: p. 98) describes SNA as “analyzes of social relations because they observe the behavior of the of the human collectivity.”

This individual human behavior within societal context is a key topic in the study of the commons. When applied to the context of socio-ecological systems, social network analysis can help to make central actors more visible. In a case study from Tanzania, Stein et al. (2010: p. 1086) analyze “formal and informal interactions between the various actors influencing water resources management and governance (e.g. state agencies, community based organizations, NGOs, and private companies)” in which a “set of actors (individuals or collectives) [are] linked through one or more relationships” (MARIN; WELLMAN, 2010). The analyzed network presents 70 different actors with more than 500 ties that are involved in the multilevel governance network that manages and acts in the studied watershed. Their findings point to the great number of diverse informal members involved in the arrangement and that make it much more complex than policy suggests. This, combined with Astrild Vatn’s (2010) classification of three ideal types of governance structures in ES governance, shows that a PES arrangement for watershed services would not only need to incorporate voluntary exchange dimensions, but (pre-existing) community systems of cooperation (or “co-management”) that often do not find a place in formal policy. For this thesis Horning, Bauer and Cohen (2016) and Agrawal et al. (2013) with their work on organizations in governance networks, as well as the theoretical insights of Gomide and Schütz (2015) on the different types possible networks are important references to be included.

3. METHODOLOGY

The methodology adopted in this thesis (see figure 14) is based first and foremost in the greater area of STS studies, then builds on the theories of institutional economics (as explained in chapter 2.1), making use of assumptions of NIE (NORTH, 1992; WILLIAMSON, 1985), social network analysis (MORENO, 1941) as well as tools based on the Collective Action Theory in commons dilemmas for sustainable management of natural resource systems (OSTROM, 1990). The objectives are explorative, making use of mixed methods (quantitative and qualitative) to characterize the institutional arrangement, and define (GIL, 2008) the conditions of the stakeholders in order to evaluate the specificities of the application of a PES scheme in the peri-urban sphere of a Brazilian metropolitan region.

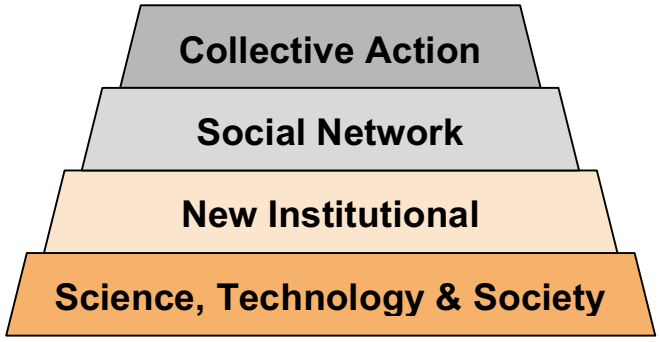


Figure 14 - Theoretical foundations of the theoretical approach in this thesis. Illustration by the author.

The initial idea of replicating the landowner questionnaires used by Zanella et al. (2014) was modified along the way, due to practical challenges. The local population had participated in several technical surveys already, which had not resulted in any concrete political projects yet. In the view of several involved stakeholders, it was impracticable to apply such a large-scale study without additional funding. Due to this situation, the State Environmental Secretariat opened access to a database of one of the surveys to be used for this research. Thus, the methodology henceforth adopted is a more theory-guided but also sample-biased one that focuses on the views of an intentional sample of stakeholders involved in the institutional arrangement (SCHAEFFER; PRESSER, 2003; MACNAGHTEN, 2017).

We thus opted for applying an approach, using quantitative data from a (pre-release of a) database on socioeconomic characteristics of the Miringuava watershed, that was made available by the Environmental Secretariat. This data is complemented with qualitative data from interviews with key stakeholders of the PES process in the basin and the agents

involved in the administration of the Metropolitan Region of Curitiba. While the limitation of the application of such an approach have to be recognized, the one chosen here was deemed most appropriate for an essentially unfunded research.

To complement this more objective data, we opted for applying a specifically designed questionnaire with qualified stakeholders, to obtain data and contextual factors for the case study. According to Souza (2016, p. 126) the minimum number of qualified stakeholders that must be interviewed in order to obtain reliable results range from 1-35. She cites authors like Malla and Zabala (1978) who set between 15-20 experts, León and Montero (2004) between 10-30, Gordon (1994) 15-35, Landeta (2002) 7-30 and Skulmoski, Hartmann and Krahn (2007) who define a reliable set of interviews at between 1-10. Here, we opted for an option of almost 40, of whom responses from 15 were obtained.

Adding to this, the questionnaire helped to gather data for both the Social Network Analysis (SNA) and the analysis of institutional robustness. The data was then used to reach the objectives of this research. Figure 15 illustrates how the chosen inputs (right) helps to reach the objectives defined for this research (left).

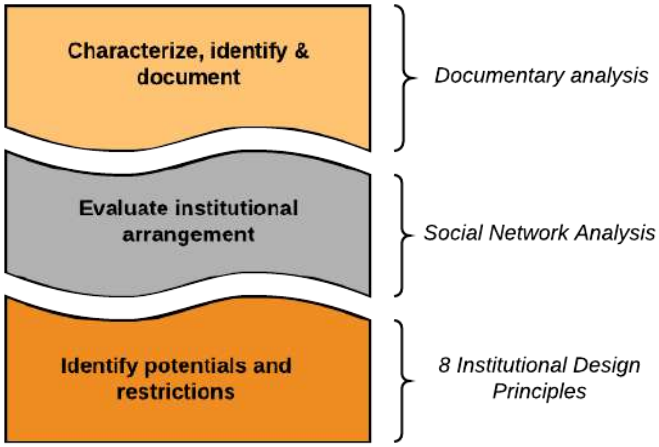


Figure 15 - Objectives in different steps of this research and their contributions to its methodology. Illustration by the author using Lucidchart.

3.1 INSTITUTIONAL ANALYSIS OF PES

To understand the governance of socio-ecological systems like the one present in this case study, it is important to assess the ecological conditions as well as its social peculiarities. There is a wide array of factors to be considered. In a review on PES in Latin America, Martin-Ortega et al. (2013) identified that a great majority (88% of the cases studied) of PES programs in the region has landowners as sellers of ecosystem services, of which a big part (73%) is bundled, meaning several ecosystem services are added up, e.g. watershed protection, carbon storage and biodiversity conservation are valued additionally rather than individually.

The consideration of institutional factors, such as transactions, and governance structures, are a focus of this research, that has been pointed out by several authors as a current lack in research. Here, Berbés-Blázquez, González and Pascual's (2016) contributions and a literature review based on their criteria are taken as a starting point. One motivation of using this approach was the different characterization of the case study in the identified literature. Corbera, Kosoy, and Martínez Tuna (2007) e.g. point out that different power concentrations and involvement or participation occur in rural areas that are situated in already protected areas. This aspect is verified here through SNA and Ostrom's eight design principles. Furthermore, according to those authors, when ecosystem services are commercialised by rural farmers, the payments do not cover opportunity costs, but do act as a significant incentive for participation in most cases. This aspect is going to be covered by the questionnaire.

Bridging organizations have been shown to play a decisive role in enabling cooperation between local governments, but also between government agencies and civil society (CRONA; BODIN, 2006; STEIN; ERNSTSON; BARRON, 2011; GREEN et al., 2015). In a study on water governance in an urbanizing watershed in Canada, Green et al. (2015) point to this important function and cross-scale communication. CPR scholars like Crona and Bodin (2006/2009) and Ferraro (2008) have also pointed to the importance of understanding information flow and involved social networks in this debate.

3.2 SEMI-STRUCTURED QUESTIONNAIRE

The questionnaire (see Annex B) was specifically developed for this case study and is based on the literature used in the literature review for this thesis on participation (e.g. SOMMERVILLE et al., 2010; KOSOY; CORBERA, 2010; McAFEE, 2012), literature on institutional economics and actors literature (NORTH, 1990/92; SCHARPF, 2000; KROTT et al., 2014), and literature on the commons for normative questions of natural resource management (OSTROM, 1990; 2007). The questionnaire was developed on a theoretical basis, but practical challenges and discussions of the groups involved were taken up in its development to better reflect the case study's reality. Preliminary versions of this questionnaire were tested with a small amount of stakeholders in order to adequate topics and questionnaire techniques.

Figure 16 below shows the four parts of the questionnaire that inquire about 1) the actor's general knowledge of PES, 2) their knowledge about the Miringuava PES case, 3) the role of the actor in this process, and 4) the institutional robustness of the arrangement, using Ostrom's 8 Design Principles as a guideline.

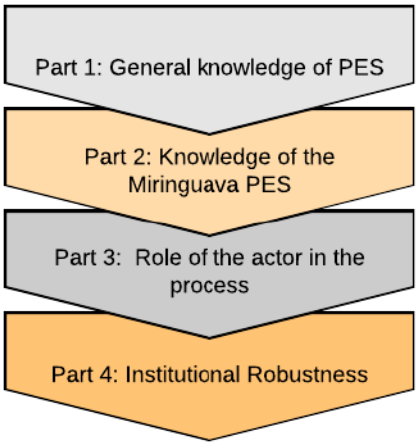


Figure 16 - Partes do questionário de pesquisa. Illustration by the author, using Lucidchart.

The guiding question of landowner participation in PES and the questionnaire methodology were adopted from the study of Zanella et al. (2014). Based on the basic structure of their material, the first section inquires openly about general knowledge and understanding of the tool, related policies and reference projects, as well as pro and contra arguments of PES. The second part inquires about the specificities of the arrangement and its main actors. Through the consultation of political science and NIE literature the focus was shifted on the characterization of the institutional arrangement, for which reason the third

part inquires about the role of interviewed actor/institution and the relation of the actors with each other (CECCON, 2009; IEIS, 2013).

A personal conversation with Coelho (2014, p. 95) about a PES case in Brasília (Pipiripau) and the necessity for more integrated approaches to public policy and decision-making, contributed to defining the understanding of PES by each actor as a variable that will influence their relation with the territoriality (*territorialidade*) and subsequently the people in their sphere of power. This is of particular interest in combination with the object of this thesis, which intents to combine an approach to the Tragedy of the Commons in the case of watershed conservation with power relations and opportunities for participation (see also COELHO; LUDEWIGS, 2017).

The methodology of Ostrom's eight design principles for institutional robustness have been tested rigorously in a wide array of issues in socio-ecological systems worldwide (AGRAWAL, 2002; COX; ARNOLD; VILLAMAYOR, 2010). The choice for applying a tool of Collective Action Theory is justified in a somewhat indirect way, as the PES arrangement is not an existing institution yet. The common pool resource (CPR) system is thought of in its institutional arrangements still in the making. The analysis contributes to assessing potential risks early on in the process.

Figure 17 shows a graph by Ostrom et al. (2002: p. 116) that helps situating some of the main factors identified as critical in this research. Ostrom highlights the importance of those factor when discussing cooperation in commons dilemmas. They include perceptual factors of the interviewed actors, their task structure as well as higher level (more general) factors like decision and social structure that include the before discussed payoff structure, uncertainty in decisions relevant to conservation, power and status, communication and the group size which are discussed in the following.

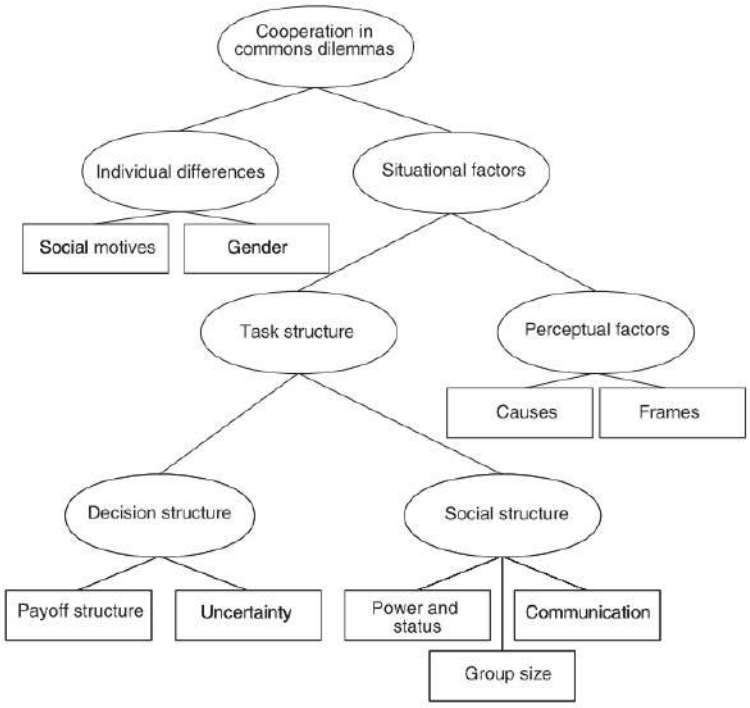


Figure 17 . Elements influencing cooperation in commons dilemmas.
Source: OSTROM et al. (2002: p. 116).

The application of the questionnaire was pre-arranged with some of the main stakeholders in the PES process in São José dos Pinhais that the researcher already had been in regular contact with. For the number of further involved stakeholders to get to the expected number of between 10 to 15, the interviewees are asked to indicate other relevant stakeholders to be contacted, following *snowball* method (KROTT et al., 2015; MACNAGHTEN, 2017), and, in case they have not been mapped in the fieldwork up to the point of the application, were included. The fieldwork period went from August to November 2018 in which the interviews were scheduled and undertaken (see ANNEX A). The analysis of the data through SNA was done in November and December. Table 2 shows the part of the questionnaire that tests the eight design principles and the possible answers or expected issues to be raised by the interviewees.

Table 2. Questionnaire part based on Ostrom's (2007) design principles.

Question	Possible answers
Are the boundaries / boundaries of properties and protected areas to be clear?	Rural property register CAR, fences
How do you see the cost-effectiveness ratio of PES?	Bureaucracy, necessary registries
Was the arrangement a collective choice?	All different interests represented?

How will monitoring be done? Who will be responsible for accountability?	Responsible local stakeholders?
If they have to apply sanctions, will they be gradual, that is, according to the seriousness of the infringement of the rules?	Municipality, NGOs?
Do you think there is a mechanism for resolving potential conflicts ("low cost arenas")? What would they be?	Watershed committee, Grupo Gestor?
In your opinion, is there (minimum) recognition of the right of participants to organize, without pressure from those involved?	Political freedom, economic pressures, ideas of liberty?
Do you see the PES supported in other institutions of another level (municipal / state / fed.) And is it possible to interact with them (is the arrangement "nested")?	Metropolitan level, state policies?

3.3 SOCIAL NETWORK ANALYSIS

The three main approaches to SNA had their first research in the 1930 and 1940s. They were led by Moreno and Jennings, characterized by a sociometry approach; an anthropology-oriented analysis by led Warner Lloyd; and a psychology-led one by Lewin. The approach adopted here follows a strand of sociological focus. The work of Ceccon (2009) on an institutional arrangement in the Metropolitan Region of Curitiba (MRC) and the work of Ieis (2013) on actor perceptions are used as a theoretical orientation that brings in factors of SNA application in the local reality of Paraná. Furthermore, the PhD thesis of Medeiros (2011) offered important insights for the communication between local actors in the Upper Iguaçu watershed that help to understand certain groupings in water governance in the region, even if his research is focussed on the more general watershed committee.

For a visual result of this research like in the example of the authors of the software in figure 18, the software Gephi, in its version 0.9.2 is used (BASTIAN et al., 2009). The network analysis shows connections and interactions between stakeholders in the PES process. It also points out certain outliers in the process, that should be more centered. For this research e.g. Águas Paraná, the local water regulatory body is expected to be one of those nodes.

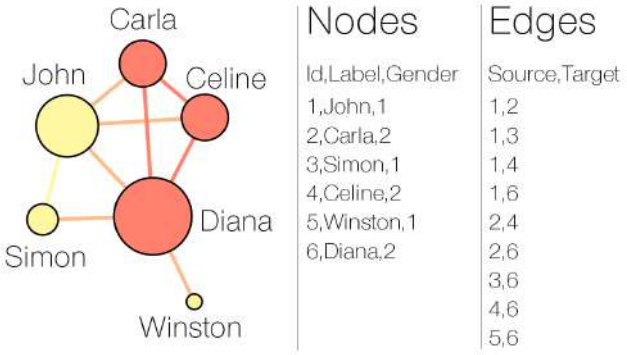


Figure 18 - Example of SNA application. Source: BASTIAN et al., 2009.

One way of contextualizing and analyzing the SNA data is by classifying the network in the typologies developed by Carlsson and Sandström (2008). Table 3 shows those authors' classification in centralization and heterogeneity of a network. The (high or low) degree of those two dimensions leads them to predict the outcomes of the resource management. When there is a heterogeneous network that is not centralized (a), the exchange of resources is improved, but the transaction costs tend to be quite high, posing a risk to the management of priorities and conflicts in the system. In a heterogeneous, but highly centralized network (b), the access and exchange of resources is facilitated, with relatively low transaction costs and easy conflict resolution and decision making. In the case of a less heterogeneous and less centralized network (c), the resources will be scarce with difficulties of establishing collective action for their management. In a homogeneous but centralized network (d), even though there will be low transaction costs, resource mobilization will be difficult, affecting the ability to find innovative solutions to arising problems.

Table 3. The relation between network structure and qualities of co-management systems. Source: adapted from Carlsson and Sandström, 2008.

		Network Density and Centralization	
		Low	**High**
Net-work Hetero-geneity	**High**	(a) In these kinds of networks, access to, and exchange of, resources are improved. However, high transaction costs and difficulties in making priorities and managing conflicts between different interests hamper the policy process.	(b) High levels of heterogeneity promote the access and exchange of resources. At the same time, high levels of density and centralization improves the internal decision making process by lowering transaction costs and fostering good conflict resolution mechanisms.
	Low	(c) This kind of network suffers from scarce resources and has obvious difficulties in establishing collective action.	(d) The ability to make decisions and solve conflicts at low transaction costs is possible within this network. However, the process of resource mobilization is insufficient, which affects the ability to find innovative solutions.

4. PES IN THE MIRINGUAVA WATERSHED

Situated in the South region of Brazil, the state of Paraná is one of the country's most important agricultural poles and a significant global supplier to global markets. Many of Paraná's current characteristics originate from the colonial period in which this state was influenced heavily by the coffee economy of the state of São Paulo. However, different from the low internal integration and the predominance of the small properties and family farming dominant in Santa Catarina, Paraná's agricultural and consequently its environmental structure are peculiar of an agricultural productive state (PARRÉ; GUILHOTO, 2001). The process of capitalization of southern Brazil's agriculture, based on wheat, soybean and rice production as well as extensive livestock farming in recent years, has led to a concentration of agricultural land (*concentração fundiária*) in the region. According to Parré and Guilhoto (2001) two elements were important in this process: the expansion of soy-related agroindustries (oil, bran, rations, etc.) and, the reorientation of the political-institutional apparatus in order to give support to this new style of agricultural development.

The economic panorama with a focus on agriculture provides an important first introduction to this and other case studies of PES around the world. As discussions and disputes surrounding PES take place mainly in rural areas or at the frontiers of intact natural areas, where they are applied to help mitigate drastic land use change and (re)establish healthy and biodiverse forests, taking the greater agricultural picture into consideration for this local case study can help to situate the strategies adopted in this case, in which several global tendencies can be observed and confirmed.

The global tendency of PES can be observed in three pilot PES projects in the Brazilian state of Paraná that are administered by the State Secretariat on the Environment and Water Resources (SEMA). They are situated in the municipalities of Castro, Piraquara and São José dos Pinhais. The last two are situated in the MRC and due to its characteristics in terms of provision for the central city of Curitiba, as well as its the progress in recent months in São José dos Pinhais, this case study was chosen for the elaboration of this thesis (see map in figure 19). Another central aspect is the pressure of urbanization drivers on the ecological systems of that municipality, that make it an excellent example of a global trend of institutional arrangements in peri-urban areas of big and mid-sized cities (CABRAL BOSSLE, 2010; GÓMEZ-BAGGETHUN; PASCUAL; MARCOTULLIO, 2013).

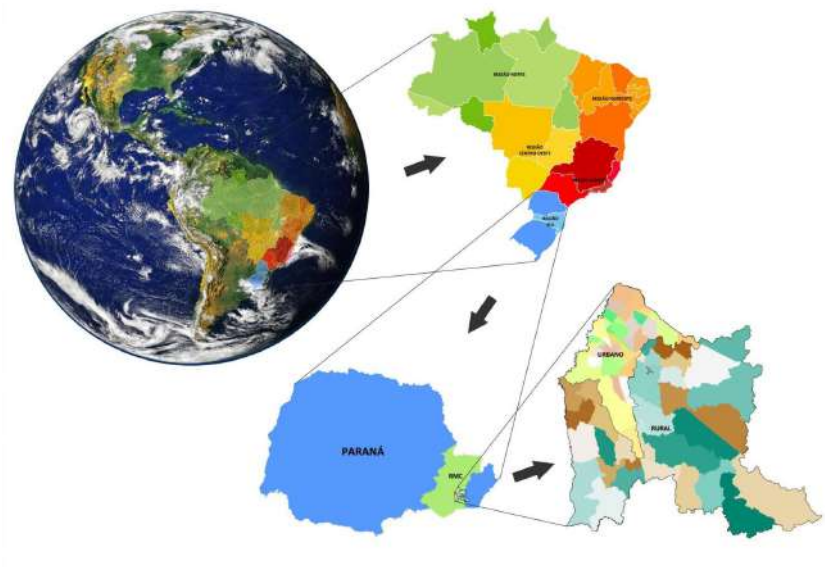


Figure 19 - Position of São José dos Pinhais. Source: SÃO JOSÉ DOS PINHAIS, 2018c.

This chapter gives an overview and analyzes the involvement of the actors that participate in the institutional PES arrangement under development in the Miringuava basin. For this purpose, the case study is characterized in a broad spectrum of environmental, economic, political, legislative, urban planning, and demographic factors (chapter 4.1). In the following chapter 4.2, the actors involved in the process are described and analyzed in the three broader categories of public, civil society and private sphere, before discussing the results of the interviews, Ostrom's eight design principles and the SNA in chapter 5.

4.1 CHARACTERIZATION OF THE CASE STUDY

The characterization of the case study, including relevant legislation on the metropolitan level, is presented in this chapter. It consists of a documentary part that compiles data from public documents, scientific sources and some data that was made available to the researcher during the research process. This includes, among others, memos of meetings, project reports and a database of a recent socioeconomic diagnostic of the area in which the PES is being implemented.

In the context of the predominantly agriculturally-oriented context in the state of Paraná, the case study is situated in one of the two main urban areas of the state. The state capital of Curitiba, Brazil’s 8th largest city by population, constitutes a metropolitan region of 3.2 million inhabitants (COMEC, 2018a). Figure 19 from the Municipal Atlas of São José shows (in green) the Metropolitan Region of Curitiba, which is the second largest of the country by area, but at the same time shows quite low density. As figure 20 from the Paraná Institute for Economic and Social Development (IPARDES, 2011) shows, the municipalities

in the greater Curitiba area, including São José dos Pinhais, are the only ones in the state considered “metropole” level, pointing to their overall importance, not only for Paraná, but also the neighboring states of São Paulo and Santa Catarina, to which it provides services.

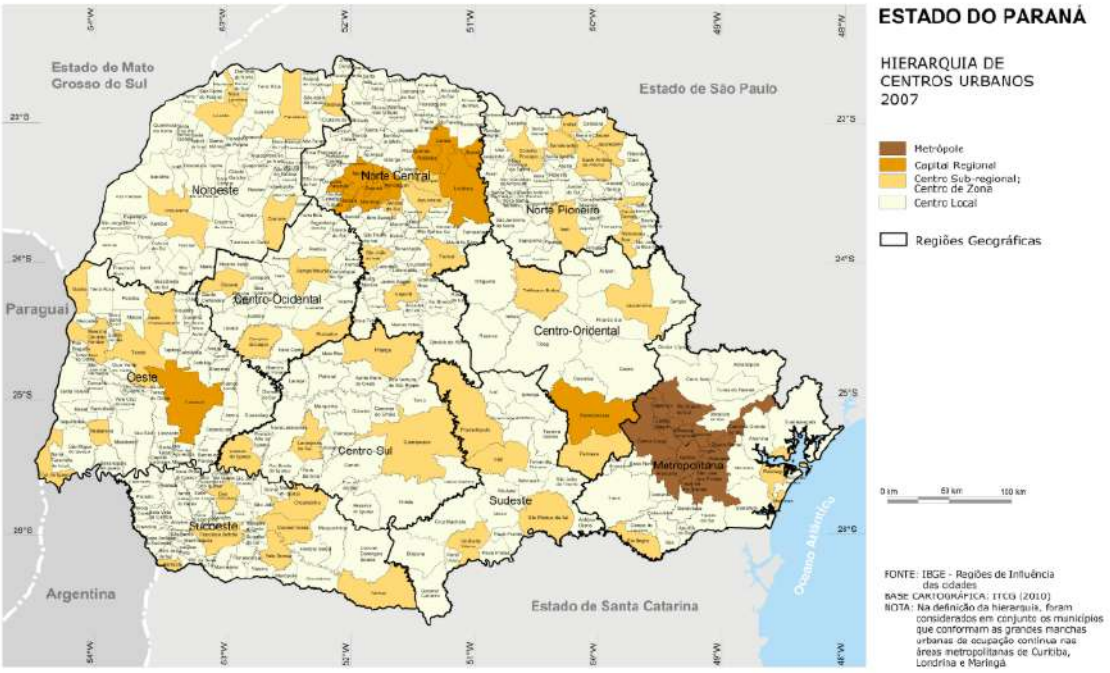


Figure 20 - Hierarchies of urban centers 2007. Source: IPARDES, 2011.

The case study of the PES watershed conservation policy is best understood when looking at a relief map of the area (figure 21, below) and a map of the watershed (figure 22, below). The relief of the municipality of São José is shown in figure 21 with the first high plateau (orange) of Paraná, which holds the Miringuava basin and the Serra do Mar mountain range (red). The Miringuava river is an important tributary to the Upper Iguaçu Basin, which also received waters from the (strongly polluted) urban rivers of Curitiba, the neighboring rivers Rio Pequeno and Piraquara from the city of Piraquara.

The rivers from the Serra do Mar mountain range to the East of Curitiba (see figure 21) are of great importance to the water supply of the central city of Curitiba and its metropolitan region, as its population steadily grows and the per capita water consumption patterns rise (ANDREOLI et al., 1999). As the map below shows, Curitiba is situated in the First Plateau (*Primeiro Planalto*) of Paraná. In order to regulate the conflicting demands, the Coordination of the Metropolitan Region of Curitiba (COMEC) developed the necessary legislation in coordination with the state sanitation and water supply company SANEPAR, the state environmental institute (IAP) and the basin committee SUDERHSA (Superintendence of Water Resources Development and Environmental Sanitation.

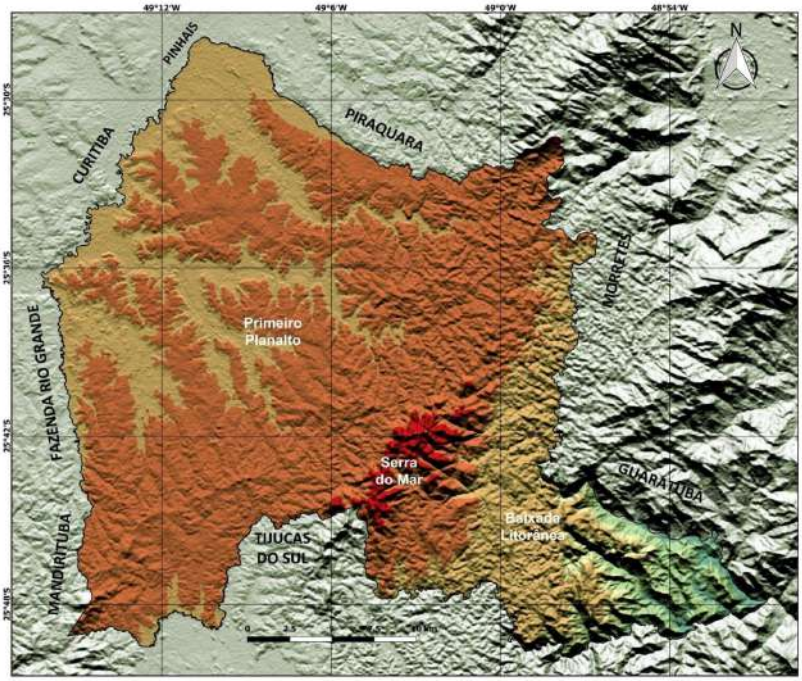


Figure 21 - Relief of São José with the first high plateau (orange), the Miringuava basin (left/yellow) and the Serra do Mar mountain range (red). Source: São José dos Pinhais, 2018c.

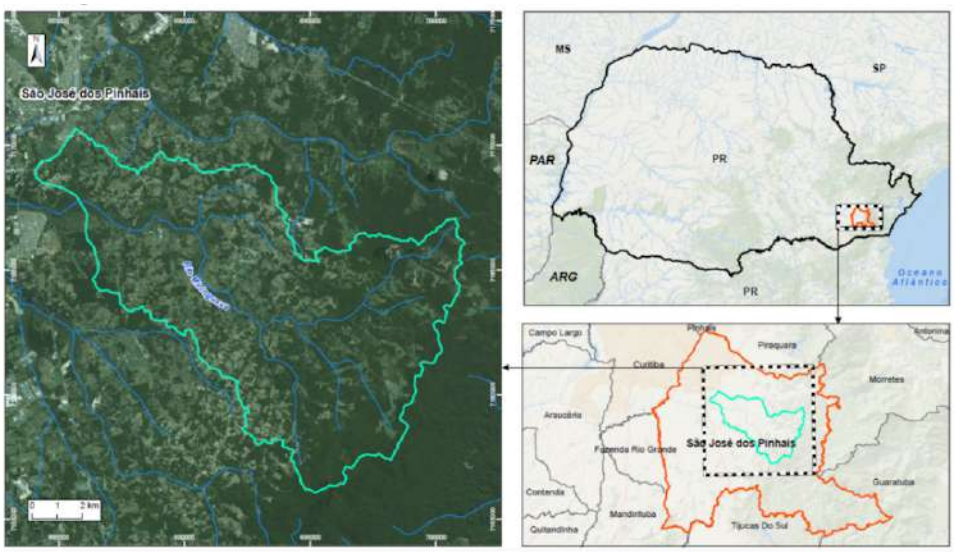


Figure 22 - Map of Miringuava watershed in São José dos Pinhais, PR, Brazil. Source: PROFILL, 2017.

The resulting state law (n° 12.248) from 1998, with the nickname “Headwaters Law” (*Lei dos Mananciais*) created an Integrated management and protection system for the metropolitan region (SIGPROM) that is in place until today (COMEC, 2018b). Some of the tools defined in this law go hand in hand with other important pieces of Brazilian urban legislation, like e.g. the City Statute (federal law nº 10.257), that help to solidify democratic and participative governance of urban planning processes.

In terms of urban planning, the Water Supply Law established, among others, new territorial planning units as well as a metropolitan water management council, facilitates the creation of Areas of Social Interest of Occupation (*Áreas de Interesse Social de Ocupação*) and defines "river basins of interest to the MRC." These provisions give rise to the studied conflict surrounding the Miringuava dam, of which PES will be one possible mitigation and that will help to comply with the requirements of these laws.

São José dos Pinhais and most other municipalities in the East of Paraná close to the Serra do Mar mountain range are part of the Atlantic Rainforest biome, which is "one of the richest forests in species diversity and endangered of the planet" (SOS MATA ATLÂNTICA, 2018a). About 15% of Brazil's territory are covered by the Atlantic Rainforest biome, which spans over 17 Brazilian states. According to SOS Mata Atlântica (2018a) only 12.4% of the forest that existed originally remain today, and of these remnants, 80% are in private areas. Deforestation continues to be a significant problem to the existence of this biome, especially where agricultural production is expanding. This is especially the case in northeastern states such as Bahia and Piauí, but also in the South. However, recent studies with data from the Brazilian space institute indicate a historic fall in deforestation for traditional deforesters like Paraná, the third biggest contributor to deforestation of Atlantic Rainforest (REZENDE et al., 2018; SOS MATA ATLÂNTICA, 2018b).

Different state and non-state actors involved in conservation efforts have been pushing for progressive and innovative approaches to conservation of the Atlantic Rainforest in Paraná. PES has recently appeared on the agendas of the state and municipal secretariats of the environment and there are few cases that serve as a reference. Furthermore, several non-state actors have recently pushed for proposing a national legislative framework for streamlining different approaches and facilitating the implementation of PES arrangements in a more standardized manner. This problem has been pointed out by academic research from institutions like Embrapa, especially mentioning the great investments in experimentation and trial and error approaches that are currently necessary (PRADO et al., 2015; ALARCON et al., 2016). There is a law proposal (PL 792/2007) for a national PES law that has been elaborated by various of the NGO actors also involved in the case study in the Miringuava basin. However, even though the draft bill has passed the environmental and rural development commissions of Brazilian congress, it has struggled to get on the agenda and get approval of the finance commission since 2011. In the period of this research (2017-18), according to the website of the Chamber of Deputies (BRAZIL, 2018), the draft bill has only been designated to a rapporteur (April 2017) and then handed back without comments (February 2018) with no further developments.

After this broader scenario, the characteristics of the Miringuava basin shall now be investigated more closely. The municipality of São José dos Pinhais has a territory of 94,592

ha, of which 81% are rural area (77,286 ha, see figure 23). Approximately 13% of this rural area (13,510 ha) are used for agricultural activities, in its majority for olericulture (vegetable growing). As shown in the general scenario above, the municipality fits the profile of the agricultural state and is the main producer of vegetables in Paraná, however, with an atypical percentage of almost 95% of family farming. Furthermore, it has about 50% of its territory committed to the production of water for public supply (MAIA, 2017; SÃO JOSÉ DOS PINHAIS, 2018). According to the Paraná Agricultural Department on the Rural Economy, São José turned over roughly R$ 424.282.000 (= USD 114.208.228)[2]. Through government programs like the *Merenda Escolar* (School Lunch) and recent plans of some municipalities of the Metropolitan Region to implement 100% organic produce for schools until 2030, the importance of the municipality's supply function and its ecological importance could become more apparent and communicated through those channels (AEN, 2018).

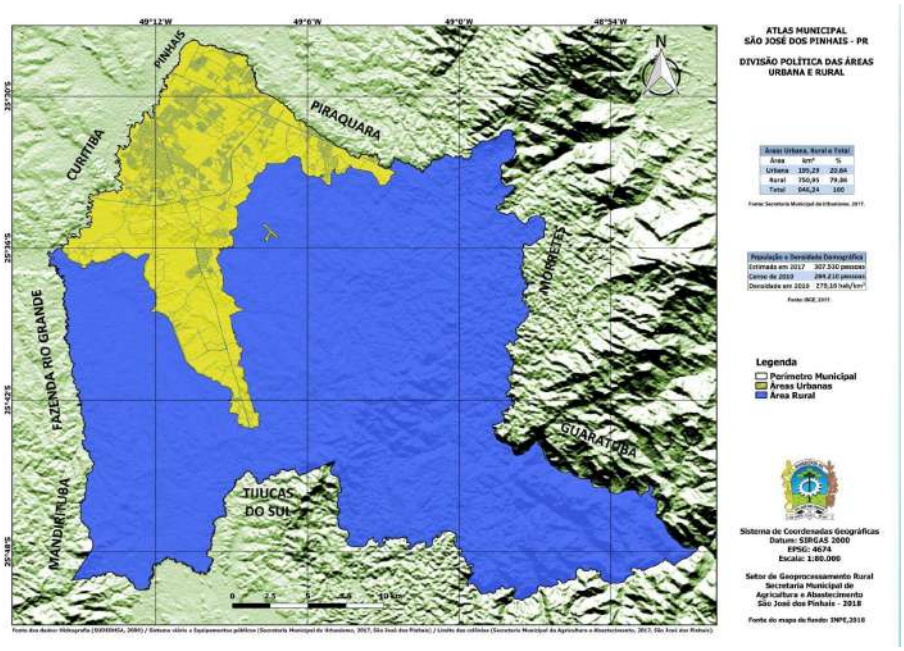


Figure 23 - Urban (yellow) and rural (blue) areas of São José dos Pinhais.
Source: SÃO JOSÉ DOS PINHAIS, 2018c.

The municipality has been of growing importance as a water supplier and as an agricultural pole, both of which are important to be considered together, as they are in a constant land-use conflict in the development discussion of the city, and the Miringuava basin has become a real "battle ground" (FERNANDES, 2007). Even though the focus of this research is on the hydrological dimension of PES, the importance of considering the food dimension of this local development issue in the greater context, or even in a nexus perspective is crucial for understanding the various variables that interact and impede changes in practice and thus in land use (see HARVEY; PILGRIM, 2011).

[2] Exchange rate as of 05/11/2018.

In a report of a municipal project with financing from the World Bank provided independently by two different interviewed stakeholders, there is a compilation of socioeconomic and physical characteristics of the Miringuava basin in the 1990s (SÃO JOSÉ DOS PINHAIS, 1995). This project can be seen as one of the first structural approaches to the conservation of the basin and to the agricultural practices in the region. Figure 24 shows a map from COMEC from 1990 showing the basin and an earlier planned delimitation of the first planned Miringuava reservoir, which was planned much further down-stream, close to the Polish immigrant village community of Colônia Murici.

As one interviewed stakeholder who has a property in the area and has been involved in the environmental concerns of the basin, reported that there was strong resistance to the large flooding of the area with the dam this far downstream. Many of the farmers are said to have learned from the experience of Curitiba's Passaúna reservoir, which, in the period of its construction saw great displacements of a similar Polish immigrant village structure.

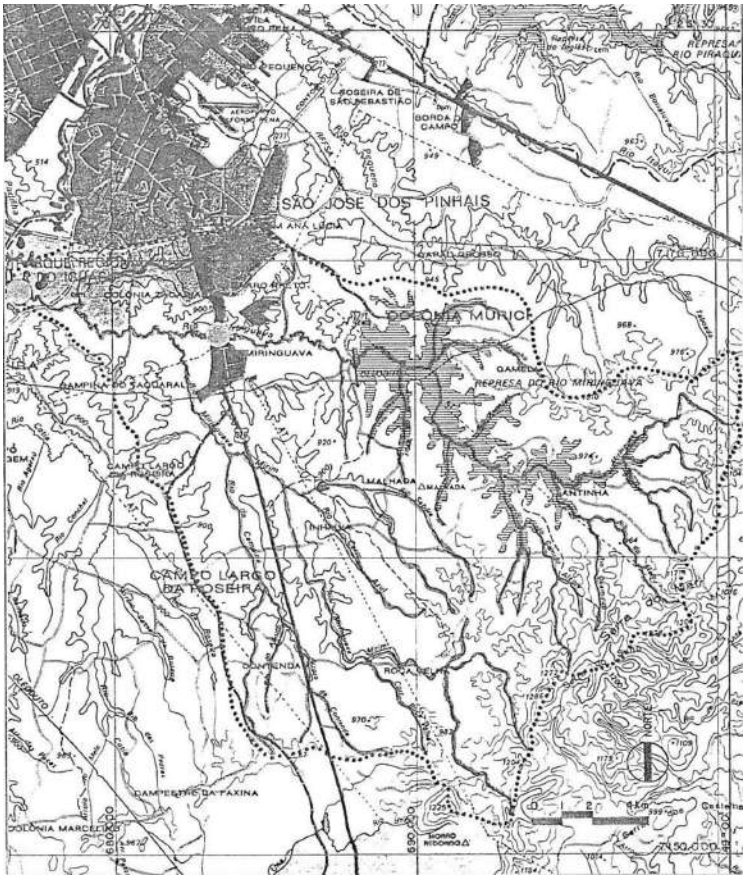


Figure 24 - Map of the Miringuava basin with earlier delimitation of the planned dam. Source: São José dos Pinhais, 1995, based on data from COMEC, 1990.

The appearance of water-related issues in the urban planning processes of Curitiba and its metropolitan region (MRC), a comparative study of the Master Plans and documents from the actors involved in metropolitan governance and literature on the global water agenda (BISWAS; TORTAJADA, 1998; BISWAS, 2004; RIEU-CLARKE; ALLAN; HENDRY, 2017), Gadda et al. (2018) found that Curitiba follows a global trend (see figure 25) and is even more active in the promotion of environmental and water-related issues in its urban planning. However, they conclude that this assertion is the situation in the city's urban planning *documents* and does not necessarily reflect its urban management *practice*. In fact, Cassilha et al. (submitted manuscript) conclude from an analysis of the COMEC Integrated Development Plan, SANEPAR's Master Plan of the Integrated Water Supply System of Curitiba and MRC (SAIC), and the Plan of the Upper Iguaçu Basins and Tributaries of Ribeira that there is more discursive and less practical integration. Some of the metropolitan governance institutions seem to be empty shells and do not effectively promote integration, especially not when it comes to environmental issues.

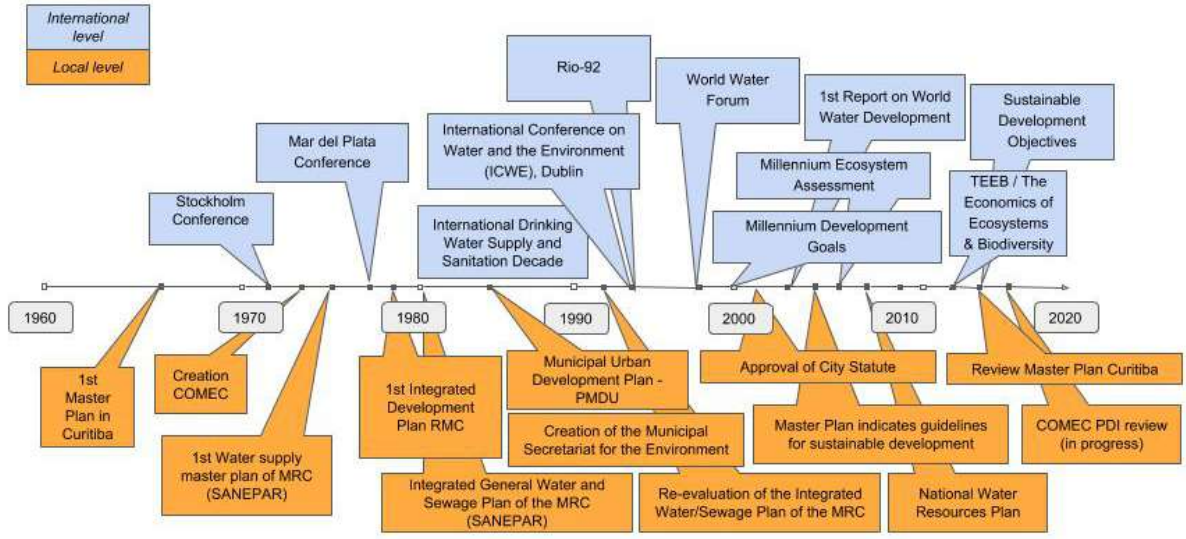


Figure 25 - Timeline of water governance-related international and subnational events, treaties and plans. Source: GADDA et al., 2018.

Lima and Mendonça (2001) affirm the urban pressures that the municipalities at the headwaters of the Iguaçu River are exposed to, reminding of ideas about the rapid urbanization of rural spaces (CHIODI; MARQUES; MURADIAN, 2018). Citing the Coordination of the Metropolitan Region of Curitiba (COMEC) Lima and Mendonça state: "the urban centers in the municipalities of Piraquara and São José dos Pinhais should be rigid in their growth, due to their location very close to the water catchment areas" (COMEC, 1999, apud LIMA; MENDONÇA, 2001). One researcher in an analysis of the soil use in the Miringuava watershed found that "with an increase of 118.18% in urbanization in those 20

years [1980-2000]" a 400% increase in direct action on the permanent preservation areas was produced (CABRAL BOSSLE, 2010: p. 89).

These findings can be confirmed when considering the environmental protection areas surrounding the central nucleus of Curitiba (figure 27, below) and the urban growth vectors defined by the COMEC (figure 26). Considering the expansion vectors defined by the metropolitan coordination agency, São José dos Pinhais will experience (and is already experiencing) a very high demand for land in the time from 2000-2020 (COMEC, 2006, p 182). Figure 26 highlights the importance of these growth vectors especially for the case of São José dos Pinhais which shows the highest rate of almost 20% expected growth in this municipality. The second biggest growth, expected in the direction of Colombo is lower, at 18.6%, but also does not get close to the defined environmental protection units.

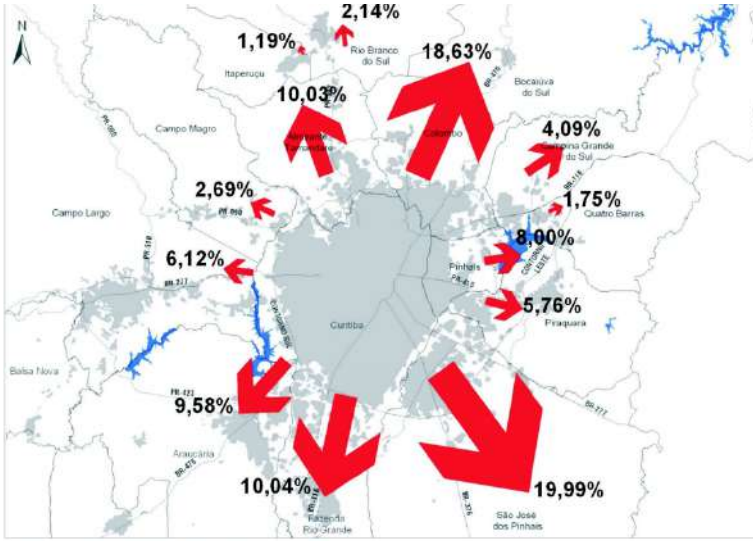


Figure 26 - Expansion vectors / population increase percentage 2000-2020 of the Central Urban Nucleus without Curitiba. Source: COMEC, 2006, p 182.

Considering these pressures, it is relevant to understand the physical and ecological conditions of the watershed and its surrounding areas. Figure 28 (below) shows the remaining forest patches in the metropolitan region, revealing that a great portion of them can be found in the municipality of São José dos Pinhais, yet close to the central municipality of Curitiba (COMEC, 2006).

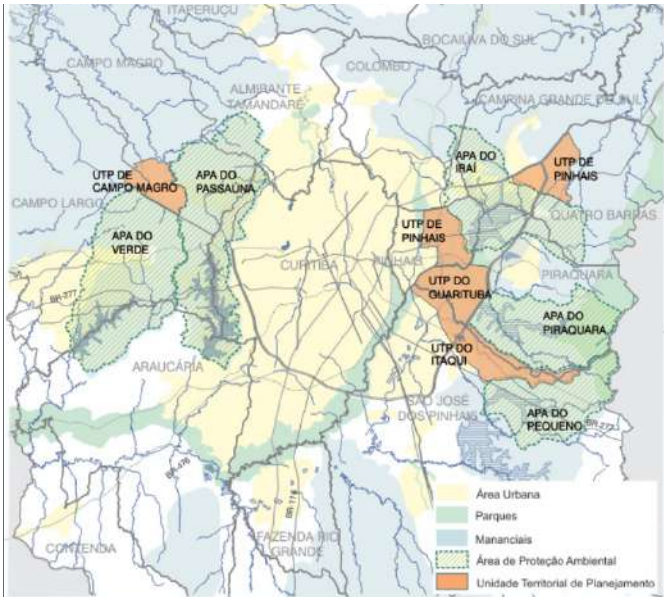


Figure 27 - Areas of Environmental Protection and Territorial Planning Units of the MRC. Source: COMEC, 2006.

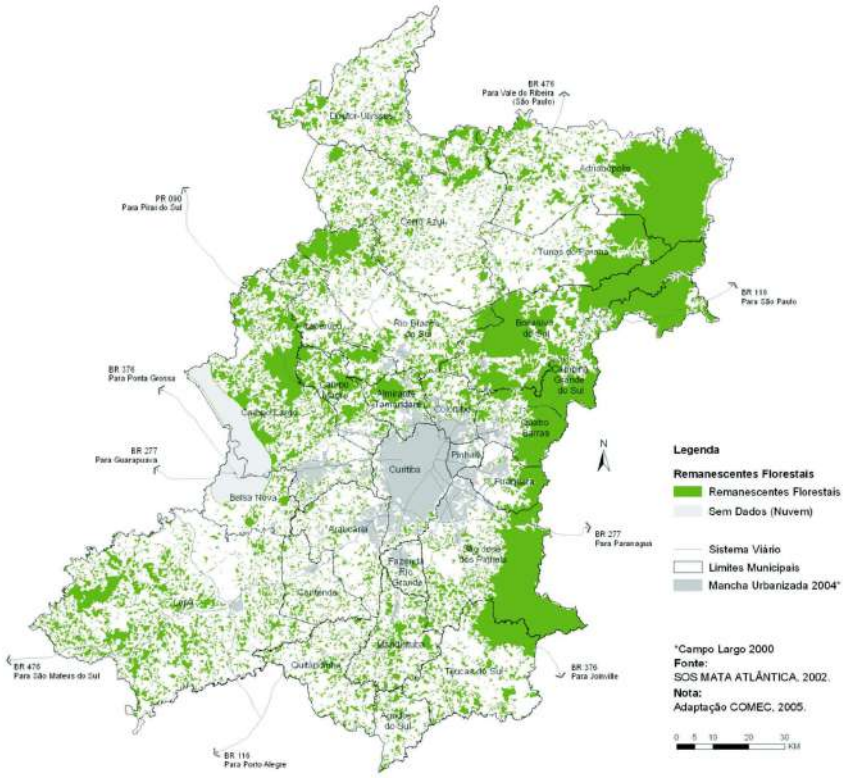


Figure 28 - Forest remnants in the Metropolitan Region of Curitiba. Source: COMEC, 2006.

According to the NGO Global Forest Watch, an initiative of the World Resources Institute (WRI), from "2001 to 2017, São José dos Pinhais lost 1.48kha of tree cover, equivalent to a 2.2% decrease since 2000, and 131kt of CO_2 of emissions" (GLOBAL FOREST WATCH, 2018). Figure 29 (below) shows a map of deforestation identified through satellite image analysis from Sentinel 2A, with current images from 7 September 2018. For

the study object, one significant deforestation patch (pink color) can be identified (see right image in figure 29) that can be attributed to the construction works on the dam and reservoir project by SANEPAR.

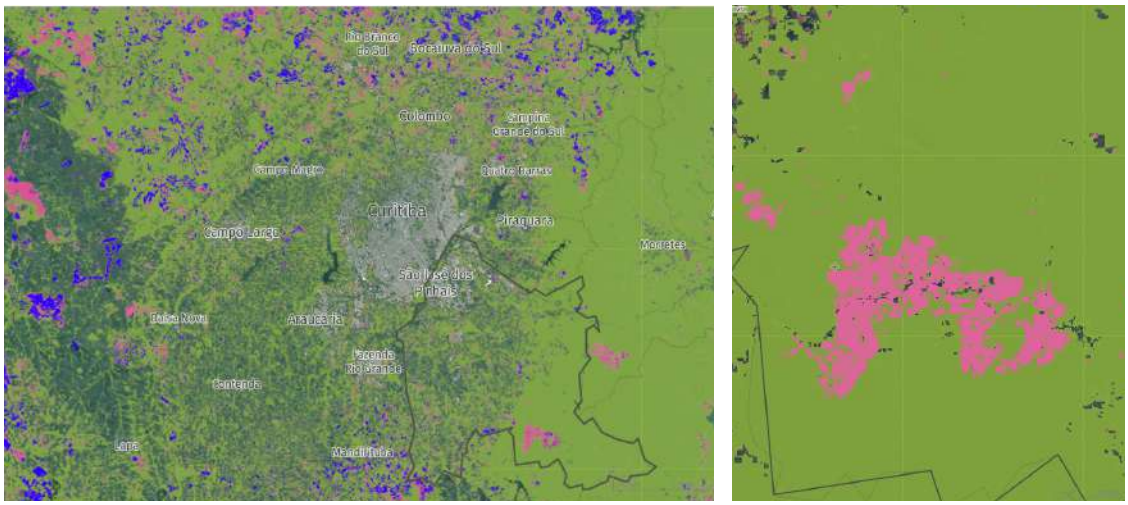


Figure 29 - Tree cover loss (pink) and tree cover gain (blue) in São José dos Pinhais (grey line) and zoom on the dam construction site (right). Source: GLOBAL FOREST WATCH, 2018.

The environmental legislation framing the PES discussion on the federal level, is encompassed by several laws that touch on issues close to or relevant to PES and conservation, given the fact that there is no Federal PES law as of now. However, as the legislation is an important enabling factor, but also a threat to the success to the implementation of a policy like PES that modifies territorial relations and practices, it is very important to understand the judicial framework and the role of the involved actors (GREIBER, 2010; ALARCON et al., 2016; KILL, 2017). Greiber (2010) points mostly to the responsibility of public institutions:

> Law and policies lay the general foundations for the establishment and operation of an institutional structure that supports PES; in particular the participation and role of public institutions have to be clarified (GREIBER, 2010, p. 41).[3]

Franco and Prado (2014, p. 64) affirm the importance of the public hand in mediating PES market forces in order to include smallholders and poorer communities that would otherwise take over. For this reason, an integration of PES legislation on different administrative levels and in different judicial areas is necessary. For instance, the Federal

[3] Author's translation of the original in Spanish: "El derecho y las políticas sientan las bases generales para el establecimiento y funcionamiento de una estructura institucional que apoya los PSA; se aclaran en particular la participación y el papel de las instituciones públicas".

Environmental Education Law (nº 9.795) from 1999 as well as the respective Paraná State Law on Environmental Education (17.505) from 2013 establish important integrative components of the PES debate, since the tool is designed to bring about behavioral changes and does not do so by itself.

In order to situate the discussions in the basin, figure 30 (below) illustrates a compilation of relevant initiatives, legislation, meetings, and (political) events in the municipality, the watershed or the greater bureaucratic context they are inserted in. The approach to the environmental conflict through a timeline was inspired by Gomes' (2017) approach to a documentary analysis on the construction of small hydro power plants in Paraná.

The earliest traces go back to the 1930s, a time in which, according to interviewed stakeholders first discussions on the hydrological potential and for the conservation of the Miringuava watershed took place[4]. When the metropolitan coordination COMEC is founded in 1974, its first integrated development plan (PDI) from 1978 and its review in 1982, the strategic importance of the headwaters East of Curitiba and their due conservation is first recognized in political documents (SÃO JOSÉ DOS PINHAIS, 1995). The first documented efforts that took place in the basin were conducted for a socio-environmental project, coordinated by the Municipal Secretary for Agriculture (SEMAG) and received financing from the World Bank. The project with the title "Conservação Ambiental da Bacia do Rio Miringuava" had a total funding of R$ 900,725[5].

[4] This information could not be confirmed in the documentary research.
[5] In 1995 the BRL-USD exchange rate was practically 1:1.

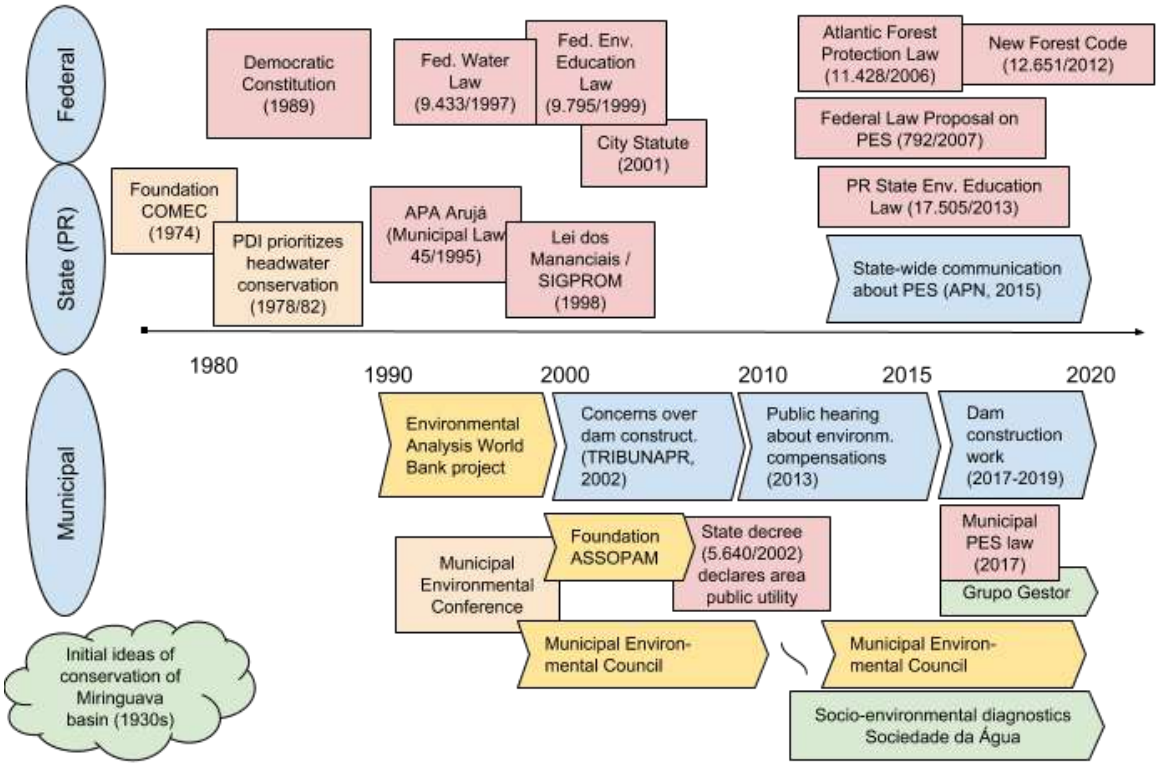


Figure 30 - Timeline of initiatives, meetings, events and legislation relevant for the conservation of the Miringuava watershed. Based on document analysis and interview data.

According to a municipal report, most of the conservation units in the MRC were established by the Paraná State government and form part of the National System of Conservation Units (SNUC) (SÃO JOSÉ DOS PINHAIS, 2014). While one part of those conservation units was established to protect and highlight natural or cultural landscape assets, the ones protecting the Miringuava region fall into the category of prioritization of the protection of basins with dams (existing or future) destined to water supply, such as APAs (*Área de Proteção Ambiental*, APA by its initials in Portuguese) of Rio Pequeno, Piraquara and Iraí. The Environmental Protection Area Arujá, adjacent to the Miringuava watershed, was created by municipal law Nº 45 already in 1995, but has seen several modifications of its fringes, because of the installment of automotive industries in the area. The Miringuava APA is still in definition, and might be considered one of the more polemic cases in the region, according to the interviews with stakeholders from both the public sphere and the local population, due to many disputes in the definitions of its limits.

The state of Paraná and particularly the municipality of Curitiba pioneered several environmental legislations concerning urban spaces (WEINS et al., 2019). Accordingly, several local actions in the MRC have been taken in line with or even before similar federal

legislation, such as the “Headwaters Law” (*Lei dos Mananciais*) that created the SIGPROM system of environmental protection zones in 1998. Not always in accordance with this progressiveness, it is only a small part of the population that gets involved with environmental concerns. In the case of the construction of the Miringuava dam, the Association of Landowners, Residents, Breeders and Farmers of the Miringuava River Basin of São José dos Pinhais (ASSOPAM) that represents the interests of the several village-like territories (*Colônias* in Portuguese) played a decisive role in changing the proposed measures.

The village communities (*Colônias*) in the Miringuava watershed are located upstream of the “mother” village Colônia Murici[6]. Colônia Avencal, Gamelas, Papanduva da Serra, and other small settlements towards the Serra do Mar are considered part of the European immigrant heritage, where historical Italian, Polish, Ukrainian and German lifestyles and traditions are held alive. The communities are in their majority catholic, with a recent surge in evangelical churches. Formed by Polish immigrants between 124-129 years ago, the local population lives practically only from agricultural and livestock farming. The *Colônias*, together, are responsible for supplying approximately 40% of the consumption of olive groves in the Metropolitan Region of Curitiba, as well as the shipment of products to the states of São Paulo, Rio de Janeiro and Santa Catarina (SICTUR, 2018).

The installment license for the Miringuava dam (IAP, 2014) in paragraph seven recalls about the necessity to comply with all provisions in the 2007 Atlantic Forest Protection Law (Nº 11.428), the only biome-specific law in Brazil of this kind (AMIGO, 2017). The 2012 modification of Brazil's Forest Code (Law Nº 12.651), which has partly reduced environmental protection requirements, has caused great concern among environmentalists and civil society. One NGO representative from SOS Mata Atlântica, Mario Mantovani, describes the law as follows:

> "Deforestation increased due to the new forest code, which was passed by the rural bench [the parliamentary lobbying group for agribusiness]," Mantovani said. "They created a slew of mechanisms to pass amnesties, to decrease protection for watersprings and river margins ... everybody thought they could do whatever they wanted in Brazil regarding deforestation."
> *Mario Mantovani of SOS Mata Atlântica* (AMIGO, 2017).

The political and social dispute put forth by the public debate about this law reflects very well the greater dividedness of Brazilian society concerning the issue of a “developmental” approach to the country’s governance, and which is frequently raised by international organizations, and contested by national interest groups.

[6] Alternatively spelled Muricy

A State Decree (Nº 5.640) from 2002 finally brought forth the priority of the interest for public use for water provision as legally binding in the concerned upstream areas of the Miringuava river. The dam project had been moved from the original plan close to Colônia Murici (see figure 24, page 69) to the upper area East of Colônia Avencal. This community will be the most affected one and almost all of the expropriations for the flooding of the reservoir in the upstream area have already been processed. Compensation payments are pending however, as the affected community members have repeatedly voiced in various occasions throughout the fieldwork period. A property with the typical landscape and the relatively simple infrastructure is illustrated in photo 1.

A first public hearing on environmental compensations was organized by the municipal administration for agriculture at the end of 2013 to inform about the construction and necessary compensation measures like PES (SÃO JOSÉ DOS PINHAIS, 2013a). However, those public hearings (as will be explored in chapter 4.2.2.1) have had little effective participation of civil society and disputes that surged have been are being resolved in the sphere of state justice.

Photo 1 - Agricultural property in Colônia Avencal in the Miringuava watershed in July 2018. Image source: the author.

For the characterization of the socioeconomic characteristics of the watershed and its inhabitants, a simple quantitative analysis of the database of a survey from the local water company (SANEPAR) and the state secretariat of the environment (SEMA) was conducted. The data was collected in a survey carried out by the environmental engineering company Sociedade da Água S.A. This company was subcontracted by PROFILL S. A., a company

from the state of Rio Grande do Sul who won the public process for this diagnostic survey. The survey was carried out as a prerequisite for the currently ongoing construction of the reservoir in the upper part of the Miringuava river (photo 2). The local state water company SANEPAR had to comply, among other conditions, with 40 items on the permission to construct the dam. The Environmental Institute of Paraná (INSTITUTO AMBIENTAL DO PARANÁ, 2016) lists these requisites in the “Licença de Instalação N° 18.493” and the conditions should have been met by the end of January 2018. The construction of the dam generated controversies, as the idea had been around for several decades. However, in informal conversations with landowners and some members of the Management Group, people report not to know at all about the construction or to know very little. For this reason, SANEPAR has included an information center on the construction site, which has been visited by the Management Group and members of the community. Here, issues concerning the delineation of the APA for the reservoir surged, and were reiterated by employees of the company to be resolved via judiciary (Ministério Público).

Photo 2 - Construction on the Miringuava dam (in 2017) of which the implementation of PES is a condition for construction. Source: SANEPAR, 2018b.

The MRC’s integrated water supply system (SAIC, with a total capacity of 9,495 l/s) currently draws its water from four main sub-systems: The Iguaçu system that provides about 35% (3,300 l/s), the Iraí system with 27% (2,600 l/s) and the Passaúna system with 19% (1,800 l/s) and 9% (900 l/s) from the Miringuava system (SANEPAR, 2013, p. 43). The current proportions of the system are shown in figure 31 with the Miringuava basin in green. With the construction of the dam, its capacity is foreseen to more than double to 2,000 l/s, making it the third biggest provider of the SAIC and, according to SANEPAR will provide high-quality water for an additional 650,000 inhabitants of the region until 2030 (SANEPAR,

2018c). The expansion through this dam is especially important because of the limits to the expansion and the age of the other subsystems.

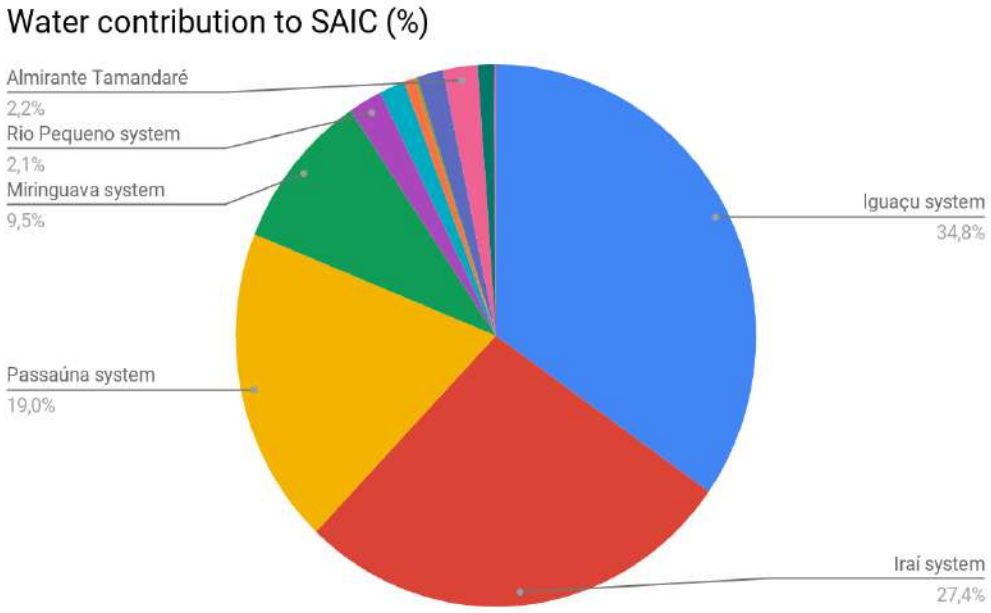


Figure 31 - Water contribution of different systems to the MRC's SAIC system in percentage. Author's illustration, data source: SANEPAR, 2013, p. 43.

The analysis of the database for this research was supported by the undergraduate researcher (*iniciação científica*) at the Studio Cities and Biodiversity laboratory, Larissa Dias, who has been working on correlating the different data layers. The analysis of the database shows that the inhabitants of the region have been living on their properties for an average of 24.44 years, with a minimum of 1 and a maximum of 117 years, most likely considering the ancestors' settling in the region (see Figure 31).

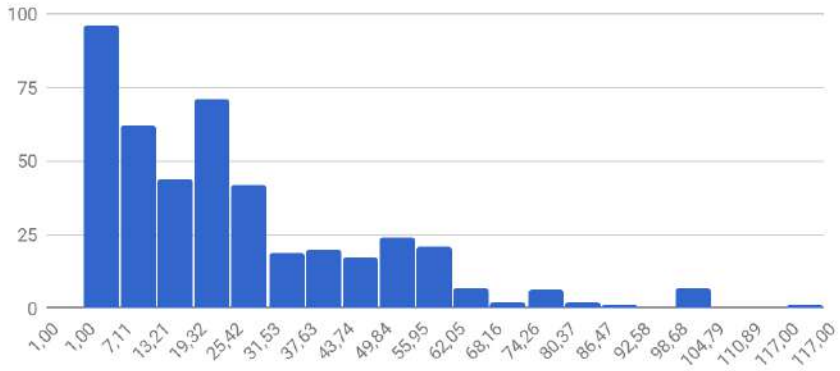


Figure 32 - Time landowners have lived on their property in years. Data source: SEMA, 2017.

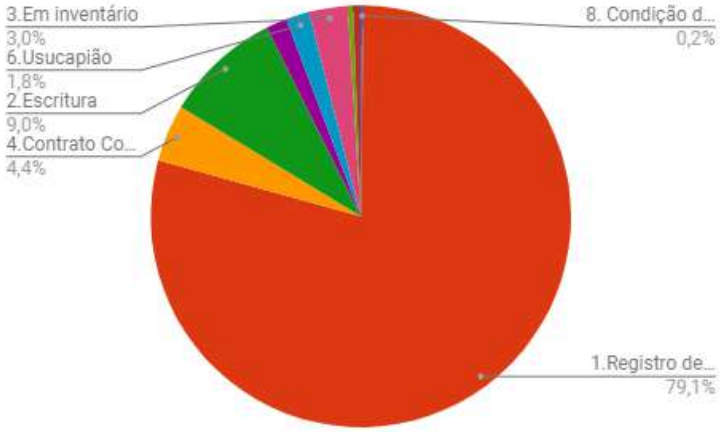


Figure 33 - Ownership relation of properties in percentage. Data source: SEMA, 2017.

Almost 80% (n=397) of the residents interviewed by Sociedade da Água S.A. report to be the owner or a family member of the owner (see figure 33). Another 9% (n=45) report to be in possession of an ownership title or contract (*escritura*) or of a sales contract for the property (4.4%, n=22). 1.8% (n=9) report to live on their properties and have annexed them through usucaption. 3% report to be in process of inventory. A very small percentage of 0.6% (n=3) have a land lease. Only 0.4% (n=2) report to have no documentation on the land. 1.6% (n=8) report other relations that are not further identifiable through the database.

Those ownership relations reflect the predominantly family-owned farming characteristics of the watershed. Furthermore, this data helps to understand that the great majority has formal land titles and help to give data that supports part of the Collective Action Theory lens that were tested using Ostrom's eight design principles.

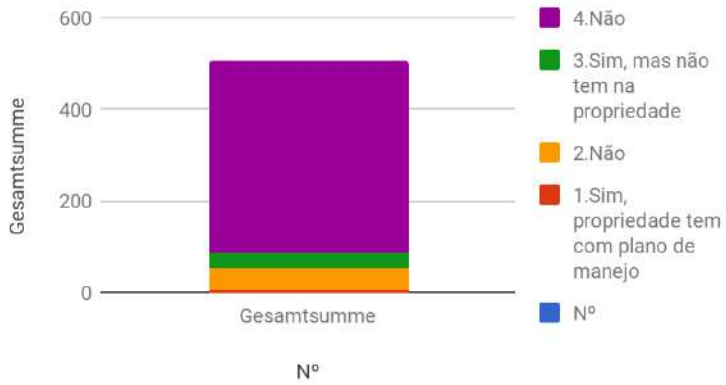


Figure 34 - Reported knowledge about the RPPN legislation. Data source: SEMA, 2017.

The landowners show little knowledge of the current environmental legislation (see figure 34), with more than 80% (n=467) responding not to know the Private natural heritage

reserve (RPPN) that is an important conservation policy instrument that has been in place since 2000. 33 respondents (6.5%) report to have knowledge of the policy, but do not have land with conditions for it. Only five participants of the survey report to have a land management plan (*plano de manejo*) that is a basic requirement for registering a private conservation unit.

4.2. ACTORS INVOLVED IN THE PES DEBATE IN THE MIRINGUAVA BASIN

The PES arrangement in the Miringuava basin involves a great number of stakeholders, both directly and indirectly. The focus of this research is on the actors involved more directly in the elaboration or execution of the program in the year 2018, with a focus on participatory aspects for which the Management Group (*Grupo Gestor*) has been presented as an apt forum to discuss between diverging opinions on the low level management of socio economic issues in the basin.

Table 4 shows an overview of the considered actors. The table shows all the actors currently deemed relevant by the Strategic Management Unit (*Unidade de Gestão Estratégica*, UGE in Portuguese) set up for PES in São José dos Pinhais when planning the PES measures. The UGE currently comprises the State (SEMA) and Municipal (SEMMA) Environmental Secretariats, the NGOs SPVS, FGB, TNC and sporadically Secretariat of Agriculture and Supplies (SEMAG)[7]. Subsequently, these stakeholders were contacted, and, following the *snowball* method, other central or knowledgeable stakeholders were involved. The list of actors provided by the UGE included several stakeholders that were relevant only at earlier stages or that are still considered to be contacted only in a future stage of the project, once it is judicially and operationally implemented. These are, among others institutions that only provided data for the planning process (like the Land, Cartography and Geology Institute), or industries and educational institutions, that do not interact with the UGE as of now. This group of stakeholders was excluded from the sample.

[7] Please see table 4 below for organization abbreviations.

Table 4 - Considered actors involved in the PES program in the Miringuava basin (in alphabetical, not order of importance). Illustration: Author's elaboration.

Level	Public Administration	Civil Society & NGOs	Private sector
International		TNC	
National	ANA	FGB	
State	ÁguasPR, Emater, IAP, Min. Públ., SEMA	SANEPAR, SPVS, CPRA	FIEP, Painel Pesquisas
Municipal	SEMAG, SEMMA, SEMPL	APROMEL, CMMA, CMDR, FETAEP	Sociedade da Água
Local		ASSOPAM, Copa Sol, Igrejas, Rede EcoVida, Sindicato Rural, SINTEA	

ÁguasPR = Instituto das Águas do Paraná; ANA =Agência Nacional de Águas; APROMEL = Associação dos produtores orgânicos e Meliponicultores de SJP / Associação de Produtores Orgânicos; ASSOPAM = Associação dos Proprietários, Moradores, Criadores e Agricultores das Áreas da Bacia do Rio Miringuava de São José dos Pinhais; CMMA = Conselho Municipal do Meio Ambiente; CMDR = Conselho Municipal de Desenvolvimento Rural; CPRA = Centro Paranaense de Referência em Agroecologia; Emater = Instituto Paranaense de Assistência Técnica e Extensão Rural; FGB = Fundação Grupo Boticário; FETAEP = Sindicato dos Trabalhadores Rurais de São José dos Pinhais; FIEP = Federação das Indústrias do Paraná; IAP = Instituto Ambiental do Paraná; Min. Públ. = Public Prosecutor; SEMAG = Secretaria Municipal de Agricultura; SEMA = State Secretariat of the Environment and Water Resources; SEMMA = Municipal Secretariat of the Environment; SEMPL = Secretaria de Planejamento e Desenvolvimento Econômico; TNC = The Nature Conservancy.

According to a communiqué of the State News Agency of Paraná published in 2015, there is a great number of (possible) institutions involved in the PES process (PARANÁ, 2015). These institutions are: the National Water Agency (ANA), State Secretariat of the Environment and Water Resources (SEMA), Secretariat of Planning, Emater, the Paraná state water company Sanepar, Instituto das Águas do Paraná, Institute of Land, Cartography and Geosciences of Paraná (ITCG), the Paraná Court of Auditors, the Environmental Institute of Paraná (IAP), the Federation of Industries of the State of Paraná (FIEP), the municipalities of Piraquara and São José dos Pinhais, Copel, Grupo Boticário Foundation (FGB), the Society for Wildlife Research and Environmental Education (SPVS), and The Nature Conservancy (TNC).

According to another communiqué (PARANÁ, 2014), social participation is a focus in water governance, including those PES projects. They state that Paraná is at the forefront of many Brazilian states with regard to the integrated and decentralized management of river basins and that the state has 11 river basin committees already in place. The basin committees mentioned here are composed of representatives of the federal government, the states, the municipalities, water users and civil entities of water resources operating in each river basin. According to SEMA's water resources coordinator at the time "the committees

encourage the participation of the different segments of society in the planning of the hydrographic basins" (PARANÁ, 2014). In how far this is the case for PES, is going to be a lead question of this thesis.

Explorations of the interactions and an analysis of the minutes of the basin committees in Paraná however, point to a peculiarity of the Committee of the Upper Iguaçu Basins and Tributaries of the High Ribeira (COALIAR), which was the first established in the state. Although the representation quotas even stand out above the requirements of the law, according to Medeiros (2011), the meeting minutes "present few records of the directors' manifestations" and "few manifestations of the participants." According to the author, "collective approvals are registered without debate, questioning or conflicting decisions" and that this "lack of those record makes it difficult to know the sectorial and/or individual positions of the counselors." Medeiros (2011: p. 214) further states that:

> "The decentralized management model seems to face limits in its implementation, confusing practices and ideas that fed the bureaucratic and technocratic models, since the segments of the system still carry in their forms of action the" vices "of the old ways of managing the waters (MEDEIROS, 2011; MEDEIROS; CANALI, 2012)

In how far this also applies to the discussions of the activities of management group (*Grupo Gestor*) in the Miringuava basin, will be discussed in detail in chapter 4.2.2.1.

The recent Municipal Law No. 2.964/2017 in São José dos Pinhais regulates all legal requirements for PES on the municipal level, including a municipal PES funds to finance and process payments (articles 11 and 12) (SÃO JOSÉ DOS PINHAIS, 2017). The decree that regulates the law in more detail and allowing for its application, was still being elaborated in the field work period for this research in 2018. A working group of the municipal (SEMMA) and state Secretariat of the Environment (SEMA), interested municipal secretariats (SICTUR, SEMAG) as well as three local NGOs are participating in this process (see photo 3 at a working group meeting below). The NGO Fundação Grupo O Boticário (FGB) is a protagonist in this phase and is contributing with the evaluation scheme and its ES valuation formula *Oásis*, which is going to become a technical standard for PES in São José dos Pinhais and Piraquara (FGB, 2018a).

According to manifestations in the interviews for this research, SPVS and TNC are contributing with their local and technical expertise respectively. In this process, the creation of the UGE was also still being negotiated at the end of 2018 (see also IAP, 2016). The researcher was invited to participate in one of those working meetings in the Municipal Secretariat of the Environment in May 2018. Here, representatives of the State and Municipal environmental secretariats, and the two NGOs TNC and FGB were present and

details of the law and its regulation were discussed in a quite collaborative manner. The atmosphere between the actors is very familiar, certainly also because of the efforts of the NGOs to bring those specific stakeholders together on a regular basis.

Photo 3 - Meeting of working group on municipal PES decree in São José dos Pinhais in May 2018. Source: the author.

The law, that is published and in force, but yet without a regulation (a judicial tool necessary for the public sphere to be able to act accordingly) have been elaborated in a collaborative effort by, what one interviewed stakeholder called the “core group” of institutional actors in the PES issue in São José dos Pinhais: SEMA, SEMMA, SPVS, TNC and FGB. Most of the interviewed stakeholders that are more closely involved in the process confirm this arrangement to be the main actor, both from an inside and an outside perspective, with only some divergences concerning the public and municipal sphere and the non-perception of several of the NGO actors. The results of quantitative data on this arrangement are discussed in chapter 4.4 of this thesis.

It is important to remember here, that the legislation in São José dos Pinhais is closely connected to the central municipality of the metropolitan area of Curitiba, as the PES payments will originate a great deal from this municipality, and it will also be a main beneficiary of the policy. In its article 66 of the Revision of its urban master plan establishes the directives for PES programs as "an instrument of the municipal environmental policy that will compensate legal or physical persons that act, individually or cumulatively, in the conservation and environmental improvement of the city" and understands them within the Climate Change Mitigation and Adaptation Plan (CURITIBA, 2015; BRUEL et al., 2016). However, the law and its directive themselves do not mention the interdependence with

other municipalities of the metropolitan region, such as São José dos Pinhais, as a major provider of food and water.

This, after the City Statute expressly encourages such considerations and, even though the MRC's SIGPROM states (in its Art. 1/II, see COMEC, 2018b) its mission as "to integrate the actions of the various organs and spheres of state and municipal public power and initiatives of private agents." Several of the environmental laws have been altered in recent months, and, according to several interviewed subject from civil society of São José dos Pinhais that are observing these modifications, they are not taking place with due information and consultation of the public. Even though COMEC has a specific legislation page on which those changes are communicated, the appearance and technical language make it challenging for normal citizens and even for scientists to quickly understand the implications of those changes.

Considering the reported knowledge of the landowners on environmental legislation (figure 34, page 80), the disparity in citizen education enables a technical approach to be executed by public administration without much questioning, and against the critical assumptions of STS studies on science education. An additional weakness of the organization of civil society in unions (to be discussed in chapter 4.2.2.2) and municipal councils (see discussion in chapter 4.2.2.4), exacerbates the relatively weak involvement of societal groups and opens the door to special interest groups. In order to guarantee the fair representation of Brazilian citizens' interests by the public administration, the Public Prosecutor (*Ministério Público*) has been enshrined in the 1988 democratic constitution. The role of this organ and other public ones will be discussed in the following subchapter. It has not been possible to include the Parana Institute of Technical Assistance and Rural Extension (EMATER), which does very important work on the ground in terms of agricultural information and outreach, due to time restraints on both sides. Alongside with other relevant actors that could not be interviewed during the fieldwork period, they are considered in the SNA, to the extent that they were considered by the interviewed stakeholders. While this is a methodological shortcoming of this research that has to be recognized when using the snowball method, it also represents the availability of those actors and helps draw a tendency, which is contextualized with the help of the literature.

4.2.1 Public sphere and administration

As discussed in the literature in chapter 2 (see 2.3.1) most PES applications around the world and in Brazil are, despite their discursive references, state-mediated policy tools. Accordingly, the case study of the Miringuava basin confirms those theoretical observations. The public sphere has a protagonist role in the execution of the PES policy on several levels.

On the one hand, SEMA and SEMMA are the promoting entities that integrate PES as an innovative policy tool with several other initiatives. The National Water Agency (ANA) played a role as an initial impulsor of PES, but is cited by the interviewed actors as an actor that is not perceived to have significantly influenced the current PES debate in the MRC. The State Water Institute (*Instituto das Águas*) that supports governance of Paraná's watersheds in the interest of the general public through the basin committees - even though surprisingly - could be pointed out as a marginal stakeholder. The Environmental Institute of Paraná (IAP) has played an important role in monitoring environmental compliance and in promoting PES application, especially in the case of the Miringuava watershed, where it has been working with the General Prosecutor's Office (*Ministério Público*) to defend environmental interests of and compensations for the local population.

It can be stated that the public sphere in the MRC has seen a long term environmental and adoption strategy to the environmental changes observed in its ES provision. The embeddedness of the public sphere with other sectors in a few specific networks has certainly contributed to the relatively quick implementation of PES as an adaptation strategy (BARBI; FERREIRA, 2013).

In the following subchapters the main actors will be analyzed concerning their involvement in the Miringuava PES arrangement in three actor categories (public, civil society and private sector). In the first place, the state water company as a major impulsor of the PES debate in the watershed will be explored and analyzed. After, the state and municipal secretaries and at last metropolitan governance organizations are analyzed for the public sphere. Then, the diverse civil society groups will be analyzed. Here, too, the "Management Group" that is at the forefront of the socio environmental work in the basin, surrounding the dam construction will be analyzed. After, the municipal councils, as participative organs, the involved NGOs and at last the affected population and the respective associations they are organized in, are explored and analyzed.

4.2.1.1 SANEPAR

The Companhia de Saneamento do Paraná SANEPAR is a state-owned water and waste management company that was founded in 1963 as Companhia de Água e Esgotos do Paraná. According to its own data, it provides those services to residential, commercial and industrial users in 100% of the 345 cities and 293 smaller areas in the state of Paraná (SANEPAR, 2018a). Among others, SANEPAR manages the Integrated Water Supply System of Curitiba and Metropolitan Region (SAIC), of which the Miringuava dam is already a part of, and is planned to more than double its contribution (see figure 31, page 78) in order to secure the supply to the growing demands of the MRC (SANEPAR, 2013).

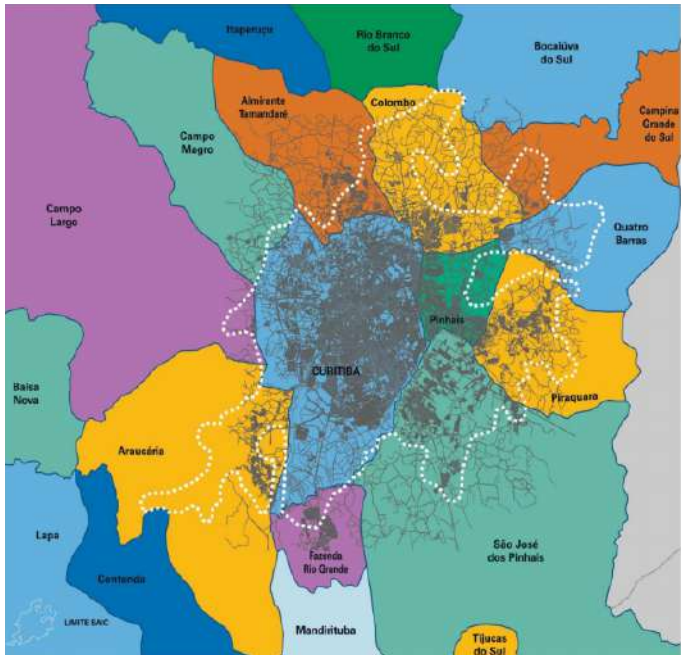


Figure 35 - Municipalities of the Metropolitan Region of Curitiba, urban area and scope of SAIC. Source: SANEPAR, 2013.

Figure 35 (above) shows the urban area (in gray) and the coverage of the integrated supply system of Curitiba and Metropolitan Region (SAIC, dotted white line). It also shows that it essentially serves the core municipality, since Curitiba has full coverage, serving the municipalities bordering Curitiba partially. According to Cassilha et al. (submitted manuscript) this happens, although several of these municipalities are important contributors to the system, as is the case of the municipality of Piraquara and São José dos Pinhais. Sanepar develops the Master Plan of the Integrated Curitiba and Metropolitan Region (SAIC), according to the inputs of the involved municipalities, considering the surveys in the respective Master Plans, which contribute to the quantification of water demands always for a 30-year horizon, as well as projections of urban occupations. Currently, as shown in Figure 35, the SAIC system supplies treated water in the municipalities of Almirante Tamandaré, Araucária, Campina Grande do Sul, Colombo, Curitiba, Fazenda Rio Grande, Pinhais, Piraquara, Quatro Barras and São José dos Pinhais, that are all part of the metropolitan region.

Clearly visible in figure 36 (below) which shows the future of the MRC's water supply, on a map by the Water Resource Committee of Paraná (CERH/PR), the size of the Miringuava reservoir is quite reduced when compared to earlier maps of the undertaking (e.g figure 24, page 69). Also, considering that the map is from 2014, the construction and use of the reservoir foreseen here until 2016 has not been met. The project is currently still in the construction phase (as of December 2018).

The Miringuava watershed has a treatment plant already, however, the treatment efforts and their costs have gone up in recent years, as the area is increasing its agricultural production, resulting in both more organic mass and sediments, as well as more pesticides to be filtered out. In consideration of those changes, applying PES and environmental education activities in the Miringuava basin was not only a legal condition to SANEPAR for the construction of the dam but the environmental regulatory body IAP (2014). It also immensely benefits the company's operations, an aspect which was openly confirmed by the interviewed stakeholders (TNC) in and around the arrangement. This facet of PES as a cost-saving measure for SANEPAR is also recognized by many of the other actors, both critical and supportive of the dam project.

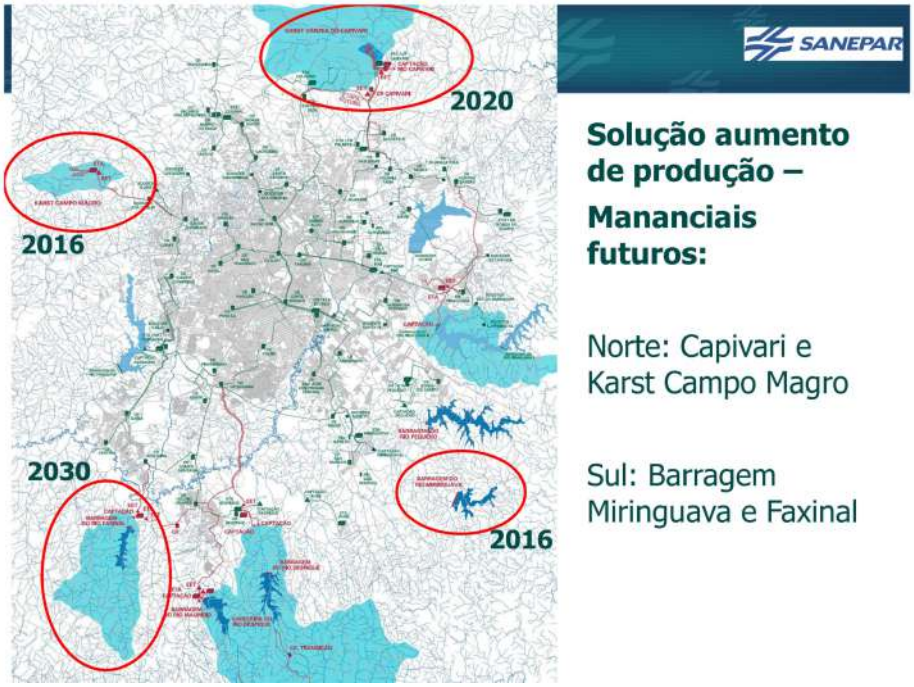


Figure 36 - SANEPAR's solutions to the expansion of drinking water provision including future watersheds to be explored circled. Source: CERH/PR, 2014.

The construction of the dam will bring along a significant alteration in the hydrodynamics of the basin (BOSSLE, 2010), but also cause broader environmental and social implications and urbanization pressures. For this reason, the above mentioned installment license (Nº 18.493) from IAP (2014) foresees a long list of conditions to be complied with by SANEPAR. Some of the measures besides the implementation of PES are:

- Archaeological recovery
- Wildlife rescue and monitoring
- Environmental management program with the community and employees

- Quantitative and qualitative reports of the areas that will be compromised by the project (lake phase) to accurately define the volumes of the wood material to be effectively removed
- Carrying out the Rural Environmental Registry (CAR)

The undertaking of the dam construction which has a budget of 143,000 BRL[8] (FERNANDES, 2007) is financed by the Brazilian Bank Caixa Econômica Federal, that, according to one interviewed subject, has a certain say strategic matters of the project. This actor was not named as a relevant actor in the PES process though, as their involvement is very indirect. According to Fernandes (2007) the project was first presented to the local community in 2001. SANEPAR is making efforts to communicate about the dam project and the compensatory measures taken, and has thus made technical visits to the construction site possible to the technical community (SANEPAR, 2018d). The researcher was invited to a visit with the local farmer community, most of whom will be directly affected, but had never been to the site before. The approach taken by SANEPAR could be defined as rather focussed on technical and engineering dimensions of the project, leaving social aspects in a separate sphere. The public company established a Social Communication and Environmental Education program through which some of those less technical issues should be communicated and discussed (MAIA, 2017). However, issues concerning the expropriations and the usage restrictions because of the APA have been reiterated to other public institutions, causing confusion in the population about the responsibilities and competent representatives. One interviewed subject, a landowner from the basin who describes themselves as “a preservationist” describes the indemnity process in which the environmental department’s Daisy Teixeira has been a key person inter mediating between judicial department and the IAP institute

PES in the form it is applied in the Miringuava basin, is clearly a measure that needs broad integration and long term strategic planning. In the understanding of where the approach came from, one environmental education manager saw the New York City case as the main and initial reference to PES, while knowing only other local references that were linked to the Miringuava case through the state policy (PARANÁ, 2012; SEMA; IAP, 2018). Between the two interviewed environmental education managers that are involved in the community work and implementation of the PES scheme, the interview stimulated an interesting debate about the approach to the right way of democratically implementing environmental measures. With reference to the upcoming presidential elections[9], and induced by the rather strong-handed state approach with China's Eco-Compensations, one

[8] 36,794,972 USD with an exchange rate of 1 BRL = 0,26 USD as of December 2018.
[9] Date of the interview: 28th of September 2018

interview revealed the recognition of democratic procedures for the implementation of PES. Naming the experience of the Management Group (*Grupo Gestor*), they said[10]:

> "What is our methodology, our strategy there? It's to call everybody, put it on the table, and say, 'Guys, what do we have to do in this basin for the preservation of it', right? The government does more or less the same thing with us, it does not have all that power. They [the government] talks like this: look, let's think together, right? It takes more work, maybe it takes longer to achieve it - China is getting there faster, because 'go ahead, I'm making you do it' and the person does. But, we do not have all this awareness here yet, right?" *Interviewed stakeholder.*

The Management Group, which will be dealt with in more detail in chapter 4.2.2.1 has resulted from earlier socio environmental accompaniment in the basin, when it was used as a communication channel for SANEPAR, according to one interviewed stakeholder. However, for the current function of a discussion and management tool, the group has not been very effective yet. The criticisms and risks of PES e.g. seem to have been dealt with very superficially on the side of many of the state-side stakeholders, and questions raised by the researcher in the interviews were often new or not very familiar to the involved actors. Questions like the risk of loss of feeling of responsibility because of payments through commodification, as they have been discussed above (chapter 2.2.4), have led to a few discussions with the involved actors, but mostly disregarded due to practical constraints in the process.

4.2.1.2 SEMA

According to its own institutional description, the Secretariat of State for the Environment and Water Resources (SEMA) is the coordinating entity of the State System of Environmental Management and Water Resources of the State of Paraná and its purpose is to formulate and execute policies on the environment, water and atmospheric resources, biodiversity and forests, cartographic, agrarian-land management, erosion control and environmental sanitation and solid waste management. Regarding technical advice, SEMA has a Communication Department that carries out dissemination of results of its actions, an Environmental Education Advisory and the Articulation for the Formulation of Agenda 21. This exemplarily reflects findings about the importance of local governments in climate

[10] Translation by the author. Original quote: "Qual que é nossa metodologia, nossa estratégia lá? É chamar todo mundo, botar na mesa, e falar: 'Pessoal, o que a gente precisa fazer nessa bacia para a preservação dela', né? O governo faz mas ou menos a mesmo coisa com a gente, ele não tem esse poder todo. Ele fala assim: olha, vamos pensar juntos, né? Dá mais trabalho, talvez a gente demore mais para chegar - a China está chegando mais rápido, porque 'passa, estou mandando', e a pessoa faz. Mas, a gente não tem essa conscientização toda ainda, né?"

change action (BARBI; FERREIRA, 2013). Furthermore, SEMA also coordinates projects on the state level included in the National Environmental Program II and the Coastal Management Program. There are four coordinating bodies responsible for formulating its guidelines: Water and Atmospheric Resources Coordination (CRHA), Coordination of Biodiversity and Forests (CBIO), Coordination of Solid Waste (CRES) and the Climate Change Coordination. The website of the project “Bioclima” (www.bioclima.pr.gov.br), which is communicated as one of the main integrative environmental policy projects by several of the interviewed actors, has been offline or restricted to user access (as of October 2018).

The SEMA system also has seven regional offices distributed according to the delimitation of the watersheds of the State of Paraná and works closely with the Environmental Institute of Paraná (IAP), the Land, Cartography and Geology Institute (ITCG) and the Water Institute of Paraná, are municipalities of the Secretariat of the Environment and Water Resources.

In the organization of the PES programs in Paraná, SEMA is cited by almost all interviewed stakeholders as one of the most central actors. The State Government created the PES law in 2012 and regulated it in 2015, allowing for legal compensation of rural landowners who adopt good environmental conservation practices. The payments are planned first for properties of the Piraquara 1 basin and SEMA has been conducting studies for three other basins: Piraquara 2, Miringuava and São Cristóvão in the city of Castro. This will allow PES compensation to more than 900 rural landowners in these three regions. The PES will also benefit owners of Private Natural Heritage Reserves (*RPPN* by its initials in Portuguese), with funds for making the necessary analyses for environmental management plans (plano de manejo) and PES. However, the collected interview data has also shown that several of the stakeholders that are not in regular and direct contact with SEMA do not know of its statewide PES strategy.

The Paraná Reference Center in Agroecology (CPRA), autarchy linked to the Secretariat of Agriculture and Supply was founded in 2004 with the objective of recovering the area around Iraí's Environmental Protection Area (APA), which until then had served research focused on conventional agriculture and the organization of agricultural fairs. According to its mission statement “CPRA is proving, every year, that the development of more responsible agriculture is not only possible but also necessary” (CPRA, 2017). Its involvement in the PES arrangement and discussion in the Miringuava basin has been recent, but with strong intentions, since the conflict between conservation and conventional agriculture has been identified. The center has been a primary organizer of a participatory seminar that was held with local farmers in October 2018 with the Miringuava Management Group and the company that is carrying out the socio environmental accompaniment for SANEPAR (see chapter 4.2.2.1).

4.2.1.3 Municipal Secretariats

The municipality is the smallest administrative unit of the Brazilian federal system and, in many issues, is of equivalent autonomy between the federative entities, and can be defined as "a public entity, constituted by a human community, based in a determined territory, that manages its own and particular interests" (PIZELLA, 2015; CASSILHA et al., submitted manuscript). The municipal secretaries thus play a major organizational role in the Brazilian administrative and public policy system. The municipal secretariats involved in the discussions surrounding PES in the Miringuava basin are the secretariats of the Environment, Agriculture, and to a lesser extent the secretariat of Traffic and Public Works, and the secretariat of Industry and Tourism.

Municipal Secretariat of the Environment (SEMMA)

The Municipal Council in Defense of the Environment was founded in 1979 and turned into the Municipal Secretariat of the Environment in 1988 under the new federal constitution. The Secretariat for the Environment (SEMMA) according to its own description "takes care of the protection of nature throughout the municipality and defines environmental conservation policies and actions." It is also responsible for services such as environmental licensing, public cleaning, animal welfare, parks, squares and municipal funeral services.

Its current organizational structure is very simple with only two departments: the Department of Environmental Control and the Department of Monitoring and Biodiversity that have four and five divisions respectively. As there is no specific division for conservation matters, officials from a different division (waste) are currently responsible for the PES in São José dos Pinhais. Despite this organizational issue, SEMMA has been quite active in promoting and participating in PES debates in the whole country. The close cooperation with local NGOs that work in the municipality has contributed to the inclusion of the municipal actor in those networks, in addition to its close ties to the state Secretariat of the Environment that also enables wide knowledge exchanges with other PES projects in Brazil.

One official from this Secretariat named the discontinuity of actors and programs in the political sphere of the municipality as one of the greatest challenges to deal with in the environmental policy-making process as well as the execution of their programs. For this reason, the study of the institutional arrangement here, has shown in how far the cooperations between the secretaries with actors outside of the formal political sphere and in the NGO and even informal sphere is of great importance to conservation policies and particular the issue of PES (BARBIERI; FERREIRA, 2018).

Even though (or precisely because) this thesis argues for PES as an inherently political endeavour, a deeper understanding of the non-political ties with civil society is an important step. The case of one engaged individuals that are currently in charge of promoting the PES issue, might be a positive sign for conservation policies, as these individuals will likely continue in this line despite changes in political regime. However, with this relatively individual-dependent push for such a policy that is not yet supported by the local community nor by beneficiaries (and possible payers) for it, the institutional arrangement it is set in, is still relatively weak. The SNA and network structure (chapter 5.3), the evaluation of Ostrom's design principles for this case (5.2) and the qualities of co-management systems (see Table 3, page 47/48) by Sandström and Carlsson (2008) give a measurable theoretical hint and scientific base that allow for affirmations about a lack of political ownership by local population observed by other researchers (MARTINE; MCGRANAHAN, 2010).

Municipal Secretariat of Agriculture (SEMAG)

The Municipal Secretariat of Agriculture and Supply defines itself as a channel of communication between rural man and the public administration. It seeks to represent small (family) producers and rural workers and helps to market their products. The secretariat was created in 1993 under a decree that reorganized the municipal administration (Municipal Law Nº 2).

In terms of PES, SEMAG was involved in earlier developments, around 2010, a time in which there was strong involvement of the municipal councils as well. One interviewed actor related that first efforts to conserve the watershed were made by SEMAG. However, in the current arrangement, SEMAG has not been participating frequently. The interviewed stakeholder from the secretariat reports that their current role is a support role to SEMMA. They preferred not to manifest their opinion on several issues. Curiously, in the testing of Ostrom's eight design principles, they responded so to the principle of recognition of the participants' right to organize, without pressure from those involved.

A former councillor provided drafts for a municipal PES law and decree (SÃO JOSÉ DOS PINHAIS, 2013b) that were developed around 2013. The piece of legislation developed at this point was never passed and with the assuming of the new core group of the state and municipal environmental secretariat with the three NGOs (SPVS, TNC, FGB) the current legislation (SÃO JOSÉ DOS PINHAIS, 2017) was built from scratch. Some of the articles of the earlier proposal foresaw some more detailed prescriptions than the current one. For instance, its article 6 defined the payment frequency (12 monthly payments) and an

independent valuation method (50 municipal reference values per hectare) for APAs and Legal Reserves.

The corresponding decree foresaw a stronger observing involvement of the Municipal Councils of the Environment (CMMA[11]) and for Rural Development (CMDR[12]) in its chapter 3, Art. 5, § 3, making an evaluation of the program's development and achievement of its goals by those two participative organs legally binding. Furthermore, the PES financing was foreseen to come from the ecological tax (*ICMS Ecológico*), defined in chapter 4, single paragraph of the law proposal. Paraná was the first state of Brazil with specific incentives for green initiatives to municipalities that have water supply headwaters (2.5% of the funds) and municipalities that have Municipal, State and Federal Conservation Units, Indigenous Areas, *Faxinais*, Permanent Preservation Areas (RPPNs) and/or Legal Reserves (FARIA, 2018). As such, the current legislation has a clear handwriting of more technical and legal expertise (NGO contributions), but does not have as much local and democratic ownership.

Municipal Secretariat of Industry, Commerce and Tourism

The Secretary of Industry, Commerce and Tourism (SICTUR) unites several public and private interest groups of the municipality that work on common agendas to "boost and enhance local commerce through actions" and "encourage residents of São José to prioritize their municipality when it comes to buying" as well as promoting investment in the city (SÃO JOSÉ DOS PINHAIS, 2018d). SICTUR highlights the municipality's strategic location and the Afonso Pena International Airport that brings a large number of visitors from other Brazilian states and from around the world. São José dos Pinhais' extensive green areas are also highlighted by the tourism department, considering that it is "formed by two of the country's main environmental characteristics - the Atlantic Forest and the Serra do Mar - and has natural settings such as parks, woods and waterfalls."

SICTUR has recently expressed more concrete interest in participating in the PES debate with the "core group" composed of the environmental secretariats and the NGOs, recognizing the importance of well conserved land for a surging eco-tourism trend. The Miringuava watershed is home to the "Wine Trail" (*Caminho do Vinho*), was identified as a region with the touristic potential in 1998, according to the local association Associação Caminho Do Vinho Colônia Mergulhão (ACAVIM). This happened during the inventory for further elaboration of the Tourism Development Plan of São José dos Pinhais. Participatory meetings with the Community took place in 1999, where the project proposal was presented. According to both the association and SICTUR, decisions on matters of tourism along the

[11] *Conselho Municipal do Meio Ambiente*
[12] *Conselho Municipal de Desenvolvimento Rural*

"Wine Trail" are made with the associates and in partnership with SICTUR (ASSOCIAÇÃO CAMINHO DO VINHO COLÔNIA MERGULHÃO, 2014).

4.2.1.4 Water Institute of Paraná

The Water Institute of Paraná (Instituto das Águas do Paraná or simply “Águas Paraná”) was created in 2009 by Paraná state law (Nº 16.242), and is linked to the State Secretariat for the Environment and Water Resources (SEMA). It replaces the Superintendence for the Development of Water Resources and Environmental Sanitation (SUDERHSA) transferring this institute's responsibilities and employees to Águas Paraná. The institute is now the executive body that manages the State Water Resources Management System (SEGRH/PR), “with the purpose of providing institutional and technical support to the implementation” of state law nº 12.726 from 1999, the State Water Resources Policy (PERH/PR).

The Water Institute is responsible for the “planning and execution of technical actions and projects for the protection, conservation, recovery and management of surface and underground water resources” with the aim of preserving and restoring water quantity and quality. In this function the role of Águas Paraná in the PES debate should be a central one, as “implementation of technical engineering services,” “dissemination of information on water resources” as well as the “preparation and implementation of the state water resources plan and river basin plans” fall into its self-declared responsibilities (INSTITUTO DAS ÁGUAS DO PARANÁ, 2018). Most importantly for watershed PES, its role in the “functioning of river basin committees” and “management of the state water resources fund,” which permeate the whole implementation process of a PES scheme, are important responsibilities, that Águas Paraná does not seem to be complying with, in the case of the Miringuava watershed.

Several of the interviewed stakeholders confirmed that the Water Institute is very poorly equipped in terms of staff and that many central officials are retiring and there are no new openings to fill their functions or pass on their knowledge. The landowners' association ASSOPAM’s representative interviewed for this research affirms that the former SUDERHSA (*Superintendência de Desenvolvimento de Recursos Hídricos e Saneamento Ambiental*) seems to be drowned out. However, there is little to no research on this topic, which is surprising, given the importance this institute could have in promoting democratic watershed governance. One of the few studies with a critical geography view on the issue is Medeiros (2011).

4.2.1.5 Public Prosecutor

As mentioned above the Public Prosecutor (*Ministério Público*), which is a federal ministry with dependencies in each state of Brazil, played a decisive role in representing the rights of the local population and checking on the compliance of the duties of public institutions. This, in the Brazilian context is of great importance, given the context of inequality (both socioeconomic and in access to information), corruption and participation in public policies. The Public Prosecutor is an institution whose function is defined by the Federal Constitution to defend the legal order, the democratic regime and the unavailable social and individual interests. It is up to the Public Prosecutor to act in the protection of civil and democratic freedoms, seeking with their action to ensure and enforce the unavailable individual and social rights. Although it is part of the Justice System, the Public Prosecutor is an independent institution, which is not subordinate to any of the branches of the Republic (Executive, Legislative and Judiciary), enjoying autonomy for the fulfillment of its functions.

In order to guarantee the fair representation of Brazilian citizens' interests by the public administration, it has been enshrined in the 1988 democratic constitution. The office has been recognized by several of the interviewed subjects as an effective branch for those functions in the PES case under investigation here. The role of this organ against or in collaboration with other public ones was (and continues to be) central to fair compensations in the expropriation process. However, the existence of this type of judicial path also seems to reinforce an attitude of public officials that facilitates their pushing away of questionings or requests for negotiations.

One public prosecutor, Alexandre Gaio, who is an individual that played a major role in bringing forth the case of the inhabitants of the Miringuava basin, unfortunately did not respond to repeated invitations to participate in the interviews for this research.

4.2.1.6 Metropolitan governance organizations

There are two main organizations that are concerned with the integration of the MRC that could take the PES debates as a concern of metropolitan integration (WEINS; SILVA; GADDA, 2018). On the one hand, the Coordination of the Metropolitan Region of Curitiba (COMEC) has been working on municipal integration issues since 1974, “to coordinate actions of public interest and to plan joint solutions for the needs of the Metropolitan Region of Curitiba (MRC),” (COMEC, 2018c) most notably the urban planning integration of public transport, but also of environmental issues like the above mentioned SIGPROM. On the other hand, there is the fairly recent initiative, called Pró-Metrópole, in allusion to a metropolitan *pro*gram that is *pro* or positive. It has been founded in 2017 and declared itself

the goal of creating a "Metropolitan Common Market of Greater Curitiba" (CURITIBA, 2017), following a predominantly commercial integration agenda, also manifested in its close relation to the Federation of Industries of the State of Paraná (FIEP).

In terms of urban planning, the SIGPROM established in 1998 by the Water Supply Law of the MRC, among others, defines new territorial planning units as well as a metropolitan water management council, and facilitates the creation of Areas of Social Interest of Occupation (*Áreas de Interesse Social de Ocupação*) and defines "river basins of interest to the MRC." These provisions give rise to the metropolitan organizations as relevant actors in the PES debate, as they also relate (even if indirectly) to the studied conflict surrounding the Miringuava dam. PES will be one possible mitigation and that will help to comply with the requirements of these laws, but also happens in response to rising demands by the municipalities of the MRC and its industries.

While COMEC already has well established partnerships with Curitiba's urban planning secretariat, the Management Committee of Pró-Metrópole is well-positioned, as it will have Curitiba's public administration represented by the mayor (currently Rafael Greca), and the presidency of Pró-Metrópole will be lead by the Secretariat of Urbanism and Metropolitan Affairs and by the Institute of Research and Urban Planning of Curitiba (Ippuc). The objectives of the initiative are presented as follows on its website:

> "To stimulate the Integrated Productive Development of the Metropolitan Region of Curitiba, by means of structured actions, attracting new investments, supporting already established sectors, increasing the possibilities of employment, ensuring the best distribution of income and the municipal collection, thus improving the quality of life of the metropolitan population" (PRÓ-METRÓPOLE, 2018).[13]

Pró-Metrópole is organized in eight Structural Working Groups: agri-food, waters and biodiversity, interfederative governance, regional integration, small businesses, productive poles, information system, and tourism. Two representatives of the waters and biodiversity working group were invited to take part in the research. One of them is also active in the Water Institute, the other in SANEPAR. The latter responded in detail via email. In their view "currently, the demands of the Pró-Metrópole are of a more strategic nature, of articulation of the Institutions and because it does not have its own budget, it seeks the technical and financial support for the execution of most of the activities through its partners." Furthermore, it has sought to take advantage of existing (and punctual) projects of the institutions involved and seeks to "leverage them in order to involve the various actors with a focus on greater articulation and integration." The stressed that the current stage (punctual processes and

[13] Author's translation

lack of integration) is “the natural and initial stage of the process [and] over time we understand and would like the process to be more integrated, robust and effective.”

The actor affirms further, that the actual work in the integration of water provision, is in the hands of SANEPAR as the main actor. This power position of SANEPAR however, as a decisive singular actor that has disproportionate leverage over how the whole integration process in the MRC will take place is an institutional risk dimension that could negatively affect environmental issues at stake (NADALIN; NETO; KRAUSE, 2013; WEINS; GADDA; SILVA, unpublished manuscript). Mendonça (2002), in a critique of Curitiba as an “ecological capital” states:

> "(...) one of the main causes of the degradation of nature and local natural resources is the watertight management of the territory. The lack of integration of objectives, plans and management action between the central city [Curitiba] and the other municipalities of the metropolitan region resulted in numerous environmental problems, which tend to aggravate the more separated and disintegrated the actions of municipal governments are” (MENDONÇA, 2002: p. 189).

The history of water management in the state of Paraná is an interesting case to study and understand the PES discussion and the metropolitan integration of the MRC in. Paraná maintained a single state company (SANEPAR) as a monopolist[14], while other states followed global trends of handing back responsibilities to the municipal level after the end of the centrally managed (civil-)military government that ended in 1985 (CASSILHA et al., submitted manuscript; WEINS; GADDA; SILVA, unpublished manuscript). A deeper exploration of this scenario is not within the scope of this thesis, but is under development for a separate publication.

When asked about the possibility of PES establishing a "rapprochement" of consumers and producers of water and food (question 4.36, Annex B), the representative says that there is interest, but the capacities of the actors currently involved (SANEPAR, IPPUC & the Secretariat of the Environment of Curitiba) added to the financial constraints already mentioned, do not allow for involvement in the PES discussion in the Miringuava at this point. They do affirm that it is necessary for other entities to get involved as well. However, considering the management model of PES in SEMMA explained in chapter 4.2.1.3 reveals that there are financial and organizational constraints at both ends. Here, the actor also expresses the ineffectiveness of existing financial resources like financial compensation, as well as state and municipal environmental funds. This information confirms an assessment about the (financial and technical) state of monitoring in São José

[14] (and arguably a mixed enterprise)

and other municipalities of the MRC by a former president of the Environmental Council (MATHIAS, 2015).

4.2.2 Civil Society Organizations

This subchapter unites a broad group of civil society organizations that includes not only NGOs and participative organs like the municipal councils that appear in the social network analysis, but also the Management Group, which has become an important forum for several of the actors from those different spheres to get together.

4.2.2.1 Management Group “Grupo Gestor”

The Management Group (*Grupo Gestor* in Portuguese) surged roughly in 2009 (according to interview data) as a communication channel and dissemination mechanism for the socio environmental work the engineering company Sociedade da Água S. A. has been offering consultancy and has executed environment and geotechnological projects for SEMA and SANEPAR, as well as SPVS for more than a decade. Even though SANEPAR had to break its contractual connection with the company, it remains an open and informal group for those same purposes. It is seen by SANEPAR as the main way to involve relevant and interested institutions and the local population and for this reason (further explored in chapter 4.2.2.1) is treated in a particular way, even though it is not considered an actor in the studied PES arrangement.

According to a communication from the State News Agency (AEN, 2009), the Management Group of Miringuava “will indicate the actions necessary to guarantee the sustainability of the region” and “proposed actions will be presented to the community in the environmental licensing process.” The communiqué also states that the already identified demands and the demands of the community and other users of the basin should guide the complementary studies to the Environmental Impact Study and the Environmental Impact Report (EIA/Rima). Further studies would be discussed at public hearings to be scheduled by the IAP.

The idea of the group, of bringing together a diverse group of actors close to the scene goes very much in line with Ostrom’s idea “of a polycentric approach, where key management decisions should be made as close to the scene of events and the actors involved as possible" (VEDELD, 2010). Complying with this function, the group requested to “consider the need for the multiple uses of water and the economic impacts on regional development and territorial organization of the municipality” (AEN, 2009).

The Management Group meets regularly every month and documents their meetings. In the field research period for this thesis, the main protagonism and organization of the meetings was the environmental education manager Daisy. She is confirmed by many of the interviewed actors as a key person in the PES implementation process and a skilled intermediary that manages to get the different sides to the table. Together with her colleague, who has been less present due to involvement in other activities, they represented SANEPAR, but showed great openness to hearing suggestions and working on handing over the *agency* for the group to stakeholders of civil society.

Alongside with them, a local organic farmer, who is a member of the APROMEL honey producer association and was interviewed for this research, led the community participation management in the group. Another important regular participant is the environmental manager Celso, who represents SEMMA in the process and was consistently named as a key stakeholder of the institutional arrangement. Marcio, the Associate Director of the Paraná Reference Center in Agroecology (CPRA) has participated continuously and persistently in the meetings during the 2007 field research period and tried to defend the organic farming issue, which is highly unpopular among the local farmers. Paulino, the representative of the Parana Institute of Technical Assistance and Rural Extension (EMATER), a state entity that works closely with the farmers of the region and plays a decisive role in the change of mentality of the farmers to accept conservation practices, while not sacrificing their livelihoods. Other regular participants came from civil society organizations, like the Rural Workers Union, Agricultural Technicians and the associations ASSOPAM and APROMEL. Photo 4 (below) shows one of the occasional meetings that were held at the construction site to be close to the affected community, and not at the Miringuava water treatment plant that is closer to the city center of São José.

Photo 4 - Group meeting at the dam construction site, 11th of June 2018. Image source: the author.

The regular meetings were used for presenting data and reports, informing about relevant events, local politics and exchanging ideas about possible alternatives and solutions to existing problems. One of the proposed ideas that was suggested by the plenary was the realization of a seminar to inform and collect opinions and visions of a broader group of residents and farmers of the affected part of the basin. This participative seminar was planned from July to September 2018.

The company “Painel Instituto de Pesquisas” from Joinville, which was contracted by SANEPAR for executing the socio-environmental accompaniment in the basin for two years started its work in October 2018, having as its first activity such a participative seminar in which a select group of dwellers of the watershed were invited to reflect about the future of their Miringuava. The Seminar “O Futuro do meu Miringuava” (see Photo 5), was organized by the Management Group and its members together with an additional support from CPRA.

Photo 5 - Poster of the seminar “O Futuro da Bacia do Miringuava” (The Future of the Miringuava basin). Image source: CPRA.

The seminar gave space for presenting data and plans from the public (city hall, SANEPAR, EMATER, CPRA as well as representatives from secretariat from Curitiba) in the morning, and consisted of a collective construction of a future vision of the vocations of the Miringuava watershed. Here, the participants were asked to discuss vocations, opportunities and problems they perceive as important in small groups of up to 8 (see photo 6). The seminar that took place in the São João Batista chapel in Colônia Avencal, in order to offer a locality close to the landowners, saw the participation of a pre-selected group of landowners, including important leading and critical figures in the negotiation with SANEPAR, like e. g. Senhor Schulis, who has been a vehement critic of SANEPAR's approach in the region.

Photo 6 - Compilation of pictures from the stakeholder seminar "The Future of the Miringuava Basin" in October 2018. Image source: CPRA.

The fact of the company (Painel) being from another state of Brazil is due to the public bidding processes and guarantees lower costs for public entities and companies like SANEPAR. It is also supposed to help combat corruption by breaking open pre-existing and unquestionable service provider deals. However, this practice has been seen critically by some stakeholders interviewed for this research, as the company is not familiarized with the basin yet and a considerable amount of time of the socio-environmental project will be spent on getting to know local conditions and understand existing social institutions and networks in the Miringuava basin.

This fits perfectly into the contributions of territorial theory discussed by Haesbaert's (2004) concept of "deterritorialization," a theme discussed in PPGTE and the research line Technology and Development. The idea that the institutions of capitalism (see also WILLIAMSON, 1985) dissolve traditional social and human-nature relations through cultural and economic homogenization can be discussed for this case. While the economic competition component (price) of the undertaking is certainly at face-value beneficial to public budget and may even contribute to avoiding local monopolies of service providers (like Sociedade da Água in the Miringuava case), the contractual basis of the relationship the company has and will have with the territory heavily influence trust relations as well as the sense of responsibility, which ultimately affects the robustness of the institutional arrangement and in last consequence the ecological, social and even economic sustainability of the PES application. The inclusion in the Management Group is a positive step towards mitigating these risks, but is certainly not free of criticism from the local population and critical involved actors, who see the PES project as an undertaking of controlling the farmers or even as a corporate endeavour to securing the land use rights to involved companies (like e.g. Boticário, see chapter 4.2.3).

As discussed in the characterization of the case study (chapter 4.1), public and civil society participation in the dispute has been sparse, and several of the disputes about delimitation and compensations have been reiterated by the responsible stakeholders to the public sphere, such as the municipality and the Public prosecutor.

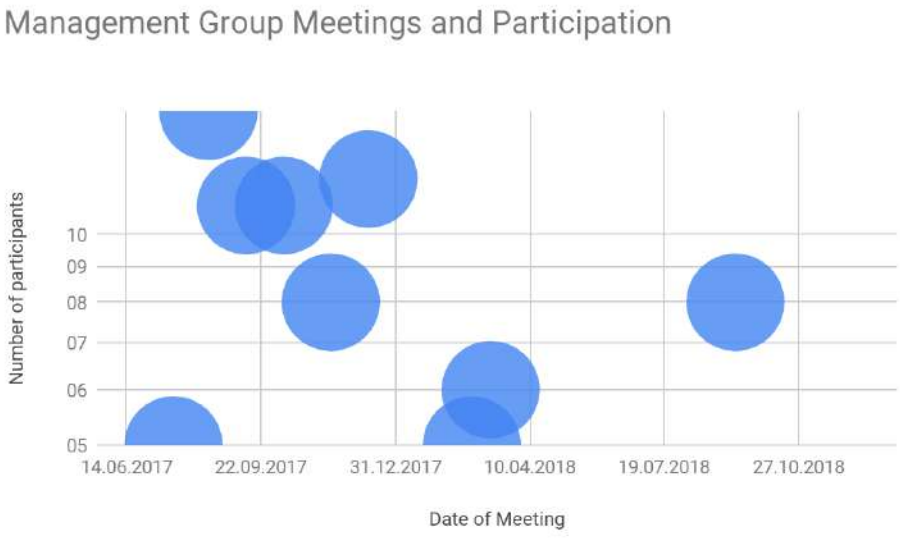


Figure 37 - Management Group Meetings and number of mentioned participants. Data source: Meeting protocols, author's illustration.

In line with observations by Medeiros (2011) and Medeiros and Canali (2012) about the meeting minutes of the SUDERHSA watershed committee, the Management Group's

protocols were analyzed for this research. Apart from the fact that they are not yet publicly accessible, they often present only a broad overview of the points on the agenda and only reveal critical information in few occasions.

Figure 37 (above) shows the meetings from 2017 and 2018 in chronological order with the number of participants mentioned (i.e. whose manifestations were documented) in the protocols. Only the first two meetings had the total number of participants documented (29 and 40 respectively). While the meetings reduced to smaller amounts of participants after the first two meetings, the stakeholders that persisted and constantly manifested their opinions stabilized at around 10.

4.2.2.2 *Municipal Councils*

This subchapter deals with the role of the two municipal councils involved in the PES debate in São José. Municipal councils in Brazil are a space of participation for (organized) civil society, that is especially important for the inclusion of participants that previously would be left aside (VIANA, 2003; WOLFE; STIFFEL, 1994 apud. MUNIZ BRONSTEIN; FONTES; PIMENTA, 2017). Mendonça and Franceschinelli (2015) name campaigns like the *#ocupeosconselhosmunicipais* (“Let’s occupy municipal councils”) that have tried to promote those forums as effective mechanisms for the participation of the public in specific decisions. However, as the interviews with stakeholders of this research have shown, and as is confirmed by cases like the one presented by Fuks, Perissinotto and Souza (2004 apud. BRONSTEIN; FONTES; PIMENTA, 2017), the councillors often become elite representatives of organizations, and even of the public service itself. Thus, the councils can actually become limited forums that are not representative of the discussion between organizations in which the direct participation of the citizen is discouraged or diluted, due to their fragile structure.

Martine and McGranahan (2010, p. 22) consider that "many of the environmental problems faced by Brazilian cities [...] have their origins in the lack of a proactive stance of Brazilian society and public power in relation to urban growth.” And Mendonça (2002: p. 189) holds that the unaligned political and spatial planning objectives that happen in this form of unparticipative management are “one of the main causes of the degradation of nature and local natural resources.” This can be affirmed for the present case study as well, and in particular for the case of the municipal councils. Initiatives like the above mentioned “Let’s occupy municipal councils” are small efforts in helping to mature the country’s young democratic institutions and stimulate ownership of society of its public and political spaces and their participation opportunities.

In the case of environmental councils, the administrative structure in Brazil is peculiar, and linked to article 20 of a resolution (nº 237/97) of the National Council of the Environment (CONAMA) and in the principle of full popular participation in the environmental law and should be a representation at a local level of what is happening at a national level (SÃO JOSÉ DOS PINHAIS, 2018b). The Municipal Environmental Council of São José dos Pinhais was created in 1996 by municipal decree and has been working relatively regularly on the basis of monthly ordinary meetings (SÃO JOSÉ DOS PINHAIS, 1996; MATHIAS, 2015). It has a public website on the council's portal of the municipality, where the protocols of the meetings help from 2015 to 2018 are digitally available. However, as of October 2018, only the protocols until April were uploaded.

The environmental council of São José is currently comprised of 26 members, half of which are from public entities. It is described as "an autonomous, permanent, consultative, deliberative, normative, auditory and recursal body of environmental actions within the Municipality" (SÃO JOSÉ DOS PINHAIS, 2018e). This inclusive character could only partly be confirmed by the interviewed stakeholders, several of whom are representatives in the council. One actor even affirmed that the councils have been effectively emptied and that the public administration does not seem to care much about the findings presented by this supposedly strong consultative organ, confirming the findings of Fuks, Perissinotto and Souza (2004) mentioned above.

Mathias (2015), a former president of the council reports about the activities of the council, documenting that it issued 160 public communiqués, held 26 ordinary and 13 extraordinary meetings in its first administration (1998-2000), 313 communiqués in its second (2000-03) and 237 in its fifth (2007-09) to denounce environmental degradation and forward them to the responsible municipal and state organs and the Public Prosecutor of Paraná. He further states that in its 17 years of existence (in 2015) the council has not been respected. "[...] proof of this is the large number of issued communiqués that were not answered by the defendant institutions, notwithstanding the Federal Law No. 12,527 [...] known as the Law on Access to Information."

Mathias further states that the end of an agreement between IAP and the Military Police's "Green Force" (*Força Verde*) at the end of 2011 left this environmental body with 520 less monitoring personnel. It now has only 150 environmental inspectors for the whole state of Paraná, which, with an area of approx. 200,000 km² has the size of Belarus or Kyrgyzstan. He further alleges that the legislative branch of the municipality, which has an environmental commission, "does not care about environmental matters" citing the lack of action on the side of local politician in applying the funds from the environmental tax (*ICMS Ecológico*, FARIA, 2018). The thirteen-page document that was presented at a plenary in 2015 does not mince words on the environmental infractions and illegal actions of the

industries in the municipality, especially that of the great automotive industry (Renault, Audio and Volkswagen).

One interviewed subject reported that these industrial interest groups are strongly represented in the public sphere of São José and politicians are favorable to investments and amplification of industrial activity in the name of the environment and at the expense of the environment. This powerful interest imbalance is also considered in the questionnaire section about pressures the involved actors find to counter-organize (ANNEX B, question 4.30). Here, some subjects that are active in the grass root civil society see industrial stakeholders and groups that defend their interest are a threat.

The Municipal Council for Rural Development was created on April 15, 2003, through Municipal Law No. 309. Its meetings took place until December 2004, but with a low frequency, characterized by a lack of meetings due to lack of quorum. As a consequence, in the period from 2005 to 2010, the Council was deactivated. With the support of FETAEP, the Emater Institute and SEMAG, the first Municipal Conference of Agriculture and Rural Development was held in April 2010, where a group of 32 farmers presented proposals identified as *green themes* for the council (SÃO JOSÉ DOS PINHAIS, 2018b). Thus, in July 2011, the council resumed its activities. Currently, according to its own description, the CMDR is fully engaged in its role of articulating the rural community with the Government with monthly meetings at the headquarters of SEMAG.

In the period of its reactivation the CMDR together with SEMAG and SEMA had a protagonist role in promoting the PES debate and the adaptation of agricultural practice in the Miringuava watershed to the demands of its growing importance as a water supplier to the MRC. However, with a change in its leadership the agricultural actors have somewhat distanced themselves from the environmental discussion, which is very probably due to the great ideological differences that these actors are confronted with when encountering NGO and environmental movement representatives like CPRA.

However, the council has sided with stakeholders like EMATER's extension department[15] and SEMAG who have defended the need to produce under the current standards of intensive agriculture for meeting the market demands of Curitiba and the greater region. This scenario is interesting in so far as the greater agricultural context in Southern Brazil (PARRÉ; GUILHOTO, 2001) presented in chapter 4.1 plays out on the lower levels and shows the complexity of a seemingly very local issue that cannot however be

[15] The central "parent organization" of EMATER has been migrating towards a more positive stance on agroecology and changes in agricultural practice like the reduction of the use of pesticides, while the outreach department is still closer to the farmers' more productivist opinion, that defends the regulated use of those pesticides.

resolved without long-term political, economic and mentality changes at the macro level. Here, the PES debate also presents itself as a deeply environmental discussion about sustainable development and economic growth and the expansion of a capitalistic logic.

4.2.2.3 Non-Governmental-Organizations

"Globalization has considerably weakened traditional governance processes. Increasing global economic integration has reduced the power of national governments while granting other economic and political actors access to the world stage" (GEMMILL; BAMIDELE-IZU, 2002: p. 2). The involvement of NGOs in politics worldwide, especially in environmental topics has been on the rise since the 1990s, seeking "involvement of a larger part of the public in issue spotting, assessment, and monitoring functions" as well as "support for knowledge generating institutions in developing countries."

It is important to give civil society a say in the building of public policies and institutions, and, as Barbieri and Ferreira (2018) point out, can, and has to lead to "new institutionalities" in political struggles faced in the Anthropocene, as they provide long-term commitment that goes beyond the logic of political cycles.

As has been discussed above, the role of NGOs in the governance of environmental policies in the case study of the Miringuava watershed follows global trends. The active and promoting role of the three NGOs that are actively involved in planning and executing the measures to make PES in the region work, is met with open arms by public administration. However, the involvement of highly specialized organizations is not without criticism and urges to a discussion of possible power imbalances that exist between formally organized and informal or only loosely organized (rural) stakeholders.

Society for Wildlife Research and Environmental Education (SPVS)

The Society for Wildlife Research and Environmental Education (SPVS) was founded in 1984 by researchers and professionals and was recognized in 2001 as a Civil Society Organization of Public Interest (OSCIP), a qualified institution of the third-sector. Its main focus in projects are new alternatives in the area of nature conservation. The self-stated mission of SPVS is to "work for the conservation of nature, through the protection of native areas, environmental education actions and the development of models for the rational use of natural resources". Its assembly is formed by SPVS members, the founders of the institution and professionals, researchers as well as society leaders who are appointed by the partners themselves based on relevant work that they do for the cause of nature conservation over time (SPVS, 2018).

SPVS strategy is aimed at the expansion and replicability of actions directed to the maintenance of natural heritage and biodiversity. Its work is carried out in joint actions with companies, public institutions and the third sector, aiming at influencing public policies and seeking to demonstrate how quality of life, economic activities are dependent on the existence of well-conserved natural areas and the conservation of biodiversity. The organization works closely with the scientific community, so its project correspond to current issues and productive activities, people's lives and business sustainability (SPVS, 2018).

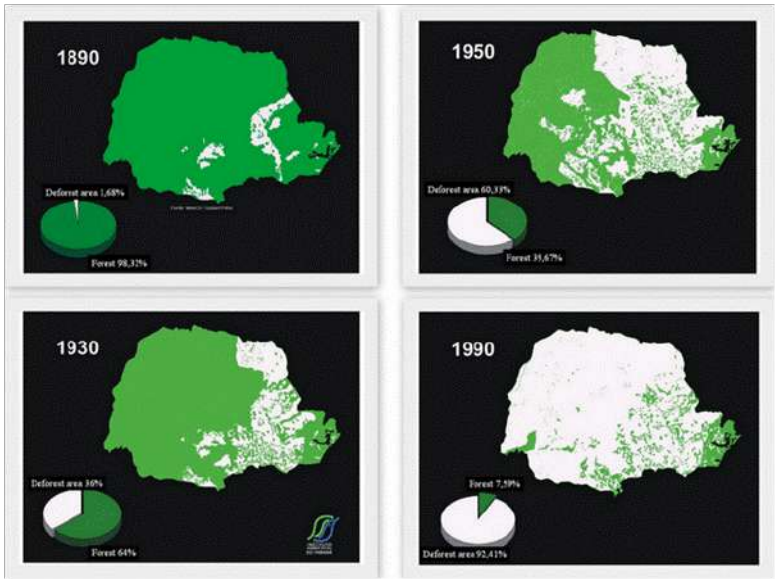


Figure 38 - Involution of forest cover in Paraná. Source: GUBERT FILHO, 1988; ALVES, 2013.

Figure 38 shows a graph from a IAP and ITGC study by Gubert Filho (1988) updated by Alves (2013) that SPVS uses in many occasions, exercising its NGP function of bridging knowledge and communicating public and scientific data with the general public (GREEN et al., 2015). The organization's experience and broad cooperation with the scientific community, other NGOs as well as local communities, SPVS has managed to get a stance as a respected actor in conservation and environmental education. Several of its projects have received international funding. Its approach to training local public school educators to serve as multipliers that inform about the importance of intact ecosystems is one of the most important initiatives in the region for the protection of the often overlooked Atlantic Forest biome (FERRETTI; BRITEZ, 2006).

The organization is involved in a first business case with an international tobacco company was one of the first cases in Brazil that have had the popularization of economic valuation of ecosystems for businesses as a major goal (SPVS, 2015). Following this initiative, SPVS has been involved in the PES initiative in the two municipalities of the MRC that provide most of the region's drinking water, Piraquara and São José dos Pinhais

(BRUEL et al., 2016). The expertise the organization has from its accompaniment of environmental projects in the mountainous region of the Serra do Mar have contributed to the stakeholders being a key provider of information and intermediary, as suggested by Gemmill and Bamidele-Izu (2002). In this function, SPVS has been participating in the core group of stakeholders in São José who have developed the legislation and accompany eventual necessary interventions and will be part of the planned Strategic PES Management Group (UGE, see chapter 4.2) in the municipality.

The project "Biodiversity Condominium" (*ConBio*) encompasses several of the initiatives within the urban environment of Curitiba and recently also its metropolitan region. The NGO has managed to attract financing from big international donors for its PES initiatives like the Caterpillar Foundation, the HSBC Water Programme, the Pan American Development Foundation and the Brazilian Socio-Environmental Stock Exchange of Bovespa (SPVS, 2016). The project has also cooperated closely with several landowners who jointly founded the Association of Protectors of Green Areas of Curitiba and Metropolitan Region (APAVE) in 2011. The role of SPVS in the promotion of integration meetings of the owners of natural areas and offering technical support has already sparked the interest of some landowners of the Miringuava basin.

Boticário Group Foundation (FGB)

The Boticário Group Foundation (FGB) was founded in 1990 as one of the first institutions linked to the private initiative focused on nature conservation in Brazil. The foundation first carried out activities with the support of initiatives from other institutions and became one of the main funders of environmental projects in the country, operating in all regions of Brazil and executing own projects. In a program of Natural Reserves, they conserve more than 11,000 ha of Atlantic Forest and Cerrado, the two most threatened biomes in the country. We idealize and execute initiatives such as Oasis, pioneer in Payment for Environmental Services in Brazil, Nature Stations, always seeking to mobilize society for the cause of conservation. All this to show that the environment is not only an inspiration, but a reason to move forward.

The interviewed stakeholder showed great amounts of technical knowledge on the PES issue, mostly for the case of Brazil. Their knowledge of positive arguments by far outweigh their knowledge of possible risks and criticism that are raised by landowners, like the fear of some farmers that PES payers will have control over their land are regarded as invalid and as a lack of knowledge that needs to tackled through specific correct information on PES.

The categorization of FGB as an actor of civil society is not unproblematic (CALONIO, 2000), as has been pointed out by several of the interviewed stakeholders for this research, as the group they belong to acts in the cosmetics industry and does have strategic interests in this process, both in terms of image and marketing, as well as in terms of the actual natural resources. It thus represents a special interest group. This is further strengthened by their financing, communication and scientific output related to the Oásis methodology. However, as the foundation's activities resemble the other two main NGOs' (SPVS, TNC) activities, they were here considered as part of NGOs and civil society.

The foundation has a been heading the initiative of the technical-scientific Brazilian Congress of Conservation Units (CBUC) for more than twenty years, which is in its 20th edition in 2019. The event serves as an annual opportunity for FGB to aggregate the stakeholders of its *Oásis* Network, through which it promotes the use of its ES valuation methodology. The foundation has seven structured PES programs in its own operation (see figure 39). It reports to have 19 formalized partnerships for PES, 50 processes for the construction of public PES policies, 28 legal norms concerning PES that have been elaborated and sanctioned and 5,000 ha in natural areas under PES contract in more than 500 contracted properties that indirectly benefit an estimated 8 million people (FGB, 2018b).

Figure 39 - Timeline of PES projects by FGB. Source: FGB, 2018b.

As a result of this continuous work, several interviewed stakeholders, including FGB's representative estimated their influence on the PES as fairly high, which is not surprising, considering that the foundation provides a lot of technical knowledge, offering the valuation methodology and a vast network for the exchange of knowledge. Kolinjivadi et al. (2017) affirm that such influential stakeholders that are part of an epistemic community would try to establish "PES as a neoliberal performative."

These considerations are an interesting aspect to monitor in the future development of the PES arrangement in São José. Research on powerful actors in forest governance like Maryundi (2011), Schusser et al. (2015) and Bach (2016) have pointed to the possible effects on the ecological sustainability of the arrangements. Schusser et al. (2015: p. 100) conclude that powerful actors like forest administration, forest user group representatives, but also donor organizations, politicians and traditional community leaders, "have a

significant influence on the outcomes of community forestry for the local users." More specific empirical research on this issue would be needed to affirm that FGB has a singular power standing in this arrangement, but it can certainly be concluded that the actor has great control over the process due to its ownership of the processes' tools.

The Nature Conservancy (TNC)

The internationally present non-governmental organization Nature Conservancy pursues the fairly broad mission of ensuring "better quality of life for future generations" through "conservation of the environment, in favor of nature, but also of humanity". It has been acting for 64 years and is present in 72 countries, where its 600 scientists and 1 Million members have contributed to preserving more than 55 million ha of land. In Brazil the organization has been working for 28 years (TNC, 2018a).

TNC has been working with the promotion of conservation finance, markets and payment for ecosystem services. Its typical NGO role as a provider of information and knowledge networks becomes evident in its cooperation with organizations like the Katoomba group and the International Institute for Environment and Development (IIED). One of its projects, "Conservation Gateway" brings together a broad array of information and reports on the issue. This is also a role it clearly plays in the case of the Miringuava PES arrangement. Here, the contribution is rather focussed on technical knowledge and offering exchange and expertise, as the NGO has been involved in many of Brazil's most prominent PES cases, like the pioneer in Extrema, Minas Gerais and worked with the World Bank financed PES case of the state Espírito Santo (PAGIOLA; VON GLEHN, 2013; ALMEIDA, 2016). The interviewed actor proudly stresses the success of their PES applications: "in Extrema people are lining up to join!"

The interviewed stakeholder, who was involved in all of TNC's PES projects shows the greatest knowledge on the issue of all interviewed stakeholders, also on the international level. It here represents a typical case of a globally networked NGO that promotes an issue with civil society (CALONIO, 2000).

The strategy of the NGO that culminates their efforts in promoting watershed and headwaters conservation Green-Blue Water Coalition (*Coalizão Cidades pela Água* in Portuguese). A study by TNC and several partners (KROEGER et al., 2017) points out the high opportunities for investment in green infrastructure and its very good relation in terms of risk mitigation, which would be around 16 USD per invested dollar. The interviewed actor however pointed out the extremely high cost of information, specifically in Brazil, known popularly and especially among business owners as "*custo Brasil*" (considering corruption and a different logic of action). They do also point out on the other hand, that, as they firmly

believe in the positive long-term effects that will eventually result also in financial returns, so "we have to sit down and do it" (TNC, 2018b/c).

Figure 40 shows a Latin America map of the Green-Blue Water Coalition project. According to the project description "the population is not yet aware of the full consequences of a water scarcity scenario" and the project "is focused on the preservation of watersheds – green infrastructure – to help ensure water to cities, and balance supply and demand." (TNC, 2018c). Curitiba is listed as the Latin American city that would most benefit (in terms of cost-benefit) from investments in green infrastructure.

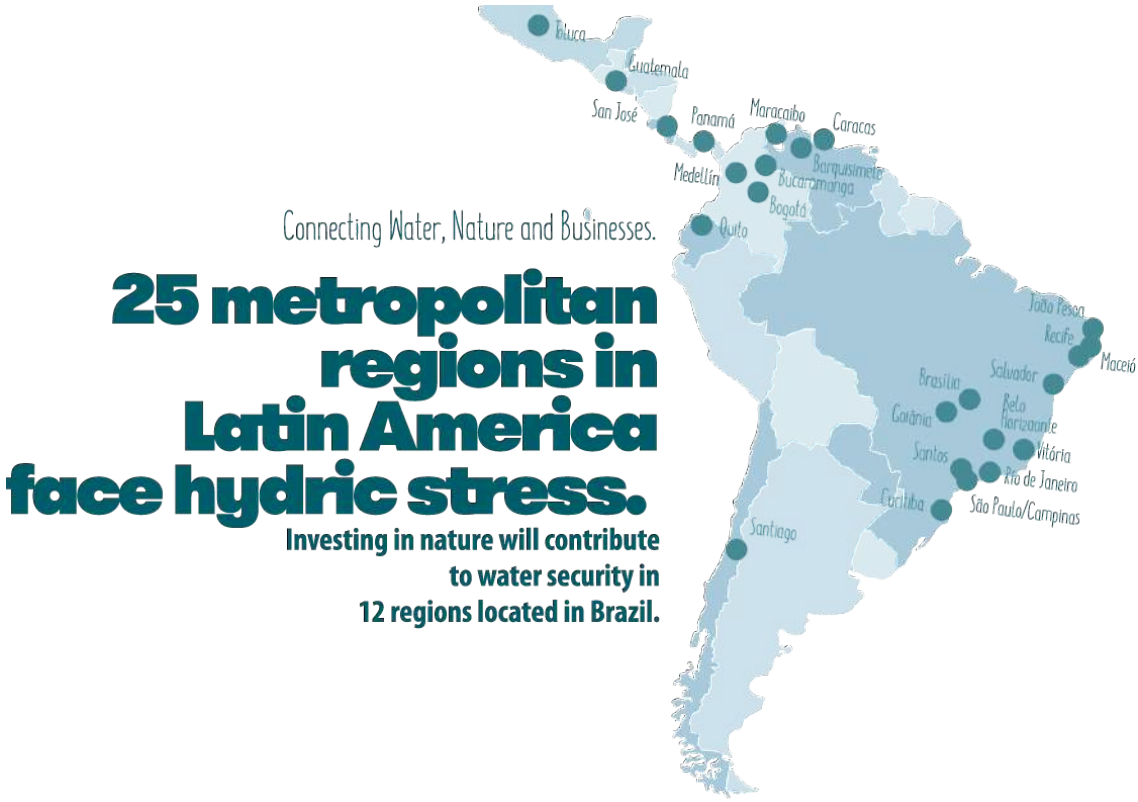


Figure 40 - Latin America map of the Green-Blue Water Coalition. Source: TNC, 2018c.

This finding seems surprising considering the year-round rainy climatic conditions of the Serra do Mar and the Atlantic Forest biome Curitiba is situated in (see figure 21, page 51). Also, considering the other Latin American cities mapped for the project, e. g. in the Andean mountains of Columbia or the Northeast of Brazil, where water is scarce. However, according to the interviewed stakeholder from TNC this is due to the geological conditions of the First Plateau of Paraná, its sedimentary substrate soil, and despite Curitiba being rain-rich. The assessment is based on the study “Beyond the source” by Abell et al. (2017) that considers investment return.

At this point, TNC's practical, technical and affirmative view of green infrastructure in general and of PES in particular becomes clear, when situating it in the discussed literature in chapter 2.2.3. Their role as a promoter of the policy tool from a market expansion of the inclusion of nature's services in capitalistic value systems does not necessarily presuppose any corporate interests behind their actions, but does spark criticism among some critical actors, also among the ones interviewed for this research. However, the role of TNC in this process has been very closely linked to the central working group, and as the data from the SNA has shown (see chapter 4.4), the stakeholder is perceived less as a central stakeholder in the PES process in the Miringuava basin than the other two NGOs.

Furthermore, TNC works as an integrator between public and private sphere as well as with the scientific community, making wide use of and communicating e. g. data produced for the Brazilian Ministry of the Environment (2017, figure 41 below) that highlights priority areas for conservations of threatened biomes. The remaining areas of native Atlantic Forest along the Brazilian coast are a focus for TNC, with 10 of the 25 cities of the Green-Blue Water Coalition (see figure 40, above) situated in what is considered Brazil's biome that is most threatened by urban growth (TORRES; ALVES; APARECIDA DE OLIVEIRA, 2007; MMA, 2010/2017; JOLY; METZGER; TABARELLI, 2014; WEINS et al., 2017).

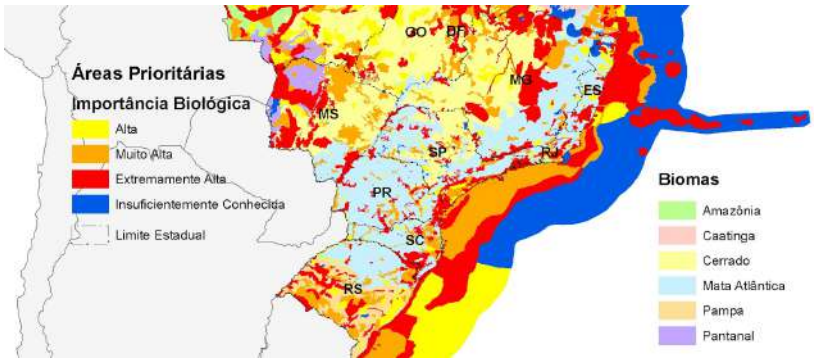


Figure 41- Maps excerpt of Priority Areas for Conservation, Sustainable Use and Benefit Sharing of Brazilian Biodiversity. Source: MMA, 2017.

Highlighting recent experiences in the municipality Jaguariúna in state of São Paulo, the interviewed stakeholder affirms that open cooperations with companies like the Brazilian beverage group AmBev have been able to effectively involve the private sector, showing "PES as a good tool for guiding the conversation on integrated solutions" as well as resulting in rich experiences to be shared with other municipalities (EMBRAPA, 2014; own interview data with TNC).

The actor further argues that PES in the rural and peri-urban sphere and particularly in the Miringuava case is a "form of aggregating technical knowledge on the properties" which helps in the generation of an awareness for conservation. Mapping and assessments

of this data helps not only the public, but also the landowners themselves, as they get engaged. When asked about PES as an evolution and overcoming of command-and-control approaches to conservation, the actor states: "command-and-control stops to exist when there is engagement and tends to be less necessary," stressing the importance of outreach work like EMATER. The actor affirms that "IAP is very far away," so local PES arrangements bring this (advanced) approach much better, as there is trust and proximity with EMATER.

Finally, the interviewed stakeholder stressed once again the importance of broad involvement, as without financial sustainability (i. e. disengaging payments), in the long term the PES application might become "its own enemy." Given that in Brazil "forest doesn't cost anything," deforestation, particularly in initial stage forests is cheap. PES here enters the stage as a possibility for landowners, who should already be complying with existing laws, to catch up, and for the public to incentivize this "correct behavior." The interviewed subject explicitly recognized the importance and political character of the arrangement that may be subject to decisions by the board of directors of SANEPAR or SEMA. In their very circumspect and farsighted view of PES, the actor also points to the dilemma of a power imbalance between urban and rural that plays into the debate, particularly in the peri-urban. "The guy in the rural environment also wants" what the increasingly urban lifestyles promote through the media, which is in stark contrast to the ever increasing amount of environmental restrictions impose on them. To them it is clear that, "if we were more correct" - alluding to the lax with compliance of Brazilian laws - the situation of deforestation would not be the way it is today, as forest and watershed protection policies have been in place since the 1940s and have had great attention ever since their two modifications of the Forest Code (see e.g. AMIGO, 2017; AZEVEDO et al., 2017).

4.2.2.4 Associations

The Miringuava basin is a region that has long been a region of traditional family farming and its cultural characteristics of European settlement from the 1880s onward makes it a particular field of analysis for its social and political analysis. This is of particular interest as pointed out in the characterization of the area in chapter 4.1 and to the theoretical dimension of cultural factors in socioecological systems as discussed earlier by Redman, Grove and Kuby (2004).

The field work for this research on the institutional dimension of PES in the Miringuava watershed has led to several interesting findings on the political and organizational dynamics of an environmental issue in the context of a young democracy that is in its maturing process. Thus, participation factors, which are a key question of this discussion, have shown a particular relevance in the global political scenario, and

particularly in the case of Brazil in the second half of 2018, when the country democratically elected a far-right candidate whose main discursive argument was strong authoritarian leadership.

This scenario is, in part, in contrast with the demands of the local population, but also calls on traditional elements of the local community. While there is a great number of associations, unions and cooperatives, it became clear here that (with few exceptions) their bargaining power as well as organizational capacities are fairly weak. The case study of participation in the PES policy exemplifies these deficiencies in an exemplary manner.

For this research, responses and interviews were obtained only from three of those associations, namely ASSOPAM, APROMEL and RedeEcoVida, while FETAEP, CopaSol, Cooper São José, CLAC and the churches (as community representatives) were not available for participation. Each of these actors will be described in more detail in the following.

Understanding the role of these collective organizations, unions and associations in theoretical terms of the discussion concerning participation in chapter 2.4 of this thesis, and particularly in the context of STS studies, these could provide a ampler and lasting function in democratic society. With reference to Feenberg (2002) and Marx and Smith (1994) De Puppi (2015) affirms that public policies will fail, if they do not address problems of labor relations, education, and the environment. She further states that this problem is not necessarily related to any specific technology or science used to base them on, but to the undemocratic values that govern our technological development model, ultimately invisibilizing actors like these.

ASSOPAM

The Association of Landowners, Residents, Breeders and Farmers of the Miringuava River Basin of São José dos Pinhais (ASSOPAM[16]) is an association of residents of the whole watershed that represents a very wide and diverse range of individuals. It is made up of 70 families, most of which are family farmers. Six of the families were directly impacted by the Miringuava dam construction and had to be moved because of the planned reservoir.

According to one representative of the organization, ASSOPAM has been an active articulator and defender of the interests the dwellers. The actor named several earlier popular movements, which ASSOPAM was inspired by. They highlight the role of the Environmental Law professor and assemblyman Vitório Sorotiuk, who signed the Decree that created Private Reserve of Natural State Heritage, participated in the advisory team to

[16] By the initial of its name in Portuguese *Associação dos Proprietários, Moradores, Criadores e Agricultores das Áreas da Bacia do Rio Miringuava de São José dos Pinhais*

the Committee of the Legislative Assembly of Paraná that drafted the Environment chapter. He further authored more than a hundred Public Civil Actions in defense of the environment for NGOs (see photo 7, below), as well as conflicts concerning environmental protection and irregular housing, which later granted him participation in the National Council of the Environment (CONAMA) (SOROTIUK, 2011).

This historical context of involvement, in which several of the dwellers of the Miringuava got involved and (according to another interviewed stakeholder from a union) recognized their rights and the possibilities of defending them. In the case of the construction of the Miringuava dam, which goes back to the year 2000, already two judicial actions and five tributary audiences with the community were yielded by 2007. ASSOPAM has thus managed to halt and alter the original project that SANEPAR had planned, with the dam reaching all the way to the Murici church (see figure 24, page 69). Approximately 300 dwellers of Colônia Avencal will be directly affected by the construction that ultimately was declared legal through State Decree 5,640 from 2002. Another 57 families who are not, or only partially affected by the dam will face changes to their routines due to the new landscape. According to Fernandes (2007) the required compliance with a number of restrictions made by the Environmental Institute of Paraná (IAP) are what the dwellers are most afraid of, as they have no control over them. Even though they are going to be affected only indirectly by the changes in the land use and activities of the basin, their livelihoods are jeopardized through this project, and would have been even more, if it was not for the involvement by organizations like ASSOPAM (FERNANDES, 2007).

Photo 7 - Tree planting initiative by NGOs with involvement of Vitório Sorotiuk. Image source: SOROTIUK, 2011.

According to the president of ASSOPAM (as cited by FERNANDES, 2007), Alceu Carlos Schulis, who lives in the region for 40 years, the dam will flood an area of 4,1 million square meters. "About seventy families will be directly affected by the construction of the

dam, but the approximately 1,000 families that belong to the community of the colony will also be indirectly affected," he says. "Rural workers, who have little study and do not know how to do anything but tinker with the land, will be unemployed because the area to be planted will be greatly reduced." However, “a study of the economic impact that the dam will cause has not been done," argues environmental lawyer Vitório Sorotiuk (FERNANDES, 2007). Suzana Albuquerque, a property owner and settler in Muricy for forty years, claims:

> "... the dam's construction process is taking place in an authoritarian manner and without the participation of the local population and representative entities of the farmers."
> *Landowner Suzana Albuquerque, Colônia Murici* (TRIBUNAPR, 2002).

Schulis further states his concerns about the necessary changes in agricultural practice, like the use of pesticides for which he sees “risks [of] having to be measured with medicine caps. Fish tanks, only with permission of the Pope. Dairy cattle, no way. Swine breeding, only if it is in another parish.” His perception of injustice also lies in the compensations: "What about the people who only know how to do this? We should receive royalties from the dam" (FERNANDES, 2007).

For the proposed alternative, organic farming, “it is rare to find those who clap for the idea.” (FERNANDES, 2007). This is so, also as there is more to think about, such as the requirement of a reforested margin of 100 meters around the dam's water slide. The standard will require decreasing area for agricultural activities, and for some might mean having to leave the Avencal village forever, in search of less restrictive areas.

APROMEL

The Association of organic and honey producers of São José is a recent *grass root* initiative of farmers in São José who understand their role as a promoter of awareness and for changing habits in conventional agriculture. The interviewed stakeholder argued that, while the Miringuava basin is home to more than 500 families of farmers, almost all of them use conventional methods, a lot of pesticides and do no or very little management of their soil, contaminating and silting the Miringuava River and its tributaries. He reports to know only three farmers in that region who are apply agro ecological practices. As SANEPAR's water intake for human consumption is located in São Marcos, 12 km from the construction site of the dam. He describes his goals and motivations in the following way:

> “We need to make the population aware that there are other forms of production without having to attack and pollute the environment. The

PES would be one of the ways to help them in the transition to agroecology." *Helison Herz Girardello ("Jatobá") of APROMEL.*

The statement makes clear, that APROMEL is aligned with the central (urban) forces (such as CPRA) that want to promote agroecology in the basin. However, while being - at least initially - positive towards PES, the approach SANEPAR and other big involved stakeholders are taking is being observed critically. In contrast to ASSOPAM, APROMEL is taking a more proactive stance. The interviewed stakeholder "Jatobá"[17] is a leading diplomatic figure in the Management Group, where he not only notifies and motivates about the meetings, but also shows a strong role as a mediator, alongside SANEPAR's environmental managers Daisy and Maurício.

Photo 8. General assembly of APROMEL in April 2018. Source: APROMEL, 2018.

The small association (see photo X) is part of the EcoVida Network (*Rede EcoVida*), which is formed together with other small associations. They support each other in the provision for clarifications and help in the moment of what they understand as an agricultural transition.

Rede Ecovida

[17] The nickname Jatobá was given to Helison Herz while he was living and working with different native tribes of the region and is the popular Brazilian denomination of the West Indian locust tree (*Hymenaea courbaril*).

The network “Participatory Certification Association Ecovida”[18] emerged from a recognition and common historical identity of initiatives of several NGOs and organizations of farmers in the South region of Brazil. It was officially founded in 1998, as a result of the articulation initiated years earlier by these entities. Currently, it has 27 regional centers, covering 352 municipalities and works with approximately 340 groups of farmers (about 4,500 families) and 20 NGOs. Ecovida organizes more than 120 ecological free trade fairs and other forms of commercialization for agro ecological products (REDE ECOVIDA, 2018).

According to Marfil (2013, see figure 42) the network has several nuclei which are made up of sub-groups that represent a small family farmer community. They are active in the three southern states of Brazil: Paraná, Santa Catarina and Rio Grande do Sul.

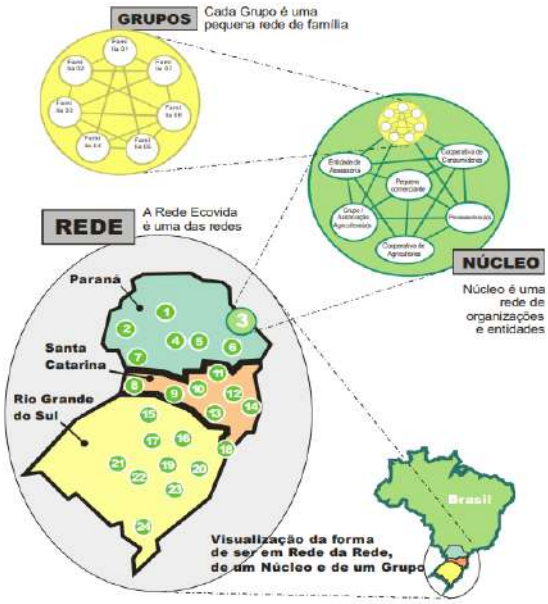


Figure 42 - Organizational structure of Ecovida Network. Source: Marfil, 2013.

Through the connections with other nuclei in the network, farmers get access to an even broader consumer market of their organic produce that reaches all the way into the state of São Paulo, and Curitiba is an important knot in this network (see figure 43, below). Even though the network is relatively recent and organic farming is still a niche market, Paraná already has the biggest concentration of certified organic farmers (CPRA, 2017). Their very active networking and information activity is also reflected in the data for the SNA of this research, where the interviewed stakeholder reported to be very connected, presenting an extreme point in the data. In fact, since the involvement of CPRA and the few but active farmers in the Management Group, the conversation has been quite favorable towards agroecology, which is a view that SANEPAR’s environmental managers support

[18] Associação Ecovida de Certificação Participativa in Portuguese or simply Rede Ecovida

Figure 43 - Map of Routes of the Ecovida Network's marketing circuit. *Source: Marfil, 2013.*

Eventually, several of the interviewed actors from the technical field said, they hoped the demand for this kind of product will rise and inevitably make organic farming the standard production method. However, as could be read from the results of the database (see chapter 4.1) of the diagnostic study on the socio-economic conditions of the landowners, this scenario is still far from becoming a reality. The great majority of them does not make use of organic farming techniques, and only considers different crop planting in order to improve yields. The use of the "isopleth" (*curva de nível*) technique has been pointed out by some technicians as an important step in the right direction.

Other Cooperatives and Unions

The cooperatives *COPASOL, CLAC and CooperSJP* as well as the union *FETAEP* could not be interviewed for this research mostly due to time constraints and the difficulty of finding contact and available information on them. Most of the organizations do not have their own websites and the email addresses or phone numbers provided directly or through directives are faulty or the researcher did not get any return through those channels.

In interviews with other stakeholders, these organizations generally did not evidence many interactions on the PES issue. Furthermore, representatives of the organizations close to these cooperatives and unions that were interviewed affirmed that the cooperative organizational capacities and unionization are a problem in the region. One stakeholder even went as far as saying that "they do not really exist, because they are so weak."

Only the employer's union (*sindicato patronal*) was highlighted by one stakeholder as "more frequently organized," while affirming that the workers' cooperatives and associations do participate regularly in a more confined array of issues more closely associated to agriculture as well.

Churches

One important organizational dimension of civil society that only became more clear during the field research period, were the different churches in the region. Since the population is very religious, the daily Mass and religious festivities have great influence on the population and are an important communication vehicle in the communities. This aspect was known to companies that work in the region, like Sociedade da Água. SANEPAR, who continued the socio environmental work in the region with a new arrangement and a company from another state of Brazil, however, needed to learn in the process of the Management Group, that without consent of the religious authorities, the population would not participate in the discussion.

The landowners' associations' meeting are regularly held in the Avencal church, however, the interviewed representative of ASSOPAM affirms that in terms of PES there is no involvement of the church yet. Following these findings, comments from the associates and the new socio environmental company (Painel), the seminar (see chapter 4.2.2.1) and subsequent meetings of the Management Group were transferred to be held at this church, and the meeting time was changed to the evening time, in order to make it more accessible to the local farmers who had great difficulties coming to the center of São José during commercial working hours.

4.2.3 Private Sector

The involvement of the private sector in the PES arrangement of the Miringuava watershed is still in a very initial stage, but can be expected to grow, once the payments are reliably regulated and necessary management structures (UGPs) are in place. The main private actors so far either work as service providers to the state for a specific part of the project and have no strategic say (Painel, Sociedade da Água), or are intertwined with private companies (FGB and FIEP). It is, however, important to highlight the indirect involvement in the private sector and in terms of knowledge generation and market creation, which will end up having an influence on the PES arrangement and its workings.

Kolinjivadi et al. (2017) sum up the view of several authors (ADGER et al., 2001; MACDONALD, 2010; HOLMES, 2011; FAIRHEAD et al., 2012; IORIS, 2014; PASGAARD et

al., 2017) cited throughout this text, making a perfect link with the adopted analytical STS view and the methodology applied here for the purposes of the discussion of institutional arrangements:

> "The attempt of PES practice to perform within neoliberal logics does not depend on a single actor or a single definition over any other, but on networks of entrenched or even hegemonic socio-cultural, political, and institutional practices which pre-select possible imaginaries of human-nature relationships."

The service and contracted companies like the local Sociedade da Água S.A. from Curitiba, who used to be active in the region for SANEPAR and continues to work for SEMA, or Profill S.A. from Porto Alegre and Painel Instituto de Pesquisas from Joinville, who conducted interviews and data analyses, entered the scenario through public bidding processes and do not have any control or strategic say. This was affirmed by one interviewed representative, who reports to be merely executing their work according to what is asked from. Their knowledge on alternatives and influence on details of the process are minimal.

The dynamics of capitalism and its impacts of territorial governance can be well felt in the case of the contracted service companies for the socio-environmental reports and accompaniment are quite visible. The Research Institute Painel, who entered the PES process during the field research period in October 2018, and was contracted for working with the population for two years, can be discussed within the base theories used here. Both within neoinstitutional economics, as well as in STS, the economic relation of the company (and others) can be seen as an expression of what Haesbaert (2004) conceptualizes as "deterritorialization," a temporal, unpersonal, not binding one. This aspect of the company's work influences directly what is described by Ostrom (1990) in her fourth institutional design principle, in which monitoring should be executed by accountable local stakeholders, which is not the case here.

On the other hand, the company brings specific knowledge from other localities that could benefit the PES process in the Miringuava basin. A case in which they have worked with protests surrounding a reservatory in the Itá county, state of Santa Catarina and a Social Diagnosis of Childhood and Youth in Curitiba could bring relevant contextual knowledge and techniques to the process (GAZETA DO POVO, 2017; PAINEL, 2018). However, in the data and statements that were collected for this research, the company has been seen as "not very present yet," but which would probably change, as the company promised to rent a house in the area to accompany the process from as close as possible.

FIEP and other industries

The Federation of Industries of the State of Paraná (FIEP) has appeared early on in the research on PES. The federation was created in the 1940s with the goal of coordinating, protecting and legally representing the various economic categories of the industries in Paraná. The list provided by the central strategic group (UGE) names them as a key stakeholder for possible future financing and certification of PES in the Greater Curitiba area. However, as mentioned above, since the process is not yet definitely regulated and organized yet, there is only minimal conversation with this actor as of now.

The TNC stakeholder sees PES as a good tool for guiding the conversation on conservation with FIEP, who has been involved with several international and Brazilian actors that were categorized as affirmative Coasean in the literature review of this thesis (chapter 2.2.3). They have been developing partnerships with TEEB and CNI, a Business Initiative on Ecosystem Services (TeSe) and carried out a training in Valuation and Business Management of Ecosystem Services (FIEP, 2017).

The critical involvement of FGB as part of the cosmetics group Boticário Ltda., a group with national operations and headquarters in São José, has been mentioned above and has been pointed out by several interviewed stakeholders. Here, we opted for defining the foundation as a civil society actor, due to its clearly defined tasks and acting so far. However, it has to be recognized that this stakeholder has commercial and brand image interests as its products benefit from an ecological reputation. The close association of the foundation with its corporate counterpart is a clear marketing strategy, but that according to its staff is not intended and never used publicly.

5. RESULTS

This chapter presents the results of the analysis of the eight design principles and the social network analysis (SNA). The methodology chosen for this research involves a qualitative part, in which an intentional population of 15 PES stakeholders (out of a universe of 38) were asked to give their views and relate their experiences and practices in the institutional arrangement and the situation of the case study, answering a semi-structured questionnaire. The questionnaire is based on issues concerning landholder participation raised by Zanella et al. (2014) and was combined in this thesis with the SNA technique and Ostrom's eight design principles for institutional robustness.

The theoretical research on participation aspects in the institutional arrangements of PES worldwide has shown a significant blind-spot on pre-existing social organization, as well as historical dimensions and power relations (see chapter 2) that present considerable risks to the achievement of the promise of conservation policies like PES to contribute to local sustainable development (SCHUSSER et al., 2015; SILVA, 2006). Martine and McGranahan (2010, p. 22) affirm that "many of the environmental problems faced by Brazilian cities [...] have their origins in the lack of a proactive stance of Brazilian society and public power in relation to urban growth." For this reason, we opted for the application of a mixed qualitative and quantitative approach to responding the objectives and to answering the general objective of characterizing the PES arrangement in the Miringuava basin.

5.1 INTERVIEW DATA

From a total of 38 organizations, 15 representatives of 14 of them[19] provided responses to the questionnaire. 10 were able to participate personally, six used a provided online interface to take part in the interviews. The questionnaire that was divided into four specific sections and a set of 5 additional final questions. Each section has 7-8 questions, totalling 36 when considering the extra questions, which were not responded by all participants. The interviews were conducted between August and November 2018.

After three preliminary interviews with stakeholders in the field, from the service company Sociedade da Água, FGB and a representative of SANEPAR together with a group member of APROMEL, the questionnaire was methodologically and contextually adjusted. These preliminary interviews gave a glimpse in the much higher importance of the organic vs. conventional farming debate that was not deemed as relevant to the PES debate, based on previous documentary analysis. The issues showed to be relevant both as a production

[19] One interview was conducted with two stakeholders from the same organization at the same time.

technique integrated with the conservationist ideas of the PES programs, but also as a tool for environmental education.

Even though race and gender aspects are not an explicit feature of this research, since those issues are an integral part of the STS debate and do influence both science and policy, the collected data also includes gender, race and age of each participant and should be briefly discussed here. Furthermore, it has to be recognized that both scientists as well as their subjects are partial and their views do reflect existing power relations. It does without saying, that we understand that there is no such thing as neutral science, understanding this context (VARSAVSKY, 1969; HARAWAY, 1995; CUTCLIFFE, 2004; LIMA FILHO; QUELUZ, 2005). We recognize that this perspective needs to be considered and discussed more, and there is a growing body of research and practical guidance on those issues (CEPF, 2018).

Given that this research worked with an intention and unrepresentative sample of the population, noting that 100% of of the interviewees declared themselves as white, could hint to the disproportionate number of whites that are in decision making positions and that do not represent the (affected) population in an equal manner when compared to the region's demographic characteristics (SCHIEBINGER, 2014; KENT; WADE, 2015). Considering demographic data (see figure 44) from the Brazilian Institute of Geography and Statistics (IBGE) and the Public Prosecutor of Paraná (MPPR), Curitiba's population (total 1,751,907) is about 78% white, 17% *pardo*[20], 1,4% Asian and 0,14% indigenous. The population of São José 73% white, 23% *pardo*, 0.65% Asian and 0.13% indigenous (MPPR, 2010).

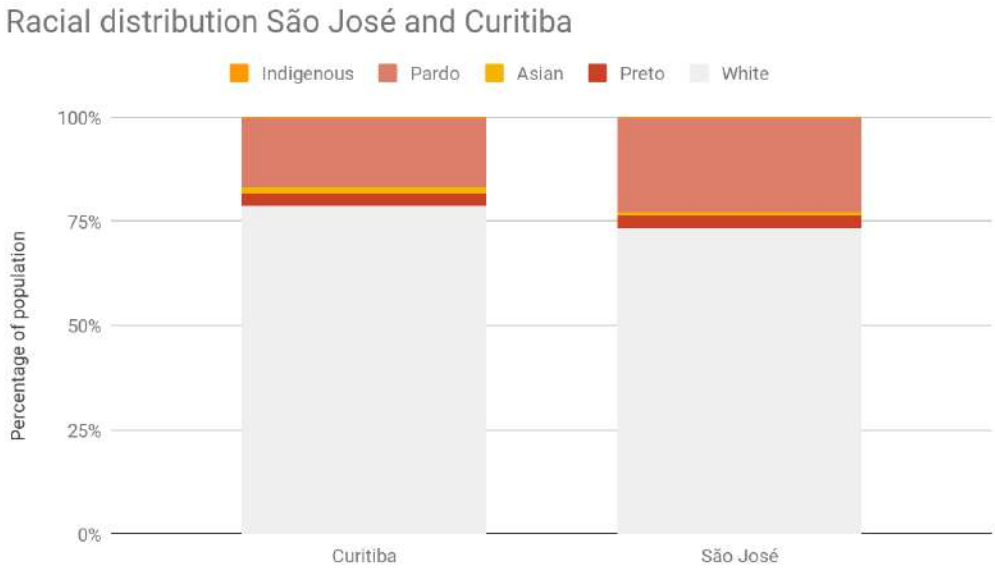


Figure 44 - Racial distribution São José dos Pinhais and Curitiba. Source: MPPR, 2010.

[20] The term "*pardo*" is a complex racial category used by IBGE, commonly used to refer to Brazilians of mixed ethnic ancestries, typically of white Brazilian, Afro-Brazilian and Native Brazilian. It includes here the declarations *preta* and *parda*, that are also commonly compiled as *negro*.

While a great part of the involved stakeholders are men, some of the key persons in the PES process in the Miringuava basin are women. For instance, all the NGO stakeholders, as well as one secretariat and an engineering firm manager that are in key positions that strategically influence the process and have to do with its communication are women. Overall, women represent 40% of the interviewed, and 60% were male.

5.2 ANALYSIS OF THE 8 DESIGN PRINCIPLES

Apart from those data findings, the qualitative results from the documentary analysis combined with the findings from the interviews are used to evaluate the institutional arrangement. For this purpose, the semi-structured interviews inquired in their fourth part about the criteria developed and tested through the application of Ostrom's (1990; 2005) design principles in order to situate the case study and to be able to give recommendations for this case study.

In the field research period, this research has also been able to identify that the social organization of the stakeholders involving the state water company SANEPAR has taken steps into a direction of formal organization that might be prejudicial for some smaller interest groups in the process. The (few) expropriated landowners represented by the relatively broad association ASSOPAM continue to take part in the organization process of establishing a dialogue about the CPRs in the Management Group. They share views about the formalization of a basin committee to articulate and eventually balance disputes, even though some of them are discontent with the slow progress of the process. Such steps, following the Theory of the Commons and the consulted literature on the social dimensions of ES are possible to solve through a robust institutional arrangement.

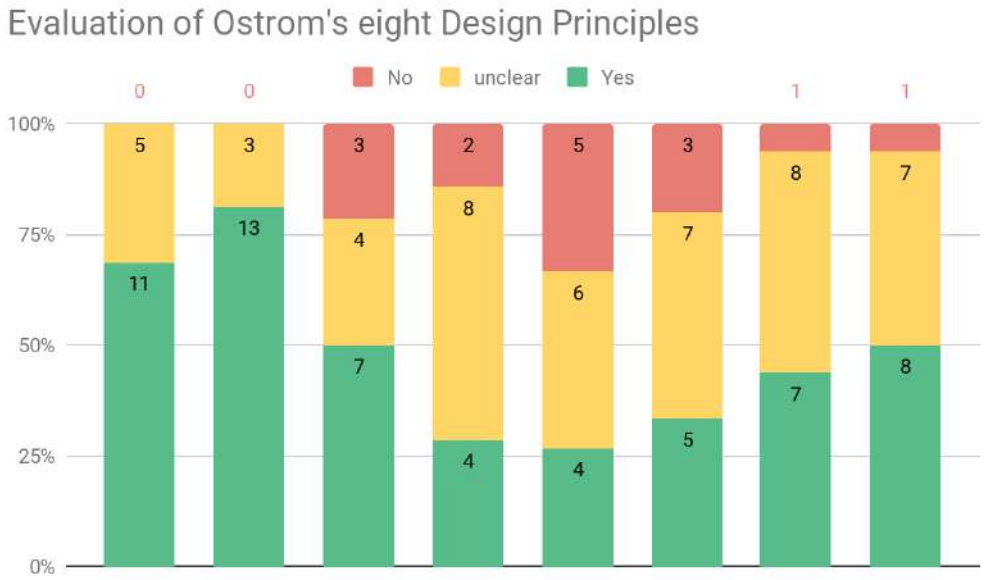


Figure 45 - Evaluation of Ostrom's eight Design Principles. Source: the author.

The distribution of the principles that apply to the CPR system of conserved forest areas in the Miringuava basin is shown in figure 45 above, while table 5 evaluates the resulting compliance of the case study with each of the principles, which are subsequently discussed in more detail. The interviewees were asked for a qualitative response about each principle, that was then classified into Yes (2), Unclear (1) or No (0) and a color code ranging from red (0), over yellow (1) to green (2) was given by tough the Excel function conditional formatting. While figure 45 (above) shows the individual responses, table 5 shows the aggregate results for this evaluation.

Table 5 - Overall evaluation of the eight design principles for the case of the Miringuava basin. Green (value 2) represents strong concordance, red (value 0) represents non-concordance for the applicability of the principles for the case study. Source: Elaboration by the author.

Principle 1 Clearly defined boundaries	Principle 5 Gradual Sanctions
Principle 2 Cost-effectiveness of PES	Principle 6 Conflict resolution mechanism
Principle 3 Collective choice	Principle 7 Freedom of social organization
Principle 4 Monitoring	Principle 8 “Nestedness” / Integration of rules

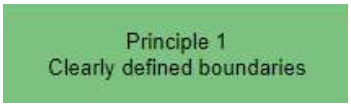
Key: 0 = red, low concordance, 2 = green, strong concordance							
1,6875	1,8125	1,125	1,0625	0,9375	1,125	1,375	1,4375

It calls the attention, that only the two first principles (clearly defined boundaries, 81% yes, and cost-effectiveness, 69% yes) were evaluated by the interviewed stakeholders as clearly applicable (close to 70%) for the case, as they strongly believe in the effectiveness of PES in relations to the costs of its implementation. Principles 3 (collective decision, 50% yes) and 8 (integration with other institution, 50% yes) were the next most applicable principles, while the collective decision question caused an conflicting picture, as three actors responded no, four unclear and seven yes. The questions about monitoring, sanctions and a conflict resolution mechanism also did not generate any unanimous evaluation.

Given that the evaluation of the principles through the interviewed stakeholders did not generate a clear outcome, the compilation of the overall evaluation by the interviewed stakeholders about the eight design principles by Ostrom in Table 5, will have to be discussed in more detail principle by principle below.

Principle 1: Clearly Defined Boundaries

The boundaries of the resource system (e.g., irrigation system or fishery) and the individuals or households with rights to harvest resource units are clearly defined (OSTROM, 2008: p. 33).



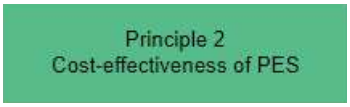
Ostrom (1990: p. 91; 2008: p. 32) describes the first principle as "boundary rules related to who can enter, harvest, manage, and potentially exclude others" that affect the trustworthiness and cooperation of the CPR users. If the boundaries are not clearly defined, the above described *free rider problem* might occur, in which strangers from outside the territory appropriate the resource. In her field research Ostrom (ibid.) found that this principle "helps immensely in increasing the probability that a person who is cooperating in limiting harvests and providing maintenance is not being a sucker because others are overharvesting and not contributing to the maintenance."

According to the interviewed actors, they greatly agree that the boundaries of the private properties are clear, as they have been consolidated for decades and there are no reported conflicts between landowners. Only those stakeholders who report not to be familiar with the region said they were unsure about this.

There are some uncertainties about the concrete areas to be protected are not defined yet, but this is obviously due to the early stage in which the PES process currently is still. Another unclear boundaries issue is the APA that is still being defined among public organs and the population. While the official statements of SANEPAR speak of the restrictive conservation zone only upstream of the dam, the Public Prosecutor and some other organs are reported to have talked about the APA area to be upstream of the catchment (close to Colônia Murci), which has caused uproars in the affected Avencal village, as it would then further affect (i.e. restrict) the farmers' agricultural practices. In the definition of the boundaries power issues are only mentioned tangentially, as most interviewed actors refer to the legally established land titles and there is practically no question of how these were negotiated and whether or not they are fair.

Principle 2 Proportional Equivalence Between Benefits and Costs

Rules specifying the amount of resource products that a user is allocated are related to local conditions and to rules requiring labor, materials, and/or money inputs (OSTROM, 2008: p. 33).



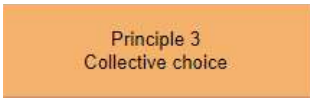
While the second principle has the greatest agreement among the interviewed stakeholders, the cost-benefit relation might not be as clear to the affected dwellers. From a management perspective, the actors involved in the judicial and operational planning as well as in the communication of the PES arrangement, the expected long-term environmental

gains are very clear. This would further be backed up by studies provided by TNC concerning the returns and financial benefits of green infrastructure solutions for Curitiba.

Ostrom (2008, p. 32) states that the rules must be designed in a way to "allocate benefits proportional to inputs that are required," which in the case of the establishment of an operational PES arrangement includes not only the physical environmental management work, but also the directly and indirectly related bureaucratic costs, the time and efforts invested in meetings as well as the "costs on users of operating a system" (ibid.).

Principle 3 Collective Choice Arrangements

Most individuals affected by harvesting and protection rules are included in the group that can modify these rules (OSTROM, 2008: p. 33).



The question of collective choice of the PES arrangement, while fairly straightforward, was evaluated very differently by stakeholders of the different spheres. Generally speaking, the public organs as well as the big NGO stakeholders (FGB, TNC, SPVS) saw the decision making process and the creation of the rules of the process as very inclusive, while the civil society actors, that have often felt confronted with the decision of the construction of the dam and the compensations of which PES is a part, see it in a top-down manner. Several of the interviewed stakeholders and other civil society representatives that the researcher talked to informally during the fieldwork period, see the decision-making arrangement as a small impenetrable circle of well-networked stakeholders with similar interests. This is confirmed in the SNA in chapter 5.3.

Ostrom (2008, p. 34) states that, in order for the third principle to apply, "individuals affected by a resource regime [should be] authorized to participate in making and modifying the rules." This is in conflict with the reality interviewed stakeholders report, as the rules and procedures are apparently *not "considered fair* by participants" (ibid.). Ostrom (ibid.) emphasizes that "[a]s environments change over time, officials located far away do not know of the change, so being able to craft local rules is particularly important." The principle further considers the possible role of local elites (see KROTT et al., 2014), as some "local common-property institutions empower a local elite to make most of the collective choice decisions," in which case it would not be consistent with design principle two, as it could be "expect[ed] that the policies primarily benefit the elite."

The aspects brought forth by this principle connect strongly with the discussion in chapter 2.4 of this thesis as well as research on forest governance by authors like Krott et al. (2014), Schusser et al. (2015), Maryudi (2011) and Bach (2016).

Principle 4 Monitoring

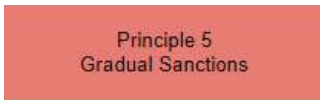
Monitors, who actively audit biophysical conditions and user behavior, are at least partially accountable to the users and/or are the users themselves (OSTROM, 2008: p. 33).

The monitoring of compliance with the established CPR rules has been a focus of some of Ostrom's later work (see e.g. OSTROM; NAGENDRA, 2006) on CPR institutions and she cites Coleman and Steed's (2008) multivariate analysis of 130 forests in 12 countries, where active and recognized forest users were shown to be more likely to contribute to monitoring and so improve the overall conditions of the CPR. Ostrom suggests that "[m]ost self-organized resource regimes select their own monitors" and that in turn "[t]hese monitors are accountable to authorized users and keep an eye on resource conditions as well as on harvesting activities." With this empirically founded and internationally relevant finding, Ostrom allows for a serious questioning of the predominant strong rule-enforcing mentality that prevails in traditional conservation policies and that can also be found in most cases in Brazil.

In the view of one of the interviewed representatives of an association, for monitoring compliance with the PES rules "a commission would have to be set up with representatives of various institutions, including beneficiaries." However, as the arrangement is not final yet, the question about monitoring was the issue on which the interviewees gave the most diverse answers and most (8 actors) responded that it is unclear to them how monitoring will be done. Only the central stakeholders from or close to SANEPAR and SEMA responded that this detail is clear and fair.

Principle 5 Graduated Sanctions

Users who violate rules in use are likely to receive graduated sanctions (depending on the seriousness and context of the offense) from other users, from officials accountable to these users, or from both (OSTROM, 2008: p. 33).



The principle of graduated sanctions generated a similarly unclear result with approximately one third of the actors responding yes, no and unclear. Among the diverse answers were positions from very radical exclusion from the arrangement upon a first rule-breaking to very mild opinions on infractions. Overall however, given the peri-urban context the watershed is situated in, its legal environmental restrictions, the greater Latin American and Brazilian scenario of public security issues, as well as within the rhetoric of the current political environment, sanctions and punishments were seen as (likely) more justified than on a global average. Furthermore, the Brazilian judicial context, in which there is relatively little

and ineffective policing of rules and laws, involves an overall stronger rhetorical agreement to correctness in compliance with rules than is actually followed through in every day practice (DRUMMOND; BARROS-PLATIAU, 2005; WEINS; POTINKARA; SILVA, submitted manuscript).

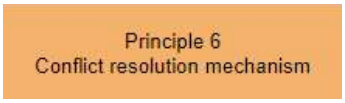
Ostrom states that initial sanctions should be “so low as to have no impact on the expected benefit-cost ratio of breaking local rules” and “can be thought of more as information to the person who is caught as well as to others in the community” (OSTROM, 2008: p. 35). Ostrom holds that compliance is often "assumed away by analysts" who assume "all-knowing and all-powerful *external* authorities who enforce agreements" (OSTROM, 1990, p.93). Some of the cases originally studied by Ostrom (ibid.) show that a “user might break a rule in error or because of difficult problems.” An interviewed subject from the Miringuava basin affirms that it depends on the seriousness of the infraction, but “if they are serious and committed the infraction purposefully, the sanction does not have to be gradual.”

Up until here, the principles apply to about two thirds (66.25%)[21]. Ostrom (2005) considers these first five principles to be a coherent set of theoretically founded explanations for characteristics and organization of CPR systems:

> The first five principles fit together to form a coherent theoretical explanation of why they may work together: when the users of a resource design their own rules (design principle 3) that are enforced “by local users or accountable to them (design principle 4) using graduated sanctions (design principle 5) that clearly define who has rights to withdraw from a well-defined resource (design principle 1) and that effectively assign costs proportionate to benefits (design principle 2), collective action and monitoring problems tend to be solved in a reinforcing manner” (OSTROM, 2005, p. 267).

Principle 6 Conflict Resolution Mechanisms

Users and their officials have rapid access to low-cost local arenas to resolve conflict among users or between users and officials (OSTROM, 2008: p. 33).



The issue of a (or several) possible mechanism(s) for resolving conflicts, specifically socio environmental ones within the PES arrangement, in the Miringuava basin, has shown to be rather unclear as of now. There are some positive perspectives and tendencies that lead us to consider this principle as more applicable than it was evaluated by the interviewed stakeholders.

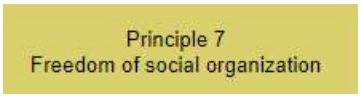
[21] With reference to defined values in the 0-2 scale in Table 5.

Ostrom (2008: p. 35) states that while it is possible that “participants may interpret a rule that they have jointly made in different ways,” “rules must be understood in order to be effective." She suggests that such arrangements for resolving conflicts must be “rapid, low-cost, local arenas.” As such, only the Management Group, presented here in chapter 4.2.2.1, shows such characteristics. For this reason, this group was considered as an important part of the institutional dimensions of the studied PES arrangement. This is confirmed by several interviewed stakeholders, that have come to accept the Management Group as what can be understood as an arena in which issues concerning the water-food nexus are discussed. Most of the stakeholders who think so are regular participants of the group and understand its workings and recognize its potentials.

Another important mechanism that is named (and even actively used) by several of the stakeholders, especially the dwellers of the Miringuava region like the farmer Jatobá, is the Public Prosecutor’s Office (*Ministério Público*). This mechanism does not however classify as such a mechanism in Ostrom’s definition, as it is neither rapid, nor local, nor low-cost. Even though it has acted in defense of the rights of the inhabitants of the region and has had a significant role in changing SANEPAR’s plans of the construction of the Miringuava dam in the direction of what the population is demanding, its formal bureaucratic apparatus as well as its geographic and perceived distance from the locality, makes it unfit for resolving informal conflicts that could be resolved in an *ad-hoc* manner by the Management Group.

Principle 7 Minimal Recognition of Rights to Organize

The rights of users to devise their own institutions are not challenged by external governmental authorities, and users have long-term tenure rights to the resource (OSTROM, 2008: p. 33).



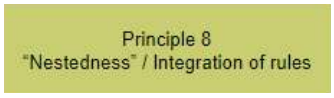
The rather macro-scale principle of “whether a national or local government at least minimally recognizes the right to organize,” is defined by Ostrom as an important condition for a self-governing CPR system to be able to establish fair inclusive rules (OSTROM, 2008, p. 36). She continues naming examples of resource systems that have great difficulties of finding such rules, when its participants are not recognized by governmental authorities, which causes the need for unanimity in decision making and presents a threat by individuals who disagree and pressure by reporting the unrecognized system. “When external governmental officials presume that only they can make authoritative rules, sustaining a self-organized regime is difficult“ (ibid.). Here, the issue of power within the arrangement and the perpetuation of the injustices within the current legal and landholder system.

While this principle was evaluated by at least half of the interviewed actors as applicable, or at least with a fairly affirmative tendency. The one critical stakeholder who says that this recognition does not exist, names industrial and agroindustry lobby groups who assert indirect pressure on the farmers and their families, as these depend on the distribution networks and jobs connected to them, jeopardizing their freedom.

Once again, the political setting of the 2018 Presidential Elections in Brazil have a contextual influence on this principle. The president-elect, Mr. Bolsonaro, has threatened at several points in public statements plans for his presidency that environmental conservation concerns have to be sacrificed in the name of economic development of the country. Furthermore, his elimination of the Ministry of the Environment, and plans of a fusion with the Ministry of Agriculture would represent a win of industrial-style agriculture over environmental conservation on the macro scale, that mirrors the local conflict in the Miringuava watershed and now has legitimization and backwind from the *Planalto* (ESCOBAR, 2018; NASCIMENTO et al., 2018). The future of this principle and the PES undertaking as a whole under this scenario should be watched closely.

Principle 8 Nested Enterprises (for resources that are parts of larger systems)

Appropriation, provision, monitoring, enforcement, conflict resolution, and governance activities are organized in multiple layers of nested enterprises (OSTROM, 2008: p. 33).



The principle of nested enterprises, according to Ostrom (2008, p. 36) applies solely to large CPR systems, recognizing that "governance activities are organized in multiple layers of nested enterprises," meaning that they are integrated in other dimensions of governance. In addition to some small units, larger institutions exist to govern the interdependencies among smaller units. Here, citing Yoder (1994) she explains that allocation of rules for water use "among major branches of an irrigation system" will "differ from the rules used to allocate water among farmers along a single distribution channel." "Consequently, among long-enduring self-governed regimes, smaller-scale organizations tend to be nested in ever-larger organizations" (ibid.).

While this principle was the third most positively evaluated one, the actual integration of the PES arrangement into higher-level governance is only given in the case of the metropolitan water supply system SAIC (SANEPAR, 2013). COMEC and Pró-Metrópole, which have the integration of (and thus multi-level approach to) transportation and commercial agendas as their priorities, so only a will and imaginaries towards a metropolitan environmental governance for the MRC could be identified, in which the PES arrangement of

the Miringuava basin would be a part at some point in the future. It is however likely and beneficial, thinking the potential integration of such a CPR from the perspective of Ostrom's eighth design principle and could help to develop concrete arrangements out of it. However, the critique of the power-blindness of this principle will have to be explored in more detail as, as higher-level formal governance institutions clearly assert their influence much more forcefully on the local CPR, which will also be pointed out in the SNA in chapter 5.3.

For this case the eighth principle was however possibly somewhat reinterpreted by the interviewed subjects and the researcher, therefore generating fairly diverse responses. Furthermore, this last principle led back to an initial inquiry of the researchers about PES as a public policy tool for a reapproximation of the urban periphery to the center (both economically and perception-wise) or even as an inducer of a form of metropolitan governance that approaches human-nature relations and resource demands of cities in a manner that moves beyond a paradigm of the "purely urban" as demander, breaking the logic of rural-urban relations (WEINS; SILVA; GADDA, 2018).

5.3 SOCIAL NETWORK ANALYSIS

> "Being well-connected within a network is important, but whom one is connected to and to which community is equally significant to the effectiveness of an actor to exchange pertinent knowledge within a network." HORNING; BAUER; COHEN, 2016: p. 63.

The SNA of the present case study, that is mainly backed up by data from the applied questionnaire, but also by documents of the process prior to the construction of the dam and the implementation of PES, reveals a small number of central actors and a greater number of actors that are connected to them in a less strong manner. Furthermore, what the analysis shows, are some outliers in the process who are connected to only few nodes in the system. This finding confirms initial assumptions on the relatively closed process of the planning and implementation of the PES arrangement for the Miringuava basin in São José dos Pinhais. These findings, combined with the section on institutional robustness from the previous subchapter can point to some punctual improvements in both communication and organization of the democratic process, while the arrangement is still under development.

The analysis data for this SNA was collected mainly in question 3.21 (frequency scale list) of the questionnaire (see ANNEX B) and qualitatively confirmed central and peripheral actors with the open questions 2.14, 2.15 and 3.22. The interviewed actors were asked to report with which frequency they interacted with each stakeholder in the list of 34 actors that were identified before and at the beginning of the field research period (see chapter 4.2). In total 147 documented relations between the actors were considered,

generating 391 lines of data. Due to availability limitations, the reciprocal links between the actors could not be confirmed, making the density of the data used for the SNA only indicative and not fully affirmative. The collected data was normalized in Excel and input as comma separated values (CSV) into the software Gephi[22] (BASTIAN et al., 2009). After the nodes and edges tables were separately imported, the nodes were ranked by degree and the edges by weight.

After this, the stakeholder data was put in order of the most mentions (i.e. reported interactions by the 15 interviewed stakeholders), prioritizing the higher quality responses of the in-person interviews over the actors that filled out the online version of the questionnaire. This was justified by the methodological difficulty of the availability of data that allows only for undirected nodes (as opposed to reciprocal balancing of the responses), as not all stakeholders could be interviewed, in which case a mean could have been drawn between diverging reported interactions. This was the case only few times in the data obtained from the interviews, e.g. between Rede Ecovida and SEMA: the first reported very frequent (3) interaction with SEMA, while SEMA reported to never (0) interact with Rede Ecovida. However, through the prioritization of the respectively more connected stakeholder, the distribution is expected to be closer to the actual network configuration observed in the field work. For the distribution of the nodes in the figures below, the Fruchterman-Reingold and Yifan-Hu distribution were set as layout configurations.

A preliminary version with data from the first six interviews was treated in a similar, simpler way and was presented and discussed at a graduate school event on the water-energy-food nexus (SPSAS, 2018; WEINS, 2018). These preliminary results are shown in figure 46 (below). The exchange with other researchers who apply SNA generated fruitful insights into data treatment and software functionality that greatly enhanced the manipulation and interpretation of the final results. The preliminary analysis however, already showed a configuration close to the expected final result and the observed configuration of the network in the field work.

[22] In its latest release version 0.9.2.

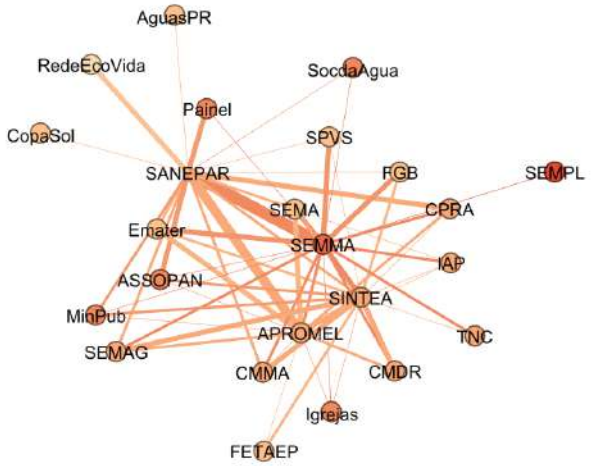


Figure 46 - Preliminary result (based on 6 interviews) of the SNA for PES in São José dos Pinhais. Author's illustration23 with the use of the software Gephi (BASTIAN et al., 2009).

In this network, in which the position of the nodes was manually manipulated after a Force Atlas 2 layout configuration, SANEPAR and the environmental secretariats SEMA and SEMMA were already identified as two poles of central actors. Centrality according to Tomaél and Martello (2006, p. 79 apud. DE PUPPI E SILVA et al., 2013) "is the feature that identifies the number of direct contacts that an actor keeps on a network, that is to say, it is what measures the level of communication of an actor." Most other NGO and civil society actors were peripheral, similarly to the final results presented below. Several edges (i.e. actors) are not present yet, as they presented no nodes yet, i.e. they had no connections with the set of actors interviewed up to that point.

Figure 47 (below) shows the final result of the SNA for the PES network of the Miringuava basin in São José dos Pinhais, Brazil, with the data gathered in all the interviews. It includes 15 actors with a total of 34 nodes. The centrality in this network already shows greater complexity. SANEPAR and the secretariats are not the only central actors anymore, as a greater number of edges distributes the interactions in the network. When looking at the secretariats, they still play a central role, as is typically the case in public policies in Brazil (DE PUPPI E SILVA, 2015). Even though here, SEMMA, SEMAG, SEMA, SEMED and SICTUR are stakeholders with an average amount of connections (17, 16, 18, 24 and 4 respectively). The civil society actors CPRA and RedeEcoVida (see figure 47) are also seen as central in this Fruchterman Reingold layout, which arranges according to centrality. However, apart from the numerical aspect, there is also the quality and kind of connection, which will be further discussed below. As has been mentioned earlier, the network structure for the studied PES case has been perceived by several stakeholders as small and closed.

[23] A special thanks to Augusto Schmidt for the incredible and patient support with the preparation and processing of the interview and SNA data. The key to the abbreviations is provided with the final results below.

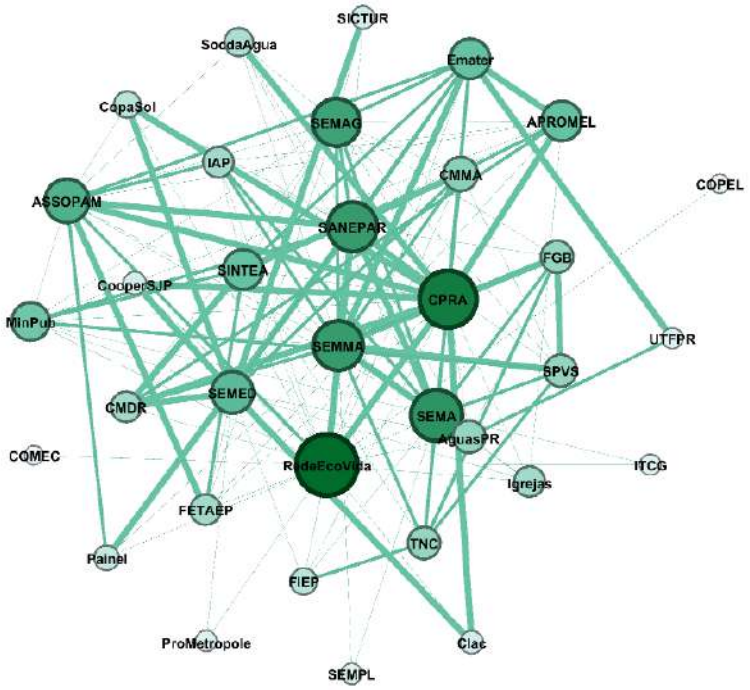


Figure 47 - Final result [24] (based on 15 interviews) of the SNA for PES in São José dos Pinhais. Author's illustration with the use of the software Gephi (BASTIAN et al., 2009).

When considering all data points, and arranging the layout in the Yifan Hu configuration in Gephi, a close clustering of SEMA, SANEPAR and SEMMA occurs (figure 48) that shows the latter's strong ties with the three NGOs, which no other actor presents. On the other end of the cluster the two actors CPRA and RedeEcoVida can be found, which concentrate a great number of connections. The color scheme hints at the extremely high connectivity of RedeEcoVida, whose direct connections are portrayed on the right of figure 48.

[24] Key to abbreviations of institutions (in alphabetical order):
ÁguasPR = Instituto das Águas do Paraná; ANA =Agência Nacional de Águas; APROMEL = Associação dos produtores orgânicos e Meliponicultores de SJP / Associação de Produtores Orgânicos; ASSOPAM = Associação dos Proprietários, Moradores, Criadores e Agricultores das Áreas da Bacia do Rio Miringuava de São José dos Pinhais; CMMA = Conselho Municipal do Meio Ambiente; CMDR = Conselho Municipal de Desenvolvimento Rural; CPRA = Centro Paranaense de Referência em Agroecologia; Emater = Instituto Paranaense de Assistência Técnica e Extensão Rural; FGB = Fundação Grupo Boticário; FETAEP = Sindicato dos Trabalhadores Rurais de São José dos Pinhais; FIEP = Federação das Indústrias do Paraná; IAP = Instituto Ambiental do Paraná; Min. Públ. = Public Prosecutor; SEMAG = Secretaria Municipal de Agricultura; SEMA = Secretaria de Estado do Meio Ambiente e Recursos Hídricos; SEMMA = Secretaria Municipal do Meio Ambiente; SEMPL = Secretaria de Planejamento e Desenvolvimento Econômico; TNC = The Nature Conservancy.

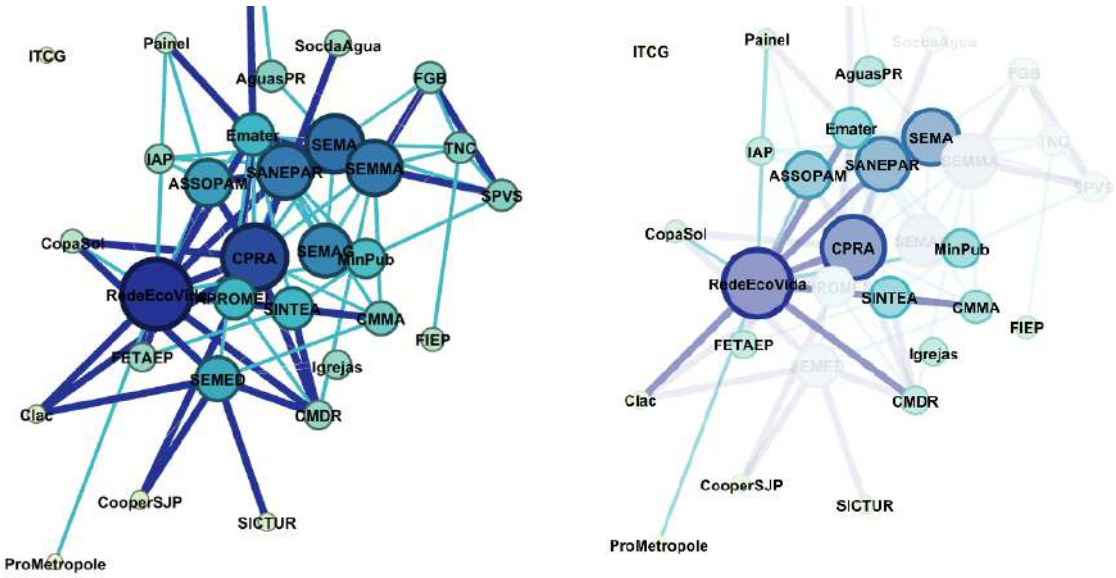


Figure 48 - Yifan Hu layout distribution without outliers (left) and view of RedeEcoVida's interactions.

The interactions reported by RedeEcoVida represent an outlier, which significantly distorts the connections of many of the actors. This high result of reported interactions with 30 out of 34 actors can only be understood either as a case of an extremely actively networked individual, or has to be seen as a methodological problem, in which the actor was biased to respond positively to the long list of actors. Considering the role the network plays in the process, uniting several farmers and networking them with other organic farming community initiatives in the South of the country, it is likely that the actor is in fact well networked. However, this picture does not reflect their observed actuation in the PES process in the field research period in 2018, considering the core group (SEMA, SEMMA, NGOs) and the Management Group. Figure 49 (below) considers only the interactions with this actor related by others, i.e. disconsidering actor 11's responses, as the reported reciprocal interactions with RedeEcoVida were much lower. This could also be justified in the greatly differing perception of e.g. SANEPAR or the state secretariat of this actor, while the other way, SEMA and SANEPAR represent high level entities, and by reporting an interaction with them, they show their own relevance.

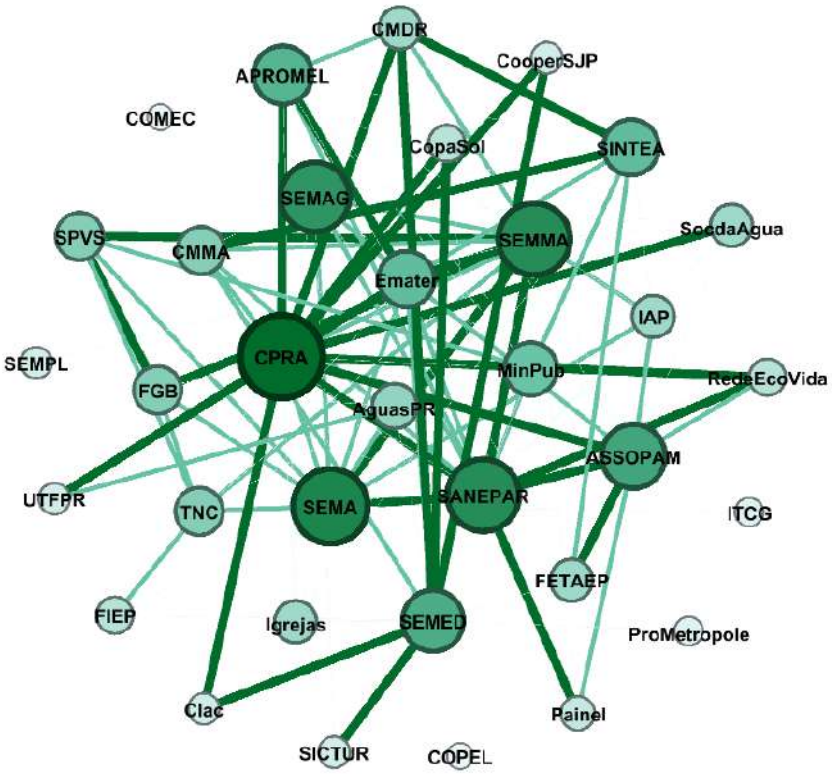


Figure 49 - Modified final result (exclusion of RedeEcoVida) of the SNA for PES in São José dos Pinhais. Author's illustration with the use of the software Gephi (BASTIAN et al., 2009).

Two of the interviewed actors provided unexpected data. The extreme points in the data were one representative who was obviously not well informed about their institution's connections, as all the other actors related much closer and frequent relations with them (SEMAG). The actor only responded the intensity "1" for three actors in the list of 34 possible nodes. This negative bias might be attributed to them filling out the online version of the questionnaire. However, the two online form responses were the best response that could be obtained from the actors, as several requests were actively turned down (with reference to non-responsibility). For this reason, one of SEMAG's data was disconsidered, also due to the availability of two sets of interviews, both of which were obtained through the online form.

The other extreme point in the data, RedeEcoVida which was already discussed above, showed a surprisingly high degree of reported interactions, responding with at least "1" for 32 of the 34 actors, a value that was only approximated (to a much lesser degree) by two other actors, SEMAG (26/34) and CPRA (23/34). This confirmation bias of reporting relations might be a methodological problem of the suggestive questionnaire approach (SCHAEFFER; PRESSER, 2003).

At the end of chapter 5.2 and hinted to in chapter 4.2.1.4, an initial inquiry that motivated this research, was, how the valuation of an ES could help to cause structural changes in the metropolitan governance of hydrological resources. An initial point of

discussion was the role of democratic governance structures and the basin committees, which through the concept of Integrated Watershed Management have been promoting natural resource governance beyond administrative borders for more than 30 years. In this respect, the role of the Paraná Water Institute (ÁguasPR) was expected to be a central one, prior to the fieldwork (GADDA et al., 2018; WEINS; SILVA; GADDA, 2018; CASSILHA et al., submitted manuscript). However, as the SNA data and the accompanied meeting of the Management Committee have shown, there is no involvement of this public body that has the representation in exactly those policy fields as its defined responsibilities.

Questions about the role of ÁguasPR during the interviews and in informal conversations with stakeholders from different spheres have revealed that the Water Institute is being "drained" in its administrative power and human resources, as no new personnel has been hired in more than a decade and the majority of the institution being close to or already past their mandatory retirement ages. Understanding this polemic, it was no surprise that ÁguasPR did not respond to requests concerning this research.

However, while several stakeholders still consider the actor as a nominally important representative as is shown in the reported connections with them in figure 50 (below, left), their low capacity to respond to those functions is alarming. The basin committees should be democratic spaces in which use and conservation of water resources in the state of Paraná are discussed. The peculiar governance structure in the state hinders the effective tackling of important issues and the passive agenda setting that is happening, by underfunding and limiting this organ, goes against constitutionally and institutionally declared principles (CASSILHA et al., submitted manuscript).

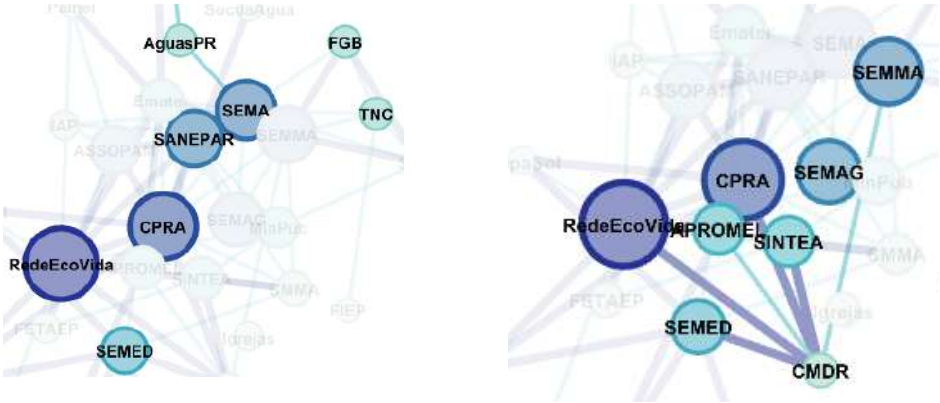


Figure 50 - Interactions of AguasPR (left) and CMDR (right).

A similar situation can be confirmed with the Municipal Rural Development Council, which, similarly to the Municipal Environmental Council (see chapter 4.2.2.2) is considered by the public organs in not many frequent interactions with this organ which supposedly

serves as a democratic control. It is also interesting for the PES case, as the original law and decree that were not finalized and eventually replaced by the ones currently in place, as they foresaw a strong inclusion of this organ in the PES process, in terms of checks and balances. The current legislation does not consider the councils in any way, and the actors that wrote it do not interact much or at all with the councils.

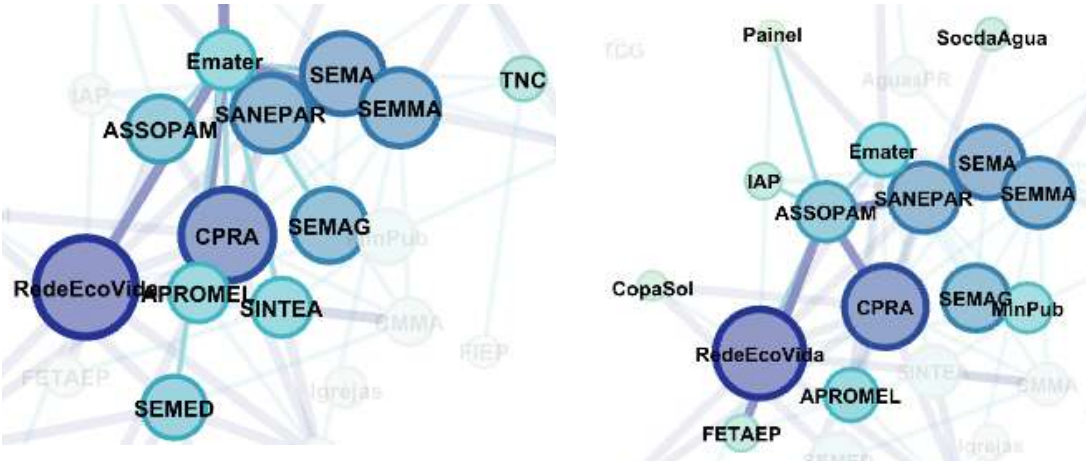


Figure 51 - Interactions of EMATER (left) and ASSOPAM (right).

An actor considered as important by several of the actors directly involved in the activities in the basin, including the secretariats as well as several of the associations, EMATER is shown to be an important link in the network (figure X, right). The interviewed stakeholder from UTFPR (outside of the central cluster in figure 51 due to few interactions) considered this public company an important communicator and instructor for the necessary planned changes in agricultural practice.

ASSOPAM whose direct interactions are shown in figure 51 (above, on the right). The association is well networked with a wide range of different actors and the two main civil society actors (CPRA and RedeEcoVida) show strong interaction with this association, partly because several of the individuals are members of both ASSOPAM and RedeEcoVida. ASSOPAM also shows the strongest interactions with the unions, which can however be considered as weakly linked, as has been confirmed in the interviews and informal conversations with the involved stakeholders. It is worth noting that ASSOPAM has a good qualitative and quantitative articulation with the municipal administration, concerning PES.

Another well-networked stakeholder (see figure 52 below), as has been pointed out above already, is the Reference Center in Agroecology (CPRA), which has its strongest reported interaction concerning PES with the RedeEcoVida network, but also SANEPAR and the state and municipal environmental agencies of the environment (SEMA & SEMMA). Furthermore, CPRA networks with the executing side, e.g. EMATER, SocdaAgua,

ASSOPAM and the unions and cooperatives (APROMEL, CopaSol, FETAEP, CLAC, CooperSJP, SINTEA) and the churches. On the other end they also interact with possible future strategic partners (financers) at FIEP and FGB. The cluster shows that CPRA is well networked with all central actors of the PES process in the Miringuava basin.

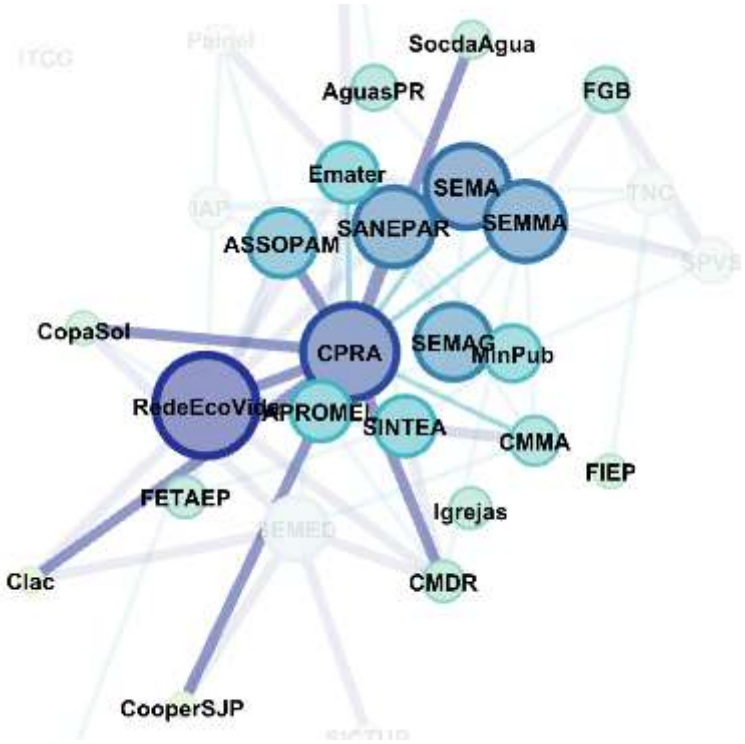


Figure 52 - Interactions of CPRA.

Smaller organizations like the Rural Workers' Union FETAEP and other less formal actors who often lack budget and human resources, are not strongly connected in the PES debate and network. The case of FETAEP (figure 53 below) shows exemplarily how most of the interactions only happen within a small circle that includes other union and association actors and the secretariats of agriculture (SEMAG) and education (SEMED). CPRA also shows relevant actions for this actor, which could, through the network benefit them.

Overall however, the fact that the unions and associations were only poorly represented in the data, as they were not cited by the other actors, but also the difficulty to contact them and obtain data on and from them, speaks about their weak integration into the decision making and management processes for this public PES policy.

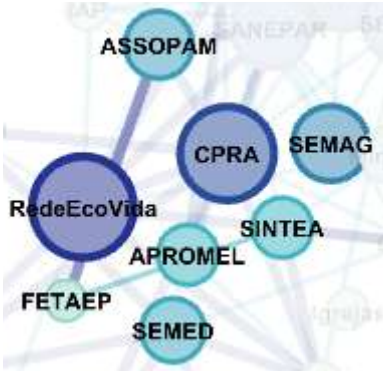


Figure 53 - FETAEP's interactions in the PES network.

As pointed out by Horning, Bauer and Cohen (2016) at the beginning of this subchapter, "[b]eing well-connected within a network is important, but whom one is connected to and to which community is equally significant" when discussing the effectiveness of an actor to exchange relevant knowledge within a network" (HORNING; BAUER; COHEN, 2016: p. 63).

The role and close representation of the involved NGOs (see figure 54) deserves a closer look, as their functions and capacities allow them to spend an amount of their efforts into networking and disseminating information through the networks they are inserted in. The figure below shows the three NGOs FGB, TNC and SPVS who are frequently named as "the NGOs" in this process and are understood as the representation of societal interests. This happens in disregard of the other civil society actors that are presented above. Their interests are much broader and diverse than these three NGOs who strictly work with the promotion of environmental conservation. The broader international networks and epistemic communities they are in, will be discussed below (Haas, 1992).

In the Yifan Hu layout, it calls the attention that the three NGO actors are aligned and close to the central nucleus group of SEMA, SEMMA and SANEPAR in the PES arrangement. Differences in their connections are evidence of their strategic interests and approaches to their projects. In figure 54 (below) they are organized from left to right according to their scale of activity, as described in chapter 4.2.2.3.

TNC as an international conservation actor with more than one million members that acts globally, reports to be linked to only few actors that are of strategic importance to the planning and execution of the PES arrangement. They are the only actor who relates frequently to FIEP, which aligns with their more pragmatic pro-business approach of involving industries in conservation matters, in which they see PES as an "attractive tool." Among the NGOs they are the least strongly connected one.

FGB, which is active largely at the Brazilian national level, has closer ties to the municipal and state administration, with whom they interact frequently and which also

provides them with important strategic information. They report to also interact with the municipal environmental council and the Public Prosecutor.

SPVS, active only at the local scale, is equally well networked with the central stakeholders of the Miringuava PES arrangement, but also relates to be connected to CPRA and SEMAG, which is due to other similar projects that align with those stakeholders as well. Furthermore, SPVS reports to have regular interactions with the Water Institute ÁguasPR, where they are the civil society representative in the basin committee of the Upper Iguaçu basin, in which Curitiba is located.

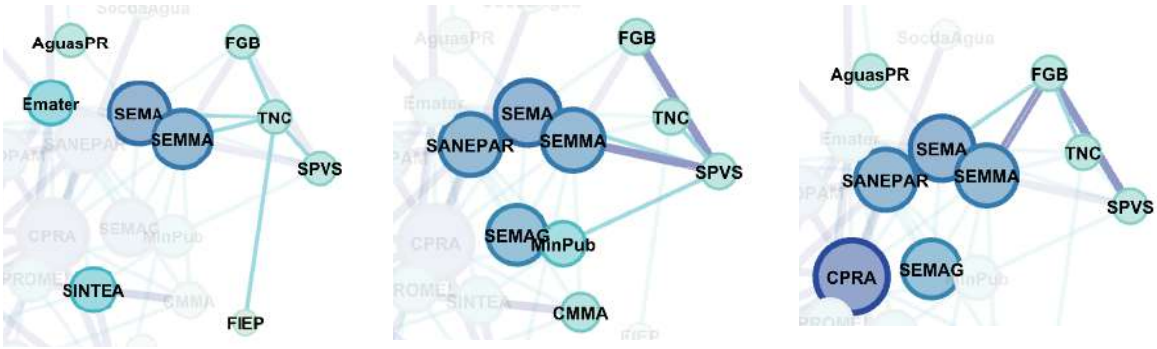


Figure 54 - Individual interaction of TNC (left), FGB (center) and SPVS (right) within the mapped network.

An interesting aspect, concerning this interest-specific NGO involvement, and which also dialogues with the STS base theories about Science, Technology and Society is the knowledge generation aspect that informs this specific public policy. According to Horning, Bauer and Cohen (2016) such tightly-knit epistemic networks, for which FGB's Oásis Network is a prime example, generate "scientific and political self-evidence" that then reinforces existing power relations in the broader political economy they belong to and act in. In their article Kolinjivadi et al. (2017, p. 12) the central role of technical expert knowledge in those dense networks is discussed, as they "harness epistemic selectivities to shape shared patterns of thinking, reasoning, and behaviour within a broader epistemic community (e.g. Haas, 1992)."

The authors further affirm that the "ES epistemic community" would require the actors it involves to "place faith in the central tenets of ES as an unequivocal and unifying lens to explain human-nature relations" (KOLINJIVADI et al., 2017, p. 12). This exclusive (due its technicality) transnational community then "meets regularly in high profile conferences, often centred around commonly-shared targets or objectives, to socially and culturally 'perform' specific human-nature rationalities" (BÜSCHER et al., 2012; ibid.). Büscher et al. (2012) and Kolinjivadi et al. (2017, p. 12) refer to the technical stakeholders as "gatekeepers" that

“preclude rationalities or imaginaries which do not conform to the cultural construct from being ‘acceptable within a specific field of scientificity’ (Brand and Vadrot, 2013: 220)” and create “ideological borders through which differentiating what is true from what is false.”.

The “ES lens” the authors refer to can be found in the discourse of several of the interviewed actors and the stakeholders close to the central PES network of the Miringuava basin. The banal but easily comprehensible “distinction between ‘service users’ and ‘service providers’ is spatially and temporally sedimented by epistemic communities as a means to generate the faith that the ES performative actually works” (KOLINJIVADI et al., 2017).

The role of the transnational epistemic communities involved in the generation of the necessary science has been treated critically by Berbés-Blázquez, González and Pascual (2016) and in section 2.2.4 of this thesis. “Transnational environmental policy initiatives” like TEEB, the UN’s Green Economy project, the Aichi Biodiversity Targets, as well as IPBES have been discussed before (KOLINJIVADI et al., 2017, p. 12). They “represent the world’s largest and most financed initiatives advocating for ES approaches for conservation, and crucially, express the neoliberal faith in the ‘pay to conserve’ rationality for ES provision” (ibid.). Considering Haas’ (1992) assumptions about these epistemic communities, their broad international collaborations with global partners such as development and lending agencies (e.g. World Bank, Global Environmental Facility) and NGOs themselves (e.g. WWF, IUCN, TNC, etc.) collaborate closely with academic institutions that then develop science like the Natural Capital Project from Stanford University that are widely recognized (ibid.).

The result of this “well-networked set of global-to-local actors” would then follow a “general tendency to invest substantial labour and energy to ‘make’ ES” in which human-nature relations are “subsequently [inserted in] economic rationalities to efficiently procure ES through PES” (KOLINJIVADI et al., 2017, p. 12).

Those critical remarks should point to the susceptibility of science and knowledge generation in the ES discourse on human-nature relations and the potential actor networks have in shaping these. Recognizing, on the one hand, that coalitions and cooperations can benefit our understanding of and reconnection to our natural environment, it also needs to be understood that the science used to justify those decisions is based on our limited knowledge of our world, and an over-reliance and uncritical acceptance of technical standards brings diffuse risks with it (BECK, 1992; 2016). If PES solutions are generated in exclusive networks, the exclusion of relevant local views of marginalized stakeholders might turn out to be much costlier, apart from being unequitable and unfair (BERBÉS-BLÁZQUEZ et al., 2016; WEINS; SILVA; GADDA, 2018).

In a network like the one presented here, where only the decision-making level could be investigated in detail, a classification, as the one suggested by Carlsson and Sandström

(2008, see table 3, page 47/48) would render two different findings. Considering the analysis of Ostrom's design principles, the CPR system in itself, i.e. the socioecological system of the farmlands in the Miringuava basin, could be considered a network with high density and centralization. This is justified, considering the dense social organization of the local farmers is extremely high due to their strong and all-inclusive church engagement. However, this would lead us to classify the heterogeneity of the network as low, as the socioeconomic conditions of the basin (see chapter 4.1) are quite homogeneous. This, according to Carlsson and Sandström (2008) would benefit the "ability to make decisions and solve conflicts at low transaction costs," but would hinder resource mobilization, affecting the "ability to find innovative solutions".

The network of representative stakeholders of the Miringuava PES arrangement, on the other hand can be considered one with both high density and heterogeneity, if we consider it in its entirety. Even though strategic decisions of the PES arrangement in its early stage were made by a small (homogeneous) core group of the municipality, state and NGO stakeholders, the tendency of the approach to the Management Group and the socioecological accompaniment through the company Painel, can open the space for debate among stakeholders with a greater variety of views. In correspondence with Carlsson and Sandström's (2008) description this network would thus "promote the access and exchange of resources" due to its heterogeneity and the "high levels of density and centralization improves the internal decision making process by lowering transaction costs and fostering good conflict resolution mechanisms."

5.4 CONCLUSION OF RESULTS

Looking back at the definition of SES by Redman, Grove and Kuby (2004), several of the dimension named by these authors have been touched upon. Demographic factors have been explored in chapter 4.1, in which the overall close connection of the older generation of the local population to the territory has been pointed out. However, migratory movements of the younger generation, particularly for educational and employment reasons play into the territorial SES dynamics and consequently into the (lack of) involvement of the young generation in the PES and other debates of general interest to the region. Technological change dimensions, as defined by Redman, Grove and Kuby (2004), but also as discussed in STS studies, in a more ample understanding of technology, for this case study can be seen clearly in the paradigm shift from traditional family agriculture, that has recently made the move to conventional practices with excessive use of pesticides, and which is now challenged by urban institutions to change to agroecology, which is an ongoing dispute within the community and between the urban center and its periphery. Here, power

dimensions that were discussed in chapters 2.2 and 2.4 become evident, considering the imposition of practices by the market and powerful institutions onto the peasants.

The analysis of the Ostrom's design principles showed that, while several of the principles apply to the SES in the Miringuava basin, favoring the PES implementation, important aspects of the program's management must be resolved still. Even though the classification of the conserved areas in the watershed as a SES is not entirely in line with Ostrom's theory of collective action, the theoretical discussion shed light on several institutional dimensions that might not be considered sufficiently by the central stakeholder and public administration, could be pointed out.

The SNA conducted here, while confronted with several practical challenges, was able to unveil a more crucial role of bridging organizations like CPRA and RedeEcoVida that are situated between the municipal and state organs and the three NGOs closely involved in the creation of the PES arrangement. Especially when it comes to the dissemination and involvement of unions and associations that play a critical role in informing about local reality and resulting demands to the policy, but also in terms of legitimacy of the rules, the SNA showed that these stakeholders could play a greater role (see DRUMMOND; BARROS-PLATIAU, 2005; GREEN et al., 2015).

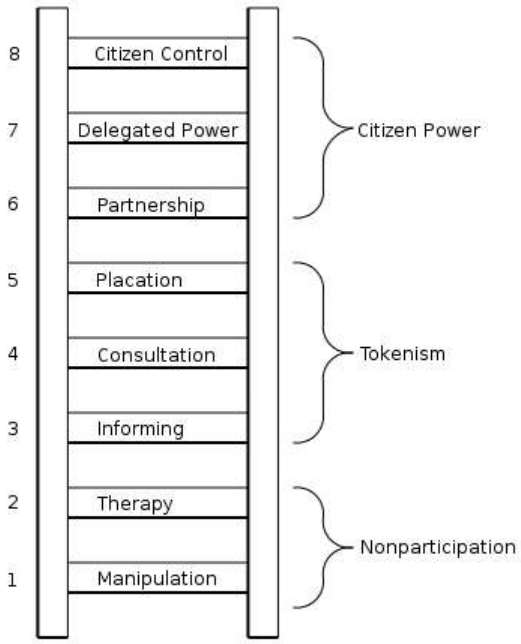


Figure 55 - Sherry Arnstein's Eight rungs on the ladder of citizen participation. Source: Arnstein, 1969.

Even though Arnstein has not been discussed here in detail, her 1969 "Ladder of Citizen Participation" can offer a simple, but theoretically founded way to classify the approach taken to the PES arrangement in the Miringuava basin, which is one of the initial

questions that motivated this research. Figure 55 shows Arnstein's figurative ladder with eight rungs and three greater sections, which is understood in an evolutionary manner, considering full participation the highest goal.

The studied case would best fit stage four, the Consultation one. This is because the initial phase of Nonparticipation, which include manipulation and therapy have definitely been overcome since the establishment of democracy in Brazil. We would situate the process in the Tokenism, in which the institutions "allow the have-nots to hear and to have a voice" (ARNSTEIN, 1969, p. 2). While the informing stage seems to overcome, the criteria in the Consultation stage best fit the present case study. Even so, some characteristics of the informing stage seem present in a few aspects of the PES process, where meetings were occasionally "vehicles for one-way communication by the simple device of providing superficial information, discouraging questions, or giving irrelevant answers."

Arnstein (1969, p. 4) describes the participation mechanisms in the Consultation stage as "window-dressing ritual" in which "people are primarily perceived as statistical abstractions" because "participation is measured by how many come to meetings, take brochures home, or answer a questionnaire." In several stages of the process in which the researcher could participate, statements very close to "required motions of involving 'those people'" (ibid.) were expressed by the management side of the PES arrangement.

The local population on the other hand, has been observed with statements very close to what Arnstein describes about surveyed. This was, among others a challenge in the design stage of this research, in which we ended up not applying a survey in the region, because the local population was complaining about questionnaires in exactly the way Arnstein describes for the Consultation stage: "Nothing ever happens with those damned questions, except the surveyor gets $3 an hour, and my washing doesn't get done that day." Arnstein states:

> Inviting citizens' opinions, like informing them, can be a legitimate step toward their full participation. But if consulting them is not combined with other modes of participation, this rung of the ladder is still a sham since it offers no assurance that citizen concerns and ideas will be taken into account. *Arnstein 1969, p. 4.*

In an attempt to visually break down the results this research about the institutional arrangement of the studied PES arrangement has pointed out, we have opted for a SWOT (strengths, weaknesses, opportunities and threats) analysis, summing up the main findings that can be extracted from the methodologies and the interviews as well as the documentary analysis. They are shown in table 6.

Table 6 - SWOT evaluation of the institutional arrangement for PES. Source: Elaboration by the author.

	Helpful *to achieving the objective*	**Harmful** *to achieving the objective*
Internal origin *attributes of the organization*	Availability of some key landowners to conserve Conviction about effectiveness of PES	Lack of knowledge on alternative PES applications; Lack of understanding benefits of conservation; Institutional robustness (beyond polit. administrations)
External origin *attributes of the environment*	Global tendency of PES and IWRM[25]; Available knowledge and financing	Disconsideration of marginalized stakeholders (unions, women) Low payments that disconsider socioeconomic inequalities Institutional disintegration

The PES case studied here, shows good potential for the development of a functioning conservation approach in the Miringuava basin. The availability of a great number of landowners to participate in the proposed measures and the conviction of the great majority of the involved stakeholders of the effectiveness of the tool, as well as global tendencies and the available knowledge are all points that favor the implementation of PES. However, the lack of knowledge on alternatives, a detailed understanding of the conservation benefits (mostly by the landowners) are harmful factors that, together with the potentially non-robust institutional arrangement pose a threat to its success. Working on how to better include stakeholders that have been marginalized until this stage in the process, as well as raising the amount of the payment (which is in the working), are threats that can be tackled at this point in the process still. However, if no action is taken, these problematic factors could exacerbate the negative effects of the policy. The disintegrated institutional development seems one of the major challenges that are found at the meso- and macro-level of the arrangement and are thus more difficult to be resolved by the involved stakeholders alone.

[25] Integrated Water Resource Management

6. FINAL CONSIDERATIONS AND IMPLICATIONS

This thesis has pointed to the institutional and social dimensions of resource management in a socio-ecological system in a metropolitan region of Brazil and has discussed the issue of social organization concerning conservation lands in a watershed under considerable pressure of urbanization and agricultural activity that represents the water-food nexus. In the inspiring lines of thought of Gutman (2007), the process of the implementation of solutions like PES demands extensive negotiations between the most diverse actors to serve its discursive purposes of reshaping human-nature relations and rural-urban integration. The proposal of PES can be an excellent opportunity for (re)integrating the urban and the rural, not only in terms of (water and food) consumer perception and in terms of economic benefits, but also on a political level. Through this integration, more robust social institutions and resilient ecosystems could be obtained.

An exploration of the political sphere was shown as an important factor in this research on the implementation phase of PES, where the institutional arrangement is still under negotiation. Alternative conceptions of ES management and institutional contexts in other case studies around the world might point out interesting and relevant lessons for participative institutions in the studied socio ecological system here. The importance of inclusive democratic governance processes in the attempt to achieve more liveable and sustainable cities have been discussed and the importance of critical citizen and science education has to be highlighted here.

As the results of the literature review have shown, the great majority of PES applications around the world does not actually follow free market ideals in practice, even though these principles guide the pro-active and positive discourse for many actors involved, as the interviews with stakeholders involved in the Miringuava case have confirmed. Another aspect that surfaced from the starting point in the scientific literature is the strong disconsideration of power imbalances and control over land and land use. In the scientific literature those aspects are pointed out as major factors, considering historical, institutional, as well as gender dimensions in the territory (VARSAVSKY, 1969; CUTCLIFFE, 2004; LIMA FILHO; QUELUZ, 2005; CEPF, 2018).

As the review and analyses have shown, PES is practically always mediated by the public hand. This entails that the role of the public (and civil society for that matter) needs to be clearly defined and judicially guaranteed in order to make sure the conservation policies serve broader societal interests and do not suffer too much alteration by special interest groups (GREIBER, 2010). The considerable lack of technical knowledge by the small municipal administrative bodies are compensated for with strong cooperations with the third

sector. Herein lies a great risk in the shaping of and in- and exclusion of factors that are (in)convenient to those stakeholders who provide the information and technical knowledge those public policies are built on. This especially holds true for the disconsideration of inequalities, which are a pronounced responsibility of the public hand. Relying on reports and studies by third sector actors, especially the ones close to corporate interests, will in the long run jeopardize social cohesion and might aggravate social and socio-environmental conflicts.

In the case studied here, where the implementation of PES is still in the first third of its implementation, and with local legislation in place for only a few weeks, generally speaking, the socio-environmental accompaniment is on a good way to including the factors that have been - for the most part - disregarded in the planning phase by the central actors of the institutional arrangement. The inclusion of the local farmer population, and those who "live off the land" in the planning process during the year 2018 (field research period) has made clear how the issues on the political agenda greatly differ from those on the ground. One of these issues, the use of pesticides, has shown how agricultural productivist guiding ideas and often anti-environmentalist sentiments are contrary to the views of strategic decision-making at the higher and central levels of municipal and state governance.

It is thus to be debated in how far the imposition of rules and restrictions on those farmers without including their views and respecting their lifestyles and needs will be just. With few occupational alternatives, the farmers see their existences threatened by the environmental actors, that are perceived as outsiders with the power to overrule them. Given this situation, it is unlikely that those individuals will adhere to rules defined outside of their interest sphere, a problem discussed broadly in Ostrom's theory. A certain disposition of the local population (broadly speaking) towards conservative positions rooted in their cultural habits and immigration background, has been interestingly exacerbated by the 2018 presidential elections in Brazil, which have brought forth a president-elect who in many occasions has expressed that he will clearly prioritize economic development over environmental conservation and social concerns. With this expressly authoritarian approach, which enjoys great popularity among the farmers, it remains to be seen how democratic and inclusive governance of watersheds in Brazil will develop in the years to come. For certain, it also gives a voice to those (environmental) administrators who have long been sceptical of slow and bureaucratic democratic processes, and who do not necessarily favor conservation interests, but economic development of greater interest groups.

Certainly, there is general availability of some key landowners to participate in the PES arrangement and to conserve great portions of their land. While some of them even consider themselves environmentalists and have long been involved in the conservation debate with local NGOs and the municipal secretariats, these landowners are for the most

part not dependent on their land for producing their sustenance. As they do not "live off the land," conserving hectares of forest is a benevolent ethical act, which will, on top of all, bring a financial return to those landowners, some of whom even plan on tourism and Airbnb income. The power dimension present with those stakeholders is an especially tricky one, as their conviction about the effectiveness of PES and the importance of the conservation of the watershed for the Metropolitan Region is well understood. Those individuals also have the potential of convincing some of the (subsistence) agricultural users of the watershed to take part in the policy initiative, remembering that PES is essentially voluntary.

On the other hand, the local farmer population, who produces a considerable amount of fresh vegetables for the regional market of the Metropolitan Region, is not yet convinced of the benefits of the proposed conservation policies the way they are. While a good part of them does have the ecological understanding of the importance of forested land for the availability and storage of freshwater in the ground, their worries are rooted in the dispute about agroecology. From the point of view of many of the farmers, organic farming and alternative approaches to agricultural production that are considered more sustainable, are not going to guarantee them sufficient rents and they question loudly whether there is enough demand and willingness to pay for all-organic farm products. The current prices the farmers manage to negotiate on the urban markets are already too low for some products to be profitable.

This usage conflict concerning conservation and the water-food nexus are represented on the other hand by some stakeholders in the process, who see agroecology as the only way forward in the light of an environmental crisis and expected water shortages, if the watershed conservation measures are not implemented as proposed. Especially the Paraná Reference Center for Agroecology, as a declared promoter of the inevitable change of agricultural practices towards more ecologically friendly ones, has been an active promoter of the Miringuava PES arrangement among the population and other local institutions. They see the moment of its implementation as an opportune moment for inducing changes in the farmers' practices. While the center holds a small amount of excellently trained staff in the realm of the agricultural transition, the resistance to their approach in the region is still great. Only a hand full of farmers, who have already started using different cultivation methods are aligned with the reformative approach and can be seen as outsiders within the local community, despite their formal representation as community members in the Management Group and the PES process. As such, the representation of a great variety of views is not yet given in this process. Only one expressly critical farmer, Sr. Schulis, who has been filing complaints and judicial actions via the Public Prosecutor, eventually takes part in the Management Group's discussion. However, due to the very basic disagreements this and other farmers have with the strategic transition of their

agricultural practices, a meaningful change is yet to be seen to get closer to a climate of dialogue in which there can be a meaningful get-together in which rules (in the sense of Ostrom) can be forged.

In view of the global tendencies of the implementation of integrated water resource management and a generally favourable international environment for the implementation of trendy integrated solutions like PES, the studied case in the Miringuava watershed is likely to end up following suit and continue the efforts to bring forth this policy. As one representative of a global NGO stated, no matter the cost, implementing PES will, in the long run pay off and be worth the efforts. With technical knowledge provided by the globally and nationally active NGOs, the availability of knowledge and even financing favor both the technical implementation, but also, given the early stage the project is in still, the inclusion of further knowledge and factors that had been either unknown or been judged insignificant up to this point.

We can thus conclude that the biggest (external) threats to the PES arrangement in the Miringuava basin are the disconsideration of marginalized stakeholders, the low (and undifferentiated) payments for conservation and the institutional disintegration of the arrangement. The inclusion of marginalized stakeholders like unions, women and others could be improved by adjusting the procedures and meeting times of the Management Group, which have been discussed in recent meetings. Furthermore, the communication via social media and Email will have to be expanded in order to better inform about the planned measures. The issue of low payments for the conservation of the land is a frequently raised criticism coming from the involved landowners. What is more, besides being a low payment that does not cover the opportunity costs for many of the farmers who do need the land to earn their daily incomes, is the consideration of socioeconomic differences that play into those payments and the availability of a landowner to reserving a piece of land for conservation. In the case of some landowners with big properties, one hectare will not make a significant difference to their income, even more so, if this landowner has more than only the rural property, and does not rely on them as their main income. At last, the institutional disintegration discussed in depth above is a challenge shared in many policy areas, which are disputed between several sectors of public administration and which are reluctant to share responsibilities or jurisdiction and control of a given issue. Here, the slow progress of the work of the watershed committee and the formalization of a sub-basin committee of the Miringuava basin, but also the former work on the legislation by the agricultural secretariat and the subsequent starting-from-scratch of the environmental municipal secretariat can be seen as a major symptom of this disintegration.

The ideals of the Theory of Collective Action could, on the one hand, may present a positive challenge to the status quo of public management and promote steps towards

independence of local institutions that are rooted in local needs and desires and that envision long-term conservation of the Miringuava watershed. On the other hand, however, the consideration or even fostering of such arrangements in public governance may see a set-back given the current national political scenario in Brazil. The discussed institutional junction of the Ministries of Agriculture and the Environment as well as the (not yet foreseeable) effects of the super-Ministry of Economics proposed by the entering government might further jeopardize financial resources for environmental conservation, by the way of prioritizing aggressive productive activity. Paraná as one of Brazil's main agricultural and the world's biggest soy exporters, which already has suffered great environmental damage from agricultural exploration in past decades, might suffer more in terms of environmental protection in this scenario.

In the course of this research, several different questions have been raised that could not be discussed in necessary detail and, while some of those discussions have generated initial scientific debates, we would like to suggest some issues for further research that need to be explored:

- Further research needs to be conducted on the political dimensions and equity implications of PES. While a vibrant critical debate on those issues is taking place already in the international scientific community, this debate is mostly theoretical and needs more empirical foundation. Works like Maryudi (2011), Schusser et al. (2015) and Bach (2015) that identify powerful stakeholders can be pointed out here as a guideline. Social relations, understood as territorial dimensions or "territoriality" (ALBAGLI, 2004) are an important lens to understand those networks.
- A scientific accompaniment of the water governance institutions in Paraná is needed, as there were only few studies from a social science, political ecology or critical geography perspective like Medeiros' contributions (2012; MEDEIROS; CANALI, 2012) on watershed committees, which seem to get very little public attention and are silently losing influence and action through its retiring personnel and no new hirings.
- This research touched superficially on a few issues regarding metropolitan integration in terms of environmental governance (see chapter 4.2.1.6) that have been a red thread in the researcher's discussions with Prof. Gadda. Integrated watershed management and the institutions that enable it are just a first step into a new and necessary approach to urban governance beyond cities' administrative

limits, which, in the case of Brazil are extremely rigid and pose a great challenge to novel approaches to the challenges of Global Climate Change.

- More detailed fieldwork with the cooperatives, unions and associations of the Miringuava basin would help greatly in understanding this urbanizing watershed. More time in the field would have been needed to include more actors and gain a more complete picture, closer to the farmers' realities. The documentation and careful consideration of those classified here as marginalized, those who "live off the land" is an urgent demand that needs to be met in order to adjust the PES policy. A more complete picture of the PES issue could be gained e.g. by farm-level interviews and conducting participative observation methods.
- This discussion could also help to elucidate the extremely complex issue of rural-urban relations and their effect on the change of human-nature relations in Brazil and the Global South, which were only touched upon superficially as well.
- Furthermore, the case of China, as the biggest (state) investor in the world in PES, the so called eco-compensation schemes is a case that deserves further exploration. Here, governance questions surrounding democratic ideals and technical pragmatism in the need for economic development gain a whole new meaning and potential for an extensive debate.

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ANNEX

ANNEX A: RESEARCH SCHEDULE

Year	2018					2019	
Month	08	09	10	11	12	01	02
Writing	X	X	X	X	X		
Qualification Presentation		X					
Scheduling of Interviews	X	X					
Interviews			X	X			
Data Analysis				X	X		
Review					X	X	
Final Presentation							X

ANNEX B: RESEARCH PROTOCOL & SEMI-STRUCTURED INTERVIEWS

Version 02.10.2018 - Online form

Protocolo de Pesquisa

Nº da entrevista: ____

Entrevistado/a: _____

Organização: _____

Gênero: ____ Idade: _____ Cor/Raça: _____

Data: _____ Horário: _____ até _____

☐Termos do Comitê de Ética
(TCLE/TCUISV[26])

Muito obrigado por participar dessa entrevista sobre o arranjo de Pagamento por Serviços Ambientais na bacia do Miringuava em São José dos Pinhais. Suas respostas contribuirão com o melhoramento da documentação e da execução do PSA na bacia. A discussão sobre as dinâmicas territoriais fazem parte do Grupo de Pesquisa "Studio Cidades e Biodiversidade" e "Políticas Públicas e Dinâmicas de Desenvolvimento Territorial" da Universidade Tecnológica Federal do Paraná.

#	**Parte 1: Conhecimento Geral sobre PSA**	
1.1	Como você entende o PSA?	
1.2	Como você classificaria seu conhecimento? Eu conheço… *0 nada 1 muito pouco 2 pouco 3 algo 4 bastante 5 muito bem* ☐ ☐ ☐ ☐ ☐ ☐	
1.3	Como você ficou sabendo sobre o PSA? Quais os projetos de referência / referências científicas?	
1.4	Quais desses projetos você conhece? ☐Produtor de Água (ANA) ☐FIDECOAGUA México ☐Caso de PSA em Extrema/MG ☐Metodologia Oásis (Boticário) ☐Caso de PSA em Castro/PR ☐Programa Nacional Costa Rica ☐Caso de PSA Guandu/RJ ☐Compensações Ecológicas CHN ☐Caso de Nova Iorque ☐Outro(s):	

[26] Termo de Consentimento Livre e Esclarecido & Termo de Uso de Imagem, Som e Voz

1.5	Quais os melhores argumentos pró PSA?	
	☐Fonte de ingresso / Ganho-ganho / Remuneração de serviço grátis ☐Conservação voluntária / Motivação para preservar / Incentivo ☐Transferência cidade-campo / produtor-usuário ☐Inovação / não mais comando-controle / mercado ☐Flexibilização de políticas / mediação via mercado ☐Outro(s):	
1.6	Quais as principais críticas do PSA?	
	☐Pagamento baixo / injusto / Desequilíbrio de poder ☐Controle / Imposição sobre uso da terra ☐Comodificação da natureza / justiça social e ambiental ☐Sobreconserção / incertezas / falta de usos alternativos ☐Flexibilização de políticas / perda de controle do estado? ☐Outro(s):	
1.7	Você sabe o que é uma bacia hidrográfica? Qual a sua importância para o PSA?	
	Parte 2: Conhecimento do programa de PSA no Miringuava	
2.8	Você está familiarizado com a região da bacia do Miringuava? *Eu conheço…* *0 nada* ☐ *1 muito pouco* ☐ *2 pouco* ☐ *3 algo* ☐ *4 bastante* ☐ *5 muito bem* ☐	
2.9	Quão importante a área do Miringuava é para a Região Metropolitana enquanto aos seus recursos hídricos? *Ela tem _____ importância.* *0 nenhuma* ☐ *1 muito pouca* ☐ *2 pouca* ☐ *3 alguma* ☐ *4 bastante* ☐ *5 muita* ☐	
2.10	Quando começou a ideia de conservar a bacia?	
2.11	Quem introduziu / começou a conversa sobre a implementação de um PSA em SJP / Curitiba? Como se deu?	
2.12	Quais opções de valoração de serviços ambientais conhece?	

	☐Regulação hidrológica ☐Alimentos, fibra e combustível ☐Polinização ☐Regulação climática ☐Valores de existência ☐Reposição de aquíferos ☐Beleza cênica ☐Valores espirituais ☐Armazenamento de CO_2 ☐Outro(s):	
2.13	Por que se escolheu a metodologia utilizada? Quem escolheu como valorar? Qual a importância desse ator no processo de PSA?	
2.14	Quem foi consultado para participar do processo e por quê?	
2.15	Quem não foi? Teve problemas com o envolvimento de alguma parte?	
Parte 3: Análise da Rede Social de PSA no Miringuava		
3.16	Qual o papel da sua instituição / organização na execução do programa e por que?	
3.17	Qual o seu papel (individual) como funcionário nesse processo?	
3.18	Como você vê sua influência no processo? *Eu tenho _____ influência sobre os outros.* *0 nenhuma* ☐ *1 muito pouca* ☐ *2 pouca* ☐ *3 alguma* ☐ *4 bastante* ☐ *5 muita* ☐	
3.19	Em que você vê sua influência agindo sobre?	
3.20	Com de quais instituições você / sua instituição interage regularmente sobre PSA (ou tema ligados)?	

3.21 Com pessoas de quais destas instituições você interage em relação ao PSA?

Ator	*Muito frequentemente*	*Regularmente*	*As vezes*	*Nunca*
SEMA				
IAP				
SANEPAR				
Emater				
CPRA				
SEMAG				
SEMMA				
SICTUR				
TNC				
FIEP				
Boticário				
SPVS				
Pró Metrópole				
ASSOPRAN				
Cooperativas				
Sindicatos: SINTEA,				
Igreja(s)				
CMMA				
CMDR				
Sociedade da Água / Painel				

3.22 Quais você acha são os atores centrais (ambos organizações e indivíduos) do arranjo de PSA no Miringuava?

Parte 4: Robustez institucional do arranjo de PSA Miringuava *Esta parte refere-se aos 8 princípios de desenho institucional de Ostrom (1990, p.90)*		
4.24	Os **limites** das propriedades e das áreas (a serem) protegidas são claramente definidas?	
4.25	Como você vê a relação / proporção **custo-benefício** da implementação de um PSA?	
4.26	Você acha que o arranjo foi uma **escolha coletiva** (inclusiva)?	
4.27	Como será feito o **monitoramento**? Quem será responsável pela prestação de contas / *accountability*?	
4.28	Se tiver que aplicar **sanções**, elas serão graduais, isto é, de acordo com a gravidade da infração das regras?	
4.29	Você considera que tem um mecanismo de **resolução** de possíveis **conflitos**? Qual seria?	
4.30	Na sua opinião, há reconhecimento (mínimo) do direito dos participantes de **se organizarem**, sem pressão pelos envolvidos?	
4.31	Você vê o PSA apoiado / integrado ("aninhado") em outras instituições de outro **nível**?	
4.32	É possível interagir com elas ou há dificuldades em alguma interface?	
4.33	Na sua opinião, por que os proprietários participam do PSA?	

4.34	Na sua opinião, por que há proprietários que não querem participar do PSA?	
4.35	Você vê o arranjo institucional como robusto, considerando a sua vinculação com a sociedade?	
4.36	O PSA pode ser uma ferramenta para reaproximar consumidores e produtores de água e assim contribuir à integração campo-cidade?	

ANNEX C: LIST OF INVOLVED ACTORS

Based on Lista_Atores_Miringuava.xlsx

interviewed in person online interview no response (*date sent* / **data interview**)

Nº	Institution	Date
01	SEMAG - Agricultura	*18/09; 05/10; 11/10; 29/10;* **01/11/18**
02	SEMMA - Ambiente	*18/09/18;* **25/09/18**
03	ACIAP Assoc. Empresarial	*18/09/18 (anom.)*
04	APROMEL	*24.09.;* **25/09.**
05	Associação dos Produtores Orgânicos de São José dos Pinhais	*05/10; 29/10*; **30/10/18**
06	ASSOPAM	*18/09*; **06/11/18**
07	NGO Amigos da Natureza	*17/09/18*
08	SINTEA / ATAEPAR / Arco-Íris Associação de Defesa da Natureza	*18/09/18* **26.09.**
09	Conselho Municipal de Desenvolvimento Rural	*05/10/18*
10	Conselho Municipal de Meio Ambiente e Saneamento	
11	Municip. SJP (Educação)	*18/09, 29/10*; **01/11/18**
12	Municip. SJP - Diretoria de Recursos Hídricos e Saneamento	
13	COPASOL	
14	CPRA - Centro Paranaense de Agroecologia	*18/09/18;* **29/10/18**
15	EMATER	*18/09/18 & 05/10/18*
16	Fundação Grupo Boticário de Proteção à Natureza	*18/09; 30/10;* ***19/11/18***
17	IAP - Instituto Ambiental do Paraná	
18	Instituto Agronômico do Paraná - IAPAR	*01/10/18*
19	Instituto das Águas - PR	*01/10/18 & 05/10/18*
20	ITCG - Instituto de Terras, Cartografia e Geologia do PR	
21	SEMED - Educação	
22	SEMA-PR	*01/10/18;* **02/10/18**
23	SEOBRAS	
24	Ministério Público	*05/10/18*

25	SICTUR - Secretaria de Indústria, Comércio e Turismo	*01/10/18*
26	Pró-Metrópole	short email response
27	COMEC	*05/10/18*
29	SANEPAR	*24/09/18;* **28/09/18**
30	Sociedade da Água	*24/09/18;* **03/10/18**
31	Sindicato Patronal Rural SJP	
32	Sindicato dos Trabalhadores e Trabalhadoras Rurais de SJP	23/11/18
33	SUDERHSA	01/10/18
34	Individual Residents	
35	SPVS	*01/10/18;* **09/10/18**
36	TNC - The Nature Conservancy	*01/10/18*; **06/10/18**
37	UFPR	
38	UTFPR	***19/11/18***

ANNEX D: TERM OF CONSENT FOR PARTICIPANTS

TERMO DE CONSENTIMENTO LIVRE E ESCLARECIDO (TCLE) E DE USO DE IMAGEM, SOM E VOZ (TCUISV)

Título da pesquisa:
Pagamento por Serviços Ambientais Hídricos no Peri-Urbano. O caso do arranjo institucional na bacia hidrográfica do Miringuava

Pesquisador responsável pela pesquisa, com Endereços e Telefones:
Niklas Werner Weins
Rua Padre Anchieta, 2671 Apt. 705, 80730-000, Curitiba PR.
Tel. 41991694207, E-Mail weinsniklas@gmail.com

Local de realização da pesquisa:
São José dos Pinhais e Curitiba, PR

A) INFORMAÇÕES AO PARTICIPANTE

1. Apresentação da pesquisa.
Este estudo é realizado para acompanhar a implementação do Pagamento por Serviços Ambientais na bacia do Miringuava no município de São José dos Pinhais, PR, para relevar questões relacionadas à participação dos diferentes atores envolvidos e o funcionamento assim como a robustez do arranjo institucional.

2. Objetivos da pesquisa.
A pesquisa contribui para os estudos das ciências sociais em volta da governança ambiental e tem como objetivo 1) caracterizar o arranjo de PSA adotado e atores envolvidos, documentar o histórico do programa, 2) avaliar o arranjo institucional a partir da perspectiva dos atores envolvidos mediante Análise de Rede Social (ARS) e 3) identificar potenciais e restrições de consolidação do arranjo.

3. Participação na pesquisa.
Sua participação na pesquisa será mediante esta entrevista (única) que vai ser guiada por algumas questões estruturantes. A duração prevista é de 45-60 minutos. De forma complementar, com a devida permissão, registros como fotografias, gravações e audiovisuais poderão ser efetuados a fim de complementar a coleta de dados. Para o participante, não haverá gastos financeiros.

4. Confidencialidade.
O uso das informações coletadas destina-se exclusivamente a este projeto. Os nomes e outros vínculos pessoais com dados coletados serão divulgados somente mediante concordância dos participantes.

5. Riscos e Benefícios.

5a) Riscos:

As perguntas a serem aplicadas aos participantes apresentam riscos mínimos de possibilidades de constrangimento, contrariedades e desconfortos inesperados de natureza psíquica, social e cultural. Caso ocorram estes riscos em qualquer momento da pesquisa, prestar-se-á apoio emocional e respeito às suas decisões de interromper, reagendar e/ou cancelar.

5b) Benefícios:
A sua participação na pesquisa ajudará na melhora do programa de PSA, podendo-se considerar fatores que até o momento não foram levados em conta pelos tomadores de decisão ou que não tenham sido expressos explicitamente.

6. Critérios de inclusão e exclusão.

6a) Inclusão:
Participarão da pesquisa atores envolvidos na formulação ou execução do PSA na bacia do Miringuava, assim como seus representantes (organizados).

6b) Exclusão:
Não participarão atores que não participaram em momento nenhum da formulação ou discussão do PSA nessa bacia.

7. Direito de sair da pesquisa e a esclarecimentos durante o processo.
A qualquer momento, o pesquisador e a orientadora poderão ser acionados para sanar quaisquer dúvidas. Os participantes gozam o direito de solicitar seu desligamento da pesquisa.
Finalmente, você pode assinalar o campo a seguir, para receber o resultado desta pesquisa, caso seja de seu interesse:

( ) quero receber os resultados da pesquisa (email para envio :_____)
( ) não quero receber os resultados da pesquisa

8. Ressarcimento e indenização.
Formas de ressarcimento e indenização, caso ocasionar algum tipo de dano ao participante, conforme itens II. 21 e II. 7 da Resolução 466/12: compensação material, exclusivamente de despesas do participante e seus acompanhantes, quando necessário, tais como transporte e alimentação; e indenização: cobertura material para reparação a dano, causado pela pesquisa ao participante da pesquisa.

ESCLARECIMENTOS SOBRE O COMITÊ DE ÉTICA EM PESQUISA:

O Comitê de Ética em Pesquisa envolvendo Seres Humanos (CEP) é constituído por uma equipe de profissionais com formação multidisciplinar que está trabalhando para assegurar o respeito aos seus direitos como participante de pesquisa. Ele tem por objetivo avaliar se a pesquisa foi planejada e se será executada de forma ética. Se você considerar que a pesquisa não está sendo realizada da forma como você foi informado ou que você está sendo prejudicado de alguma forma, entre em contato com o Comitê de Ética em Pesquisa envolvendo Seres Humanos da Universidade Tecnológica Federal do Paraná (CEP/UTFPR). **Endereço:**Av. Sete de

Setembro, 3165, Bloco N, Térreo, Bairro Rebouças, CEP 80230-901, Curitiba-PR, **Telefone:** (41) 3310-4494,**e-mail:** coep@utfpr.edu.br.

B) CONSENTIMENTO

Eu declaro ter conhecimento das informações contidas neste documento e ter recebido respostas claras às minhas questões a propósito da minha participação direta (ou indireta) na pesquisa e, adicionalmente, declaro ter compreendido o objetivo, a natureza, os riscos, benefícios, ressarcimento e indenização relacionados a este estudo. Após reflexão e um tempo razoável, eu decidi, livre e voluntariamente, participar deste estudo permitindo que os pesquisadores relacionados neste documento obtenham fotografia, filmagem ou gravação de voz de minha pessoa para fins de pesquisa científica. Estou consciente que posso deixar o projeto a qualquer momento, sem nenhum prejuízo.

Nome Completo:

_____

RG:_____ Data de Nascimento:___/___/_____

Telefone:_____

Endereço:

_____

CEP: _____ Cidade:_____ Estado:

_____

Assinatura: Data: ___/___/_____

_____

Eu declaro ter apresentado o estudo, explicado seus objetivos, natureza, riscos e benefícios e ter respondido da melhor forma possível às questões formuladas.

Nome completo:

_____

Assinatura pesquisador (a): Data:___/___/__

_____

(ou seu representante)

Para todas as questões relativas ao estudo ou para se retirar do mesmo, poderão se comunicar com o pesquisador conforme os dados acima informados.

Contato do Comitê de Ética em Pesquisa que envolve seres humanos para denúncia, recurso ou reclamações do participante pesquisado:
Comitê de Ética em Pesquisa que envolve seres humanos da Universidade Tecnológica Federal do Paraná (CEP/UTFPR) **Endereço:** Av. Sete de Setembro, 3165, Bloco N, Térreo, Rebouças, CEP 80230-901, Curitiba-PR, **Telefone:** 3310-4494, **E-mail:** coep@utfpr.edu.br