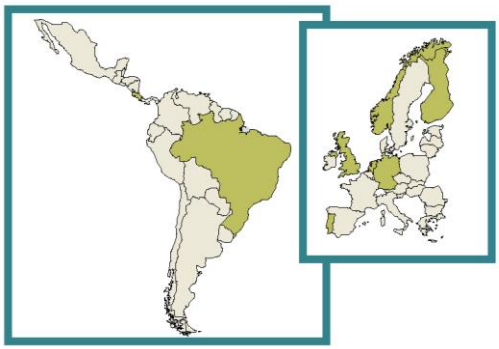

REPORT

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POLICYMIX - Assessing the role of economic instruments in policy mixes for biodiversity conservation and ecosystem services provision

Comparative assessment of policy mixes across case studies – common design factors and transferability of assessment results

Rui Santos, Peter May, David N. Barton, and Irene Ring (Eds.)

policymix.nina.no

POLICYMIX Report series brings work in progress to publication. Report results are also summarized in Technical and Policy Briefs. Reports and Briefs are available online: http://policymix.nina.no

About POLICYMIX. POLICYMIX focuses on the role of economic instruments for biodiversity conservation and ecosystem services provided by forest ecosystems. POLICYMIX evaluates the cost-effectiveness and benefits of a range of economic versus regulatory instruments in a variety of European and Latin American case studies.

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Comparative assessment of policy mixes across case studies - common design factors and transferability of assessment results

Rui Santos, Peter May, David N. Barton, and Irene Ring (Editors)

With contributions by Eeva Primmer, Paula Antunes, Adriana Chacón-Cascante, Daniel Caixeta Andrade, Pedro Clemente, Nele Lienhoop, Christoph Schröter-Schlaack, Henrik Lindhjem and Ademar Romeiro Ribeiro

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Summary

BY PETER MAY, RUI SANTOS, DAVID N. BARTON AND IRENE RING

Biodiversity conservation usually builds on strategies involving a wide range of policy instruments. Within these policy mixes, the use of economic instruments for biodiversity conservation and the provision of ecosystem services has gained increasing attention in policy and academic arenas. POLICYMIX explores many open questions regarding the combination of several instruments in a policy mix, namely on the role of economic instruments vis-à-vis regulatory approaches in biodiversity policies and the assessment of their contribution to conservation objectives, cost-effectiveness, social and distributional impacts as well as institutional requirements.

This report begins with a review of the perspective of high-level policy organizations on the use of economic instruments for biodiversity conservation and their interactions with command-and-control approaches, constituting guidelines for decision makers. The following chapters present a comparative synthesis of the results of seven national and subnational Latin American and European case studies undertaken as part of the EU-funded POLICYMIX project. It focuses on steps 2 and 3 of the POLICYMIX framework looking at functional roles, impact evaluation and scenario analysis across the case studies.

Building on the case study results, this report outlines lessons learned for design, implementation and evaluation of policy mixes associated with i) Payments for Environmental Services (PES), ii) Agro-Environmental Measures (AEM) and iii) Ecological Fiscal Transfers (EFT). The objective is to identify the extent to which the inherited wisdom from high-level policy analysis holds true in these cases, as well as to verify the application of the proposed POLICYMIX framework and the prospect for transfer of instruments and lessons between the Latin American and European contexts. The report concludes by summing up the preceding analysis, identifying knowledge gaps and suggesting additional questions that emerge from the research.

High-level policy documents reviewed for this report relate experience with biodiversity conservation and the provision of ecosystem services, although rarely from the perspective of a mix of instruments. Nevertheless, they offer an important backdrop for the reviews of experience in use of economic instruments and ex ante simulations carried out for POLICYMIX. Guidance is reviewed related to appraisal of baseline contexts, design and implementation of instruments.

Experience with implementation of PES is examined in comparative analysis of the pioneering case of Costa Rica, with more recent payment mechanisms adopted for private forest conservation in Norway, Finland and Brazil. Whereas biodiversity conservation began with a focus on public protected areas, Costa Rica, Norway and Finland later adopted private voluntary conservation, with compensation. A comparison between formal characteristics and “rules in use” (Ostrom, 2005) in these three national PES cases suggests this distinction is useful to evaluate operational features of PES, although cumbersome to operationalize. It is found that several of the formal aspects of PES

that are proposed in the literature are not always feasible to implement in practice, and differ between contexts.

Sequencing and complementarity among instruments also differ, although it is clear that forest certification can represent a point of entry for successful PES introduction, since monitoring is a common feature. The impact of PES in the cases reviewed is compared in accordance with criteria of institutional fit, effectiveness, efficiency and equity, with each case study placing different emphasis on impact assessment criteria. Furthermore, stakeholders do not always perceive the same interactions among instruments, or the functional role of PES in combination with other instruments in the mix. Nevertheless, it is clear that a command and control regulatory framework is a crucial factor in the success of PES. Opportunity costs affect program scale and distributive results when negotiation of compensation comes up against budgetary limitations. The right to make temporal non-conservation use of forestland is an important factor in voluntary participation.

AEM instruments are compared among three case study countries, in particular AEM payments integrated into the EU Common Agricultural Policy (CAP) framework, analysed in the case of Portugal and Germany, and the adoption of integrated conservation and development projects (ICDPs) in agrarian reform settlements in Brazil. AEM are compulsory for EU member states, though optional for farmers, while in Brazil the framework for AEM emerged from credit, technical assistance and licencing instruments complementary to the compulsory private land use restrictions present in the national forest code.

Experience with AEM in Portugal and Germany has not overall been favourable. In Portugal, farmers tend to prefer single AEM payment schemes over the more inflexible specific and narrow AEM measures targeted for conservation areas (ITI), adopted to complement the designation of conservation areas; in Germany, the analysis focused on design options of an agri-environmental scheme for afforestation, and farmers are reticent to afforest areas they cannot later use for other purposes due to permanence rules. In both cases, AEM appear to represent a policy mix in their own right, causing additional complexity in administration. In Brazil, land reform beneficiaries engaged in ICDP activities successfully adopted agroforestry practices on individual lots, but at a settlement scale were unable to disassociate themselves from overall Amazon land use trends of widespread deforestation and biodiversity loss, despite more rigorous enforcement. In all cases, the factors that appear most important to successful implementation of AEM include participatory design and continuous technical support to disentangle the complexity of multiple land use incentives and practices. This is particularly true in a policy environment in which changes are introduced erratically over time, and discontinuities in funding prevail, provoking uncertainty and unwillingness to adopt permanent measures.

Ex ante simulations and choice experiments with beneficiaries in both Portugal and Germany found that introduction of instrument modifications (e.g., contract options, spatial targeting) have the potential to make AEM both more cost effective and attractive to farmers. In Brazil, a policy mix of common property forest reserves, certification and market development for non-timber forest

products, including guaranteed institutional purchasing, reduced biodiversity losses significantly over regional trends.

The approach of intergovernmental transfers to compensate for spillover benefits of protected areas to other jurisdictions began in Brazil in 1992 with the “Ecological ICMS”, which allocates part of constitutionally required value-added revenue redistribution to local governments in part based on the proportion of municipal area dedicated to conservation. EFT experience reviewed by POLICYMIX case studies in Brazil and Portugal suggests that although this compensation can serve as a stimulus to proactive local conservation policies, a range of factors affect the expansion in the protected area system. In Germany, an ex ante analysis to introduce an EFT instrument between the federal level and the states showed how this is also perceived as an important means to complement national biodiversity conservation with more proactive efforts on the part of the states. Introduction of EFT by Brazilian states was important to stimulate initial municipal engagement in biodiversity conservation, but in the coarse grain study of Mato Grosso, for example, further progress was stymied by agribusiness expansion and restraints on protected area creation.

Design of the EFT allocation system can be a point of departure for improvements in such schemes. In some cases, the quality of local productive land use management can achieve synergies with protected areas, thereby generating greater amounts in revenue sharing, in turn reinforcing proactive management efforts. However, introduction of additional criteria for distribution can face political resistance from local governments that are already losers in the initial framing of EFT allocation, and the lack of earmarking for use of additional resources can backfire when revenues are used for activities that provoke further biodiversity loss (e.g., road building in the Amazon).

A serious lack of information and communication prevails among spheres of government in Brazil and Portugal related to the purpose and options for improving EFTs’ role in the conservation policy mix. Hidden among other sources, this leads to a tendency to regard such additional revenues as entitlements available for general purposes rather than a basis for enhanced biodiversity protection. In Germany, on the other hand, state governments are considered to be well aware of the criteria for revenue sharing and are expected to be more sensitive to additional revenues from this source. In general, the potential for EFT to complement other instruments such as AEM and PES has not yet been well explored by policymakers and could create important additional synergies in the instrument mix combining private and public actors’ roles in conservation.

Acknowledgements

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January 2014 Rui Santos, Peter May, David N. Barton and Irene Ring

1 Introduction

BY DAVID N. BARTON, RUI SANTOS, PETER MAY AND IRENE RING

The report is the result of a synthesis and comparison of seven case studies on economic instruments in policy mixes for biodiversity conservation (and ecosystem service provision) in Europe and Latin America. All cases have had a focus on biodiversity conservation and/or conservation of forest or agro-forest ecosystems, and on three economic instruments: ecological fiscal transfers, payments for ecosystem services in forests, and agro-environmental measures. The analysis covers the work developed in the case studies both at a national/state (coarse grain) and local (fine grain) levels.

Each POLICYMIX project case study addressed a number of instruments, making the number of cross case comparisons potentially large. To ease presentation, the choice of instruments for cross case comparison in this report was based on instruments that had been considered at state/national level and where we felt there was a potential for lessons learned between European and Latin American cases.

For PES schemes, we chose to focus on comparison of national level schemes, rather than local and project level schemes mainly because the review of local level schemes in our Latin American case studies has not been exhaustive, while state/national schemes predominate in Europe. We chose to carry out comparisons where we had similar instruments implemented in 3 or more case studies within the project. Instruments not compared in the main body of the report are nevertheless discussed in the case study appendix, and the case study reports available on the POLICYMIX website (http://policymix.nina.no).

Table 1 - Cross-case comparisons

Instrument	Specification	Costa Rica	São Paulo	Mato Grosso	Port-ugal	Fin-land	Ger-many	Nor-way
Ecological Fiscal Transfers	National to state or national/state to municipal							
Agri-Environmental Measures	national/state							
Payments for Environmental Services	national/state							

The analytical structure adopted for the cross comparison of economic instruments for biodiversity conservation for the seven project case studies builds on the developed POLICYMIX framework (Schröter-Schlaack and Ring (ed.) 2011, Ring et al 2011) and the WP3-6 guidelines (Rusch et al 2013, Brouwer et al 2013, Grieg-Gran 2013, Primmer et al 2013). The analysis in the instruments comparison chapters focus on steps 2 and 3 of the POLICYMIX framework, looking at the role of economic instruments in the policy mix, the conflicts and synergies between instruments, the sequencing in implementation, and the extent to which they are redundant or overlapping in policy processes and in the landscape itself, as well as at the impact evaluation and scenario analysis across the case studies. The case studies summaries presented in the Annex follow the major topics addressed in the WP3-WP6 guidelines.

A nested diagnostic approach to evaluating economic instruments

Despite high level policy guidance encouraging policy mixes for biodiversity conservation (see Chapter 2), it is our impression that much of the academic literature on evaluating economic instruments in biodiversity conservation – particularly PES - has been dominated by 'single instrument' analyses (e.g. Wunder et al 2008, Pattanayak et al 2010, Muradian et al 2010). This focus is understandable, as cross-case comparisons across many interacting dimensions most often cannot be supported by data across multiple locations and countries. However, this has also led to a relative gap in development of methodologies to analyse and compare policy mixes.

The comparative case study analysis of economic instruments in policy mixes has drawn inspiration from Ostrom's work on design principles for common property resource management (CPRM) institutions (Ostrom 1990), the institutional analysis and development framework (Ostrom 2005), and the nested diagnostic approach proposed by Ostrom (2007) in comparing highly context specific social-ecological-systems.

To allow for diversity of contexts, Policymix analysis framework also allows for different analytical tools being applied in ex ante and ex post policy impact analysis. Ostrom's (2007) diagnostic approach proposes that where case data are obtainable more specific methods can be applied to 'drill down' in the hierarchical structure of instruments. We test this approach in the PES chapter where we explore the Institutional Analysis and Development (IAD) framework (Ostrom 2005) to provide an in-depth analysis of 'rules-in-use' in three national PES schemes. We use this chapter to demonstrate both the potential and challenges of applying nested framework of analysis to cross case comparison.

Challenges of cross case assessment of policy mixes – some lessons from the CPRM literature

Ostrom (2009) defines 'polycentric' institutions as many centers of decision making that are formally independent of each other, and yet can function together as a system. Ostrom cites North (1990, 2005) in defining the kinds of actors and situations that are the subject of institutional research; "the humans we study have complex motivational structures and establish diverse private-for-profit, governmental, and community institutional arrangements that operate at multiple scales to generate

productive and innovative as well as destructive and perverse outcomes". "One-size-fits-all" policies are not effective (Ostrom 2009), and they are also unlikely to be observed in the real world. We feel that this framing of the problem is very much the spirit of Policymix analysis.

The POLICYMIX project has suggested the following pragmatic working definition (Ring and Schröter-Schlaack 2011: 15): "A policy mix is a combination of policy instruments which has evolved to influence the quantity and quality of biodiversity conservation and ecosystem service provision in public and private sectors". Our definition of a policy mix is descriptive rather than normative. But should policy mix analysis endeavor to find specific rules associated with successful economic instruments and policy mixes, or broader design principles? Ostrom refers to the incredible number and diversity of rules that they recorded in the course of their meta-analysis of CPRM cases. "There are thousands of individual rules that can be used to manage resources. No one, including a scientifically trained professional staff, can do a complete analysis of any particular situation" (Ostrom 2005). Ostrom writes that finally she had to give up the idea that specific rules might be associated with successful cases.

Writing about forests "it is not the general type of forest governance that is crucial in explaining forest conditions; rather, it is how a particular governance arrangement fits the local ecology, how specific rules are developed and adapted over time, and whether users consider the system to be legitimate and equitable" (Ostrom 2009). "Biologists recognize that an organism's appearance and behavior are affected by the environment in which it develops. Social scientists also need to recognize that individual behaviour is strongly affected by the context in which interactions take place, rather than being simply a result of individual differences".

Inspired by this perspective, POLICYMIX case studies have also focused on how the policy mix is contingent on the landscape mosaics, defining a "policyscape" as the spatially explicit and spatially contingent policy mix (Barton et al. 2013). Even if general policy mix design principles cannot be identified, what policy conclusions can be taken from the diversity of case studies and economic instruments reviewed here? Biodiversity governance – and the study of governance - may fail by trying to homogenize the diversity of contexts to which it applies its policies and management practices.

Organization of the document

The document is organized in 6 chapters. Chapter 2 presents a summary of messages and orientations provided by high-level policy guidance documents on the use of economic instruments in biodiversity conservation policies.

Chapters 3, 4 and 5 present a cross case comparison of economic instruments, respectively grouped in PES, AEM and EFT.

Following the spatially explicit thinking above, the decision to analyse separately PES and AEM, instead of considering AEM as a type of PES, was based on the differences found among the targeted actors and landuses. Analysed PES are related to forests and the cases address foresters or forest companies, while AEM are mainly oriented to agro-forest systems and address farmers, even if this is

related to afforestation or forest services in some way. The type of actors addressed is a distinctive feature. While PES and AEM are targeted toward private actors, EFT primarily target decentralised government authorities (municipalities; state governments in federal states), though we see synergies with instruments aimed at private actors.

In chapter 6 the main conclusions, knowledge gaps and unresolved research questions are discussed.

Summaries of each case study results following a common template are presented in the Annexes.

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2 A review of guidance documents on the use of economic instruments in conservation policies

BY RUI SANTOS, PEDRO CLEMENTE, PAULA ANTUNES AND IRENE RING

2.1 Introduction

This chapter presents a summary of messages and orientations provided by high-level policy guidance documents on the use of economic instruments in biodiversity conservation policies. It is based on a brief review of a selected set of documents published by leading international organizations, including the CBD, UNEP, OECD and the EC. The objective is to provide a basis for comparison with the common policy recommendations drawn from the POLICYMIX case studies.

The chapter structure follows the steps of the proposed POLICYMIX framework for the evaluation of economic instruments. Therefore, the identified messages and orientations are grouped in the following topics: context and baseline conditions, functional role, policy design challenges and policy implementation. As far as possible we have tried in this Chapter to synthesise high-level recommendations without mixing in any discussion of findings from POLICYMIX case studies. We then return to these recommendations in the cross comparison chapters for each type of instrument (PES, AEM and EFT), as well as in the final discussion section, to reflect on the relevance of high level guidance and to identify differences with our findings from POLICYMIX case study sites.

2.2 Context and baseline conditions

Several international and European organizations recognize that biodiversity conservation is an extremely complex problem (OECD 1999, CBD 2010, EC 2011, McGlade and van den Hove 2013). The environmental policies designed to address complex environmental problems have diverse relevant social and economic impacts. International organizations recommend the adoption of a “policy mix” approach to deal with the inherent complexities and develop a successful policy framework for biodiversity conservation. A policy mix consists of various regulatory, economic and voluntary instruments, relying on specific and appropriate institutional, economic and social assessments. In the context of the POLICYMIX project, we suggest the following pragmatic working definition (Ring and Schröter-Schlaack 2011: 15): “A policy mix is a combination of policy instruments which has evolved to influence the quantity and quality of biodiversity conservation and ecosystem service provision in public and private sectors”. The policy mix approach is essential to achieve sustainable long-term conservation and ensure equity in benefit sharing (Emerton 2000, UNEP 2002, MA 2005a, MA 2005b, TEEB 2009, Gundimeda and Wätzold 2010, OECD 2010, TEEB 2010a, TEEB 2011, TEEB 2012).

To successfully introduce new policy instruments within "policy mixes", policymakers need to evaluate alternative solutions and to recognize and describe the trade-offs between them. The aim is to evaluate all implications and guarantee that implicit compromises are fully considered in the decision making process. It is also essential to identify and incorporate realistic assessments of the limitations of both new policy instruments and institutions overseeing them, otherwise, the instruments will most likely fail to perform (Emerton 2000, OECD 2010, UNEP 2002b, UNEP 2004a, UNEP 2004b).

The choice of potential policy options or of a particular instrument can be complex and is dependent upon different dynamics and contexts, such as political support, institutional capacities, economic conditions and social needs. The viability of policy instruments can be highly influenced by the status quo into which they will be introduced (*e.g.* institutional strength, political acceptability and stakeholder dynamics). Thus, the existing institutional conditions might lead to appropriate policy options that are not necessarily the most effective ones. Therefore, it is essential to consider the institutional fit of instruments, and to perform a detailed ex-ante assessment of policy instruments, focusing not only on their effectiveness and efficiency, but also on issues such as equity, political acceptability and likely impact. Such an analysis should recognize that, for instance, there may be trade- offs between equity and legitimacy on one side and efficiency on the other (Emerton 2000, OECD 2004, UNEP 2004a, Ostrom 2005, TEEB 2012, McGlade and van der Hove 2013).

Economic instruments are increasingly supported and used as a relevant component of conservation policy since they provide a range of policy tools that encourage behavioural changes through their impact on the financial costs and benefits facing private and public agents, rather than through explicit directives or regulation (OECD 1999, Emerton 2000, EEA 2006, CBD 2010, TEEB 2010, EC 2011, TEEB 2011, TEEB 2012). To decide upon the use of such instruments policy makers should assess the need and potential utility of incentive measures before implementing them. This requires a clear and realistic assessment of the baseline conditions, namely, analysing the environmental problem, evaluating past attempts to address it and identifying the policy gaps that incentive instruments can successfully fill. This review entails gathering information on the existing environmental conditions and ecological resources (e.g. species, habitats, ecosystem services), as well as identifying stakeholders interests and dynamics (in a broader sense), the baseline institutional strength and capabilities and the existing conservation policy mix (Emerton 2000, UNEP 2004a).

The use of economic valuation methods can be valuable to support the introduction of economic instruments, as they can provide information on the economic benefits and opportunity costs of maintaining biodiversity and the costs of biodiversity loss that the instrument needs to address (UN GAOR 1992, Emerton 2000, UNEP 2002b, OECD 2004, UNEP 2004b, OECD 2010, Gundimeda and Wätzold 2010, TEEB 2010a, TEEB 2010b, TEEB 2012). For example, accounting for spatial variation in ecosystem service benefits via economic valuation allows payments to be prioritised to those areas that provide the highest benefits (OECD 2010). However, several organizations and analysts recognize the challenges associated with non-market valuation and that there are various limitations in measuring and valuing of biodiversity and ecosystem services, as both the costs and benefits of

biodiversity loss are still largely unknown and have not been properly translated into economic terms (OECD 1996, UNEP 2002a).

This difficulty can have crucial implications for the application of economic instruments, namely for those that work on the basis of market principles and thus respond best in situations that allow for accurate pricing and valuation, including particular attention to transactions costs (UN GAOR 1992, Emerton 2000, OECD 1999, OECD 2004, OECD 1996, UNEP 2004b).

The information from the baseline assessment should be assembled into a structured template and combined with a process of stakeholder involvement to identify and deal with remaining information gaps. Revising the environmental problem through the available information will help focus on the most promising policy options and propose a range of solutions. Making this assessment available to policy makers is essential to assist the decision making process in setting adequate conservation objectives and selecting the appropriate economic instruments to secure them (OECD 1996, UNEP 2002b, OECD 2004, UNEP 2004a, Coggan et al 2006).

Economic instruments can provide cost-effective solutions to address biodiversity loss in a conservation "policy mix". They make use of market mechanisms and so should be seen within the broader context of a market-based approach to the promotion of biodiversity goals, and have been extensively applied in the context of biodiversity conservation over the last few decades (UNEP 2004a, OECD 2004). Economic instruments for biodiversity conservation are designed to ensure that expected benefits of a biodiversity enhancing land use practice are greater than or equal to the cost of implementation, administration, and enforcement. These instruments realign rights and responsibilities of private and public actors, providing both the incentive and authority for them to act in a more environmentally friendly way, thus reducing the social cost to achieve a given level of environmental quality. Incentivizing actors at decentralized decision-making levels through their impact on market signals, they are generally assumed to be less expensive, more flexible, and more dynamic than regulatory approaches (OECD 1996, OECD 1999, UNEP 2002b, UNEP 2004a).

However, economic instruments are not always appropriate, as they must meet several preconditions to be viable. The most common problems hindering their implementation are: (1) short *timeframe to solve the environmental problem*, when problems have severe implications and behaviours need to change immediately, regulatory approaches may be more appropriate; (2) *excessive monitoring costs*, which can exceed the benefits of the instrument; (3) *fragmented oversight authority*, where authority to set and enforce the instrument is highly fragmented across institutions oversight might become difficult; and (4) *opposition or social stigma* towards the instrument, as social factors and interests groups can create obstacles and make market-based solutions difficult to implement (OECD 2004, UNEP 2002b, UNEP 2004a, Gundimeda and Wätzold 2010, TEEB 2011, TEEB 2012).

2.3 Functional role

In this section, we identify the main concerns and orientations referred to in the literature on the roles, interactions and dependencies of instruments in the policy mix. In the reviewed documents there are very few references to aspects related to the functional role of instruments in a policy mix. This finding reinforces the relevance and innovative approach underlying the assessment framework proposed by the POLICYMIX project. In POLICYMIX we have concluded that "there are three main determinants that influence the composition of the mix and that define the role of different instruments within the policy mix, namely the performance (and composition) of the existing policy (mix), the context-specific strengths and weaknesses of the individual approaches and lastly the interaction of the instruments within the policy mix" (Ring et al 2011: 10). In section 6.1 we will discuss the progress achieved in POLICYMIX in how to characterize policy mixes.

Long-term conservation and sustainable use of biodiversity can only be achieved through a mix of compatible and mutually reinforcing policies towards the conservation goals, instead of conflicting with them. No single policy approach or instrument will be sufficient to meet the complex objectives of biodiversity conservation (OECD 1996, OECD 1999, Emerton 2000, UNEP 2002a, MA 2005a, MA 2005b, Coggan et al 2006, CBD 2010, TEEB 2011, TEEB 2012).

The need to find a synergistic, positive and complementary interaction among economic instruments themselves and to avoid negative interactions is particularly emphasized. In this context, it is stressed that economic instruments can use a wide range of incentive mechanisms, ranging from taxes on harmful activities, to providing payments for the provision of ecosystem services (UNEP 2004b, Coggan et al 2006, TEEB 2011, TEEB 2012), and that a balanced combination of positive incentives to enhance biodiversity conservation and disincentives to discourage biodiversity damaging behaviours is required (UN GAOR 1992, OECD 1996, OECD 1999, Emerton 2000, OECD 2004, UNEP 2004b, TEEB 2011, TEEB 2012). It is also essential to identify and remove existing perverse incentives, as they might have a harmful effect on biodiversity policy implementation and effectiveness (OECD 1996, UNEP 2002a, OECD 2004, UNEP 2004a, UNEP 2004b, OECD 2010, CBD 2010, TEEB 2011).

Economic instruments are useful to enforce the "polluter pays principle", to secure property rights and to compensate relevant actors for services provided. Additionally, they can generate funds and financial resources to provide incentives for cost-effective investments in environmentally friendly technologies or practices, encouraging a strong involvement of private actors in the conservation effort (UNEP 2002b, UNEP 2004a, TEEB 2011).

For economic instruments to be effective they must fit into the existing institutional context, and be implemented in a mutually supportive way to ensure compliance with regulation and promote synergies between economic activity and biodiversity conservation. This requires identifying and targeting the policies and stakeholders that have some degree of influence on biodiversity status, namely which parties are responsible for either ecosystem benefits or damages and how the benefits and costs of the relevant activities are being spread among actors, both public and private (OECD

1996, OECD 2004, UNEP 2004a, Gundimeda and Wätzold 2010, TEEB 2010, TEEB 2011, TEEB 2012, McGlade and van den Hove 2013).

2.4 Policy design challenges

The design of economic instruments in a conservation policy mix is a challenging process. It requires addressing effectively the environmental problem within the institutional context of the existing conservation policy mix, and, simultaneously, to suit the specific circumstances and expectations of the majority of relevant of different groups of stakeholders minimizing the impacts on the economic activities undertaken in the target areas (UNEP 2004a, UNEP 2004b, Gundimeda and Wätzold 2010, MA 2005b, TEEB 2011, TEEB 2012). Instruments that are very specifically targeted (e.g. some local PES, AEM) are usually easier to design and implement than instruments that address behavior in a broader sense and target several conservation objectives (e.g. national level PES programs).

Designing instruments to address complex problems considering a large number of environmental, economic and social variables that are constantly changing can be particularly difficult. Therefore, it is recommended to periodically adjust the design of the incentives in order to better adapt them to the existing ecological and economic conditions and to increase the effectiveness of the instrument (UN GAOR 1992, OECD 2004, Gundimeda and Wätzold 2010). These amendments can be very helpful, for example to overcome technical challenges in establishing the appropriate incentive levels (OECD 2010). At the same time, adaptive management may be in apparent conflict with the objectives of permanent conservation, for example when PES contracts are not renewed due to changing conservation priorities.

The poor design of economic instruments may lead to lack of effectiveness, equity and/or efficiency. For example, for payments for environmental services (PES), such potential problems are: the risk or lack of additionality - the incentive is used to promote practices that would have been adopted regardless of the instrument's existence (however, if PES increases compliance with existing regulations then it is by definition "additional"); leakage – the instrument only displaces undesirable activities to a different area, shifting environmentally harmful activities somewhere else; and lack of permanence - the program ends up not being viable over the long-term (Gundimeda and Wätzold 2010, OECD 2010).

A key requirement from the perspectives of the regulators, as well as the addressees in the design of economic instruments, is predictability. Before designing the instrument all involved actors must have their rights and responsibilities clearly agreed, and the rules need to be well defined from the beginning. The goal is to establish a predictable path for participants that will facilitate long-term planning and investment (UN GAOR 1992, UNEP 2002b, OECD 2004, Gundimeda and Wätzold 2010). Setting clear and specific targets for the instrument that are time-driven and can be measurable through a robust set of indicators is also a key condition to ensure the transparency and credibility of the instrument (UNEP 2002a, Coggan et al 2006). A Coasean view defends that voluntary exchange

and market prices cannot be determined without clear definition of rights. However, high level policy documents are sometimes unclear about the role of securing tenure rights for the functioning of economic instruments. Some see it as a pre-condition for economic instruments, while others see economic instruments as helpful in securing rights.

The success of any economic instrument relies mostly on targeted actors, decisions and actions. Therefore it is important to design incentives with clear goals that are accepted by the majority of stakeholders at different governance levels, considering the political, economic and other baseline conditions. To do so, the instrument must be consistent with wider goals and activities of the existing development or conservation plans, and target the particular groups who are affected by, or whose actions have the potential to influence biodiversity conservation. On the other hand, it is important to identify important societal interest groups with the power to block or dilute necessary conservation policy instruments, to avoid the design process being diverted in less cost-effective directions. Instruments conflicting with the goals of relevant stakeholders, creating barriers for their participation in conservation management or contradicting wider social and economic ideologies may have their efficacy and efficiency reduced, and are unlikely to be appropriate or implementable in practice.

An effective instrument should also be designed to focus the environmental problem to be solved, avoiding overly complex measures. Trying, for instance, to address simultaneously the environmental goal and improve baseline conditions (e.g. poverty alleviation and conservation effectiveness in PES), aiming at general economic/social objectives, may lead to failure and generate harmful effects on biodiversity and its related resources (OECD 1999, Emerton 2000, OECD 2004, UNEP 2004a, Coggan et al 2006).

Relevant stakeholders should be effectively involved in the policy instrument design process, in order to build political support, institutional capacity and social legitimacy. Some degree of targeting non-conservation objectives is therefore necessary for stakeholders to perceive the economic instrument as ‘fair’, and achieve political buy-in to initial implementation. This may, however, require costly and time-consuming actions (*e.g.* communication, meetings) (OECD 2004, UNEP 2004a). Involving stakeholders in the instrument design allows the integration of local and regional knowledge, which, once combined with the biophysical characteristics of the target area will be crucial to match the scale of the instrument to the scale of the problem it intends to address (UNEP 2002a, Ostrom 2005, TEEB 2012, McGlade and van den Hove 2013). Additionally, stakeholder involvement in the design stage can also be important to identify and properly address opportunity costs and environmental externalities (UN GAOR 1992, OECD 1996). In that sense, economic instruments work in the realm of “satisficing”, rather than optimization of conservation effectiveness alone.

2.5 Policy implementation

For an economic instrument to achieve the expected environmental outcomes, it is necessary to guarantee a set of actions during the implementation stage, namely related to monitoring, information provision and engagement of relevant stakeholders. The management, enforcement and reporting activities, based on a robust monitoring framework, require significant efforts and funding. In some cases, such as when there are a large number of very small transactions in market-based instruments, monitoring and control (oversight) costs can exceed the benefit (monetized or not) of the instrument (OECD 1999, UNEP 2002a, UNEP 2002b, OECD 2004, UNEP 2004a, Coggan et al 2006, OECD 2010, McGlade and van den Hove 2013). When the authority to set and enforce regulations is highly fragmented across institutions, oversight might become quite difficult implying unreasonable costs, or even impossible to guarantee (UNEP 2002b).

It is essential to provide a complete and transparent disclosure of the performance of the instrument. A continued update of progress contributes to ensure the proper functioning of the instrument and to ensure its legitimacy. The provision of information may be important, for example, to counteract any pressure from affected stakeholders towards redesigning the instrument, in order to reduce its environmental targets or goals. Acceptability can also be enhanced if the oversight agency demonstrates adequate capabilities to perform the monitoring and evaluation tasks for which it is responsible. Monitoring and enforcement systems need to be established in order to make clear both the severity of the problem and the potential benefits of the proposed instrument (UNEP 2002b, UNEP 2004a, Coggan et al 2006).

As pointed out in the previous section, there is a risk of lack of permanence after an initial period of implementation. To tackle this issue it is important to empower the local communities and conservation agencies, in order to ensure long-term sustainability of the instrument. Even when the instrument is externally supported (e.g. using national funds), the actions of local actors are essential for its successful implementation. Keeping these stakeholders engaged makes the process easier and less expensive. Economic instruments with low transaction, enforcement and participation costs are more prone to be sustainable in the long run (Emerton 2000, Gundimeda and Wätzold 2010).

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3 Cross case comparison of payments for ecosystem services in forest (PES)

BY DAVID N. BARTON, EEVA PRIMMER, ADRIANA CHACÓN-CASCANTE, AND DANIEL CAIXETA ANDRADE

In this chapter we compare three national level voluntary forest conservation programmes in the POLICYMIX project; the Finnish "nature values trading" (METSO) scheme (Primmer et al 2013a, 2013b), Costa Rica's 'Pagos por servicios ambientales' (PSA) scheme (Chacón-Cascante et al 2012, Porras et al 2012, Chacón-Cascante et al 2013); and Norway's voluntary forest conservation agreements (VCA) (Barton et al 2012a, Skjeggedal et al 2010, Lindhjem et al 2013, Barton et al 2012b). We also include a section contrasting lessons learned from the analysis of a prospective local PES programme in São Paulo state (Romeiro et al. 2013). As the São Paulo case is prospective and local, it is not part of the comparative analysis testing the IAD framework on existing, national level voluntary forest conservation programmes.

3.1 Historical sequencing of PES – cross case comparison

The historical development of voluntary forest conservation, including payments for ecosystem services, in Costa Rica, Finland and Norway shows some broadly similar patterns (Figure 1). Despite large differences all countries started their conservation policy mix with large public protected areas in remote areas, followed by public reserves targeting more specific types of habitats. Public protected areas on productive private lands have always created conflict, but these conflicts gave way to voluntary conservation on private lands with economic compensation in the late 90's early 2000's in all three countries. In all three countries forest conservation on previously unprotected lands is currently based almost entirely on voluntary participation.

Finland has supported sustainable timber production (including reforestation in some areas) since 1950s. But this sustainability policy was not framed with nature conservation goals, i.e. these were silvicultural subsidies. Costa Rica was an early starter in providing financial support for sustainable forest management and reforestation. Costa Rica's financial support for forestry started to include soft loans (the 1977 Forest Law required that at least 2% de total state loans were to be allocated for reforestation), tax exemptions based on certification for sustainable forestry, reforestation and forest conservation during the 70's and 80's. Structural adjustment from the mid 90's led to a reform of forestry subsidies and opened up the debate for 'payments' for services. The Costa Rican PES program was created in 1996 and first launched in 1997. The program is voluntary and explicitly recognizes four ecosystem services from forest: carbon sequestration, scenic beauty, biodiversity and water quality provision. It is noteworthy that the Program has evolved over the years aiming at better biodiversity and social targeting.

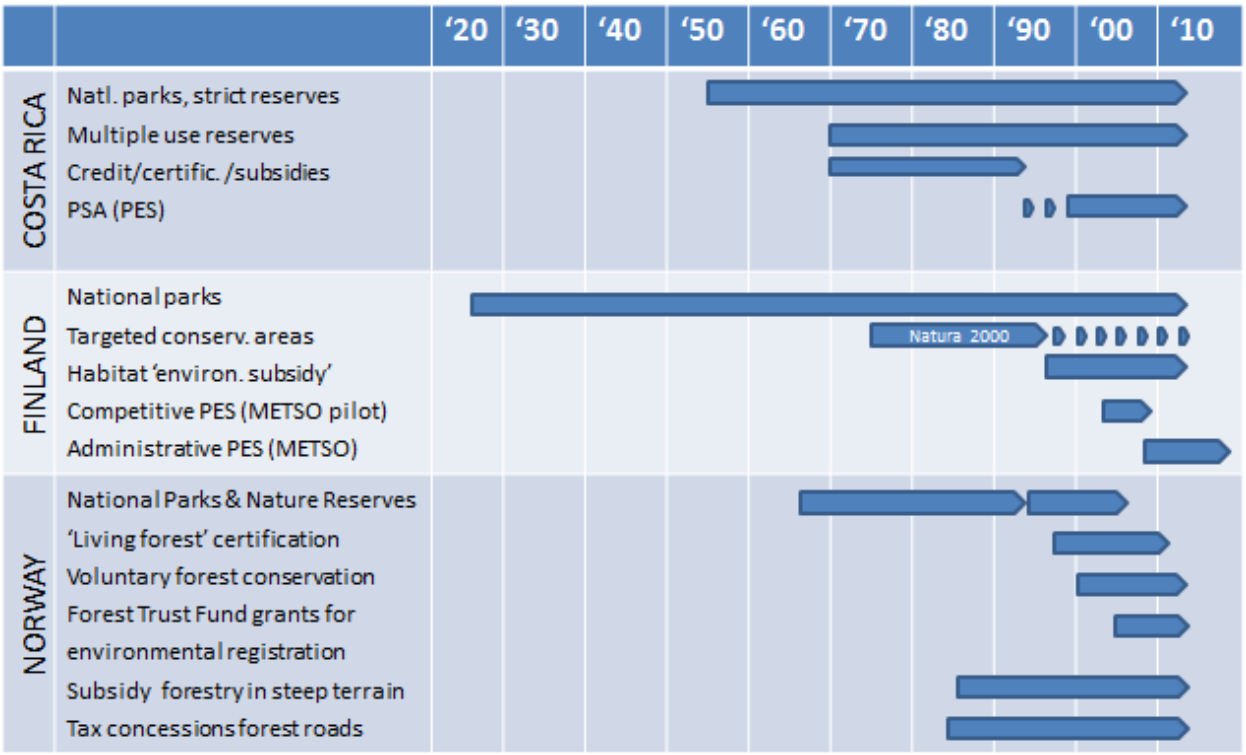

Figure 3.1. Some broad patterns in sequencing of voluntary forest conservation in Costa Rica, Finland and Norway.

While Costa Rica removed subsidies for forestry in the 1990's, it is worth noting that in Norway that subsidies for forestry in steep terrain and for forest roads have been in place simultaneously with promotion of voluntary conservation. Norway and Finland (Auvinen et al 2007) have a more heterogeneous forest policy mix than in Costa Rica in terms of simultaneous incentives for forest conservation and forestry subsidies that have been evaluated as potentially harmful for biodiversity.

In Finland, protected area establishment has been compensated for and significant economic losses generated by targeted Forest Act habitat conservation have also been compensated to private forest owners. However, habitat conservation has incurred conservation responsibilities, the costs of which fall on the forest owner. As a response to severe pressure to increase the autonomy of forest owners in conservation, a PES scheme has been established and piloted under the so-called METSO-programme (Primmer et al 2013b, 2013c). This pilot phase shifted policy to joint implementation by environmental and forestry administrations that would make voluntary conservation contracts on sites with specified habitat characteristics. As the pilot also considered ecological characteristics as bases for payment and aimed for comparison across sites, it could be considered a "competitive PES". In the up-scaled phase of the METSO programme, the approach has shifted back to compensation for economic loss in a standardized fashion and with separate responsibilities for environmental and forestry administrations, as an "administrative PES". This shift has in part been due to EU State Aid limitations on PES.

No new targeted conservation areas have been initiated since the start of the METSO programme, but some previously approved areas are still being implemented.

In Norway, the voluntary forest conservation programme is similar to parts of METSO 'administrative PES', where forest owners with of particular characteristics are invited to offer their forest as private forest reserves or for acquisition by the State. After negotiation regarding compensation, forests enter into the normal procedure for creating public nature reserves. Norway does not have the fixed-term PES modality, which is present in both Finland's and Costa Rica's PES. In Costa Rica, participation is entirely voluntary; nonetheless, a matrix of selection criteria mixing biodiversity and socio-economic criteria is defined on a yearly basis so as to better target how payments are allocated.

3.2 Implementation of PES – a comparison of rules-in-use

A comparison of PES instruments across case studies is challenging because of a lack of a common classification system describing the 'elements' that make up 'voluntary forest conservation with payment'. In this chapter we use 'rules-in-use' from Ostrom's Institutional Adaptation and Development (IAD) as a framework for comparison (Ostrom 2005) (see Table 3.1).

Table 3.1 Institutional Adaptation and Development (IAD) Framework

IAD Rule	Description
Position rules	Decision-making positions that actors can fill and which are assigned action sets at particular decision-making junctures. Multiple positions are possible for individual actors
Boundary rules	Who is eligible; entry rules; succession rules; exit rules. Defining holder and nonholders of positions
Information rules	Affect level of information available to participants about; Overall structure of situation, current state of resource, previous and current experience of others' participation, own past moves (channels, frequency accuracy, subject of communication, official language)
Aggregation rules	Whether decision requires single or multiple participants. Lack of agreement rules.
Scope rules	Known outcome variable(s) that must, must not, or may be affected by action (i.e. policy goals). Define which variables are observed and their range (includes intermediate and final outcomes in the 'policy cycle')
Choice rules	Required, permitted and forbidden actions at a particular time based on conditions that have or have not been met.
Payoff rules	Assign external rewards and sanctions to particular actions or to particular readings on outcome of state variables.

Source: action situation 'rules' based on Ostrom (2005).

Ostrom (2005) makes a distinction between organisations and institutions. Institutions encompass 'rules-in-use' at different levels of organisation; organisations are made up of actors who have different roles according to rules-in-use. Ostrom identifies 'classifying rules' which may be used to describe institutions (position, boundary, information, aggregation, scope, payoff and choice rules).

In Table 3.2 we have used the IAD framework on the Norwegian, Finnish and Costa Rican voluntary forest conservation schemes. Highlights in green in table 3.2 are examples of differences in rules-in use for voluntary forest conservation between the three cases. We also compare the rules-in-use framework with criteria used for PES case study comparison by Wunder et al (2008), indicated with an asterix(*).

Table 3.2. Examples of differences in PES schemes relative to different 'rules' in the landuse 'action situation' (Differences marked in green).
Sources: Chacón-Cascante (2013), Barton et al (2012a), Skejeggedal et al (2010), Primmer et al (2011). *Criteria used for case study comparison by Wunder et al (2008).

	Examples of rules	**Costa Rica** **PSA protección**	**Finland** **METSO PES**	**Norway** **Voluntary forest conservation**
Position rules	*1. Instrument initiator** *2. Financing sources (user, govt.)* *3. External donor support** *4. Priority-setting policy maker* *4.1 Target, annual objectives* *4.2 Priorities* *5. ES buyer** *6. ES Beneficiary** *7. Participant / ES Seller** *8.1 Intermediary*: identification* *8.2 Intermediary: application* *8.3 Intermediary: negotiation* *9. Monitoring and reporting* *10.Verification (3rd party)* *11. Cooperative, association…*	1. Forest Fund (FONAFIFO) 2. Earmarked taxes, water fees, CTO sale 3. External donor (GEF and World Bank). 4.1 MINAET-FONAFIFO 4.2 Multi-sectoral board of FONAFIFO 5. Forest Fund (FONAFIFO), water utilities, hydropower companies 6. State, private companies, households 7. Forest landholder; physical person or anonymous legal entity 8.1 NGO forest engineer (regente) & Owner self-selection 8.2 NGO forest engineer (regente) 8.3. N/A 9. NGO forest engineer (regente) 10. Conservation authorities (SINAC) 11. Few landowners are members of cooperatives or forest associations	1. Environmental and forest authorities 2. Budgets for environmental and forestry authorities 3. None 4.1/4.2 The working group on Southern Finland Forest Biodiversity Conservation 5/6. Forestry & Environmental Authorities 7. Private forest owners 8.1/8.2 Forest-owner associations can assist in application; all forestry actors are mandated to identify sites. 9. Environmental and forestry authorities 10. No third party verification 11. Nearly all forest owners are members of forest owner associations	1. Environment Agency & natl. forest associations 2. Annual government budget 3. None 4.1 Ministry of Environment 4.2 County governor environment department (value) & Forest owner association (threat, availability) 5. County governor 6. Ministry of Environment/Public interest 7. Private forest owners 8.1 Forest association & County Env. Dep. 8.2 Forest owner association 8.3 Association & State Forest Represent. 9. Environment Agency consultant 10. County environment department. 11. Nearly all forest owners are members of forest owner associations
Boundary rules	*1. Landowner eligibility ** *2. Spatial scale/planning area**	1. Legal title or holding; higher ranking score than competitors 2. National	1. Continuous invitation to tender based on prioritized forest habitat types 2. Southern Finland (all regions where	1. Voluntary proposals screened by County Governor and DN for prioritized forest types. Negotiated compensation amount.

	3. Prioritization criteria *4. Length of contract* *5. Contract renewal criteria* *6. Contract cancellation criteria* *7.Agglomeration bonuses or minimum contiguous area requirements for collective PES contracts*	3. FONAFIFO application ranking criteria: Conservation gap areas, biological corridors, expropriations, renewals, low development indicator areas, <50 ha farms 4. Fixed term contract (10 years) 5. Same as for first time applicants 6. Land title inconsistencies; Lacking protection measures (not enforced) 7. Minimum area requirement, agglomeration encouraged by prioritizing biological corridors	private ownership dominates) 3. Scarce budget is allocated mostly on a first-come-first-serve basis, however prioritizing habitats that meet the stricter conservation criteria 4. Fixed term contract (10 years) & permanent contracts 5. Same as first time applicants 6. N/A 7. None	2. County level. No national distribution targets 3. Short term threat of logging & a minimum 'regional' biodiversity value screening criteria (threat & value) 4. Permanent 'sale' of forestry rights 5/6. N/A 7. Minimum area requirement , agglomeration of properties sought by forest associations and County,
Information rules	*1. Free prior informed consent (FPIC)* *2. Public hearing processes.* *3. Freedom of information* *4. Monitoring and reporting** *and verification (MRV) requirements* ..	1. Yes, criteria openly available, but require specialist interpretation 2. No public hearing process on contract selection (criteria based). 3. Applications not listed, contracts listed, but not mapped. Owners of anonymous legal entities cannot be identified. Not strict interpretation of privacy of forest owner information. 4. SINAC monitoring; FONAFIFO reporting. No third party verification.	1. Yes, criteria openly available but require specialist interpretation 2. No public hearing process on contract selection (habitat criteria based) 3. Habitat information available among authorities, but strict interpretation of privacy of forest owner information. 4. Assumed compliance, standard forestry operations monitoring would detect non-compliance (harvesting). Re-evaluation only if contract Is renewed.	1. Yes, but criteria only known to owner, forest association and Environment agency 2. No consultation with environmental NGOs regarding site selection, ranking 3. Applications listed, reserves mapped, but strict interpretation of privacy of forest owner information. 4. County environment department
Aggregation rules	*1. Consensus or majority rules on priority setting, selection criteria etc.* *2. Lack of agreement rules. Complaints procedures.* ..	1.Criteria developed by FONAFIFO and approved by their board 2. None. Non-negotiable contract conditions.	1. Criteria have been developed with broad participation of different actors; site evaluation is done by the administration. 2.Non-agreement on compensation can lead to no contract	1. Forest owner association and Environment agency. Environmental NGOs do not participate 2. Non-agreement on compensation leads to judicial determination.

Scope rules	*1. Proxy indicators for biodiversity and ecosystem services (land use-service link *)* *2. Baseline scenario** *3. Conservation target* *4. Budget* ..	1. Conservation gaps as priority criteria 2. Forest cover evaluation every 10 yrs, no control group 3. Annual area targets for conservation, reforestation, trees in agroforestry set according to budget, determined by REDD+ carbon partnership 4. Stable earmarked tax funds; less stable donor funds, and private purchase	1. Habitat types 2. Proportion of habitat type protected 3. Area target for habitat type conservation determined by budget 4. Framework budget for several years ahead, annual budget allocation often lower than framework	1. Qualitative biodiversity value: local, regional, national 2. None defined 3. National level multi-year target 4. Variable annual budget depending on political priority/will
Choice rules	*1. Prohibitions:* *2. Rights: Permitted land uses (proxies for ES*)* *3. Guarantees:* *4. Obligations: Contractual management measures* *5. Payment Conditionality*..	1. Forestry, any hunting, residence 2. Recreation 3. Squatter eviction, title enforcement, no enforced conservation on site 4. Management procedures defined for conservation measures 5.Maintained forest cover; fire breaks, fencing, signposting	1.Forestry, residence (by landuse class) 2. Forest conservation, public open-access for recreation and berry picking 3. With fixed-term contracts: no enforced conservation on the site 4. Might include defined management procedures (which will generally generate timber sales income) 5. N/A	1. Forestry, motorized transport, residence 2. Large game hunting, fishing, grazing, berry picking, recreation rights retained by owner. 3. N/A 4. No forest management obligations 5. Landowner acceptance of compensation amount
Payoff rules	*1.Mode of payment** *2.Payment principle(incentive, compensation)* *3.Payment schedule ** *4.Intermediaries' fees** *5.Administrative fees* *6. Contract-to-payment delay* *7.Fines, other sanctions** ..	1. Annual payment 2.Differentiated payments for ES and biodiversity, less than opportunity costs 3. Fixed payment year 1-5, 4. Regulated to maximum 18% of contract amount 5. FONAFIFO charges 0,6% of contract amount for registration 6. Several months 7. Contract cancellation and reimbursement. Fines and jail under Forest Law for deforestation.	1. One-off payment at the start of the contract. 2. Compensate net opportunity costs of foregone forestry 3. One-time payment 4. Forest Management Associations can invoice planning fees. 5. No charge. Covered by administration. 6. Not significant. 7. According to Forest Act and Nature Protection Act procedures.	1. One time compensation 2. Compensate net opportunity costs of foregone forestry 3. One-time payment, 4-5% interest after settlement until payment 4. No charge. Paid by state funded Voluntary Conservation Project 5. No charge. Covered by Environment Agency (20% of total protection cost) 6. 9 months-4 years 7. As for state nature reserve: Fines

3.2.1 Key differences between the 'voluntary conservation agreement (VCA)'

The rules-in-use analysis showed that there are a number of differences between voluntary forest conservation in the three countries, which are not limited to differences in incentives (pay-off rules) of temporary versus permanent conservation. Significant differences are highlighted in Table 3.2. Below we discuss some notable examples of differences for each category of rules-in-use:

3.2.2 Position rules

Funding: Costa Rica's VCA/PES scheme has a large diversity of funding sources including earmarked taxes, foreign donors, national loans, private company purchase of environmental certificates and private donations. Norway and Finland's VCA schemes are funded from public environmental (and forestry) authorities' budgets. Notably, funding diversity may not necessarily imply more variation in programme funds year-on-year than would be found in a single public funding system.

Intermediaries: in Costa Rica the forest engineer (*regente*) identifies potential applications, aids with the application process and monitors contract compliance. Third party verification by the conservation authority SINAC is at best partial. Monitoring of compliance is carried out by environmental authorities in Norway. In Finland the permanent contracts made with PES are monitored by environmental authorities and the fixed-term contracts by forestry authorities, to a large extent as part of routine forestry management procedures. Notably, Costa Rica's system of "regentes" is exposed to rent-capture problems, as forest engineers have an incentive to enrol only farms with a record of forest conservation (lowering expected effectiveness of PES in terms of additionality), to the detriment of landholders with legal problems.

Association: all three countries have many smallholders, but in Costa Rica a minority are members of forestry cooperatives or forest owner associations, whereas the converse is true in Finland and Norway. Intermediaries in Finland and Norway are more often common-interest organisations, than in Costa Rica, where intermediaries are most often private forestry engineers.

3.2.3 Boundary rules

Eligibility criteria: property deed and registry consistencies are used as eligibility criteria in Costa Rica; a majority of applicants every year are rejected, many due to legal inconsistencies. Rejected applicants can resubmit the following year. In Finland, the applications are dealt with on a first-come-first-served basis and a positive evaluation of the site can be followed by a negotiation over price. In Norway, a number of potential voluntary participants are put on waiting lists due to limited budgets, but applicants are not rejected as they have usually passed minimum pre-selection threshold for habitat value. The option for re-application in Costa Rica is an incentive to avoid forest conversion despite not having received PES. This is potentially more cost-effective for the public authority than a system of one time permanent compensation.

Prioritization criteria: Costa Rica uses a point-based system to rank proposals, which compete with all other proposals at national level. Norway and Finland evaluate or pre-select proposals based on prioritized forest types at regional level. The consequence may be that forest owners in Costa Rica have less understanding of the necessary points to qualify for PES as this is conditional on total supply across the country and the rate at which old contracts expire in a particular region (contracts may expire in 'waves'). A potentially more explicit set of prioritization criteria in Costa Rica than in Norway and Finland, may have more unforeseeable dynamics due to national versus region/county level ranking.

3.2.4 Information rules

FPIC: information to landowners regarding eligibility and priority setting criteria is available, and participation is not coerced, but in Costa Rica evaluation of legal eligibility may require the assistance of a lawyer, and interpretation of threshold criteria for being awarded a contract requires assistance of a forest engineer intermediary.

Freedom of information: strict privacy of information of forest owner property characteristics is maintained in Norway and Finland, but not in Costa Rica. Anonymity of 'corporate' (*sociedades anónimas*) PES recipients in Costa Rica is a potential limitation to evaluation of social impacts of the programme.

3.2.5 Aggregation rules

Lack of agreement rules: a key difference between the fixed temporary payment PES in Costa Rica and one-time compensation in Norway is that in the former there is no right of appeal. In the Norwegian system lack of agreement over the amount of compensation to be paid, may lead to adjudication in the courts. The potential for costly legal delays has tended to increase the amount of compensation paid relative to traditional expropriation cases (calculation methods were practiced more liberally (Skjeggedal et al 2010)).

3.2.6 Scope rules

Proxy indicator for biodiversity: Costa Rican and Finnish PES schemes use conservation gaps or rare habitat types to prioritise areas for PES, whereas Norway uses more general criteria of local, regional or national biodiversity value. Costa Rica's Forest Law mandates priority setting for ecosystem services in addition to biodiversity, currently exemplified through priority to aquifer recharge zones.

Conservation targets: Costa Rica's area target for PES is determined by the potential for carbon sequestration as part of REDD+ negotiations with the carbon fund. Norwegian and Finnish conservation targets are determined by available budgets.

3.2.7 Choice rules

Prohibitions: Costa Rican forestland owners are prohibited from all extractive uses whether they are in PES or not. In PES monitoring of compliance with the ban on extraction is greater. Norwegian and Finnish owners retain hunting, fishing and gathering rights also after the forest is in voluntary

protection, although these can be limited if the forest owner so chooses in Finland. Costa Rica's bans on extractive uses lowers net opportunity costs of forest conservation for the landowner, making it possible for authorities to enroll larger areas for a given budget. Conversely, each unit area has a lower likelihood of deforestation due to the ban. The net effect is hard to determine. In Norway and Finland, retention of non-forestry extractive rights also lowers opportunity costs for the landowner, but this is not through prohibition, but rather through retention of rights (not coerced).

3.2.8 Payoff rules

Payment principle: The possibility to base payment on opportunity costs is greater for a system with one time compensation versus annual payment. In a one-time payment for permanent conservation such as in Norway and Finland, resources can be spent on determining foregone forestry benefits for each individual applicant. In Finland, this is done largely based on formulae, with some room for negotiation. In Costa Rica, a large number of temporary contracts require fixed payments because information costs are too high per applicant to align with opportunity costs. Also, the Costa Rican system with forest engineers (*regentes*) conducting MRV would be exposed to exaggeration of compensation calculations, where this is carried out by an appointed representative of forestry authorities in Norway.

Intermediaries' fees: in Costa Rica and Finland the applicant covers these, while the transaction costs are covered by public grants to forest associations in Norway.

Contract delays: there are insignificant delays in awarding contracts in Finland, delays of a few months in Costa Rica, while delays can be up to several years in Norway. In Norway, however, delays are compensated with annual interest payments. Broadly speaking all three systems have relatively low transaction costs (on the order of 20% or less of the contract amount for Costa Rica and Norway).

Sanctions: in Costa Rica the sanction for non-compliance with conservation management measures under the PES contract is cancellation of the contract and reimbursement. Fines and jail sentences for deforestation are threatened under the Forest Law, but seldom enforced. Many landowners are unaware of the ban on forestland use change independent of PES. Norway and Finland follow their standard procedures of forest and nature protection legislation, with almost zero non-compliance.

3.3 Functional roles of PES in the policy mix of conservation instruments

Coarse grain 'matrix' evaluations of interaction between PES and other instruments were carried out in the three countries.

3.3.1 Costa Rica

Costa Rica is distinct in that it has a general direct regulation – a general ban on land use change - for all standing forests. The ban is expected to reduce the effectiveness of PES at the farm level (negative interaction). However, there is debate about whether PES was a side-payment (instead of the principle instrument) in order to obtain a 'regime shift' through a general deforestation ban. At a macro-economic level, the ban also had the effect of lowering perceived opportunity costs of forest conservation across the board, making it possible for a limited public budget to enroll more land. For this reason, the net effect of the interaction between the ban and PES is ambiguous.

Table 3.3. Two-way interaction matrix for PES in Costa Rica's forest conservation policy mix

Policy instruments	Costa Rican PES	Protected areas	Certification	Direct regulation
Costa Rican PES		+/-	+	-
Protected areas			+	-
Certification				+
Direct regulations				

Source: Costa Rica Coarse Grain Case study (Chacón-Cascante et al 2012)

PES is expected to interact positively with certification of forest products. In fact, PES is often sought by tourism businesses as one of several 'green' certifications of their establishment. Protected areas are expected to have an ambiguous effect on PES. On the one hand PES in Indigenous territories and uncompensated land expropriated within protected areas is given a higher priority than other land. On the other hand preliminary impact analysis suggests that PES in buffer zones around national parks may be less effective than PES far from national parks (Robalino et al. in Chacón-Cascante 2013). This refers to the additionality of PES, since buffer areas around national parks have a somewhat lower deforestation probability than land further away. Impact analyses have not differentiated forest in terms of forest connectivity.

3.3.2 Finland

The different policy instruments in the current policy mix appear to complement each other in potentially attracting different types of forest-owners (Primmer et al 2013a); more preservation-oriented owners would choose a permanent PES contract leading to establishing a private protected

area and more forestry income oriented ones would choose the fixed-term PES contract. Fixed-term contracts have functioned as a gateway for forest-owners to enter a conservation contract, attracting them to also consider permanent conservation. The regulatory conservation programmes - protected areas preceding the PES era - provided motivation for taking up less restrictive instruments, by posing a regulatory threat (Primmer et al 2013a, 2013b). The existence of a regulatory instrument can be crucial for the success of a voluntary instrument.

Ecologically, the different instruments complemented each other in that national parks and conservation programmes were designed to protect important areas permanently, sometimes covering large tracts while habitat conservation by law secures small-sized patches. The PES complemented these regulatory instruments by protecting small patches and somewhat larger areas either permanently or for a fixed term. The fixed term PES allowed targeting conservation budgets in an adaptive fashion, responding to environmental and social changes. The lack of connectivity of valuable protected sites remains a challenge in Finland because the surrounding matrix of managed forests mostly does not have the critical characteristics of e.g., broad-leaf old-aged and dead trees. Although the PES prioritizes sites close to protected areas, the mechanism has increased connectivity very slowly.

The most important cause of redundancy between instruments was generated by the significant overlap between the instruments in the habitat types and ecological criteria they addressed (Primmer et al 2013a, 2013b). Redundancy may be a particular concern in cases where the same ecological characteristics are protected in the same geographical area with different instruments. The national level analysis of the policy sequence demonstrated that the same habitat types had been addressed with almost every new policy instrument (Primmer et al 2013a). The targeting of similar habitats with different instruments is a signal of a failure to protect habitats and is likely due to limited budgets. Redundancy demonstrates the methodological difficulty of addressing future policies as well (Sironen et al., manuscript). We speculate that the tendency to develop yet new instruments to protect, e.g. fertile herb-rich habitats might generate inertia in the implementation, although if the instruments are introduced in a smart sequence, a voluntary mechanism might be more successful after an enforcement mechanism that does not have legitimacy.

The instruments were in conflict mostly through their characteristics of not meeting ecological or social goals (Primmer et al 2012). Regulatory instruments had less legitimacy as they limited the forest owners' rights, while small set-asides and voluntary PES did not support reaching ecological connectivity targets or conserving large sized habitats. The introduction of PES always has the risk of crowding out some forest-owners who would have conserved their sites without compensation. The PES rests on the existing formal institutional basis of the forest and nature conservation laws and administration (Auvinen et al 2007), but is less connected to the less statutory instruments, like the forest certification or different best practice guidelines. Even though these are applied on the majority of private lands, they are not perceived as conservation instruments.

Table 3.4. Explorative evaluation of interactions of the existing forest biodiversity conservation instruments in Finland

	Primary goal served	Complementarity	Redundancy	Conflict	Sequence
National parks	• Large areas with specific features of regional or national importance	• With instruments targeting dispersed valuable sites of local importance • With instruments setting aside habitats for a fixed term	• With instruments targeting the same ecological features in the same geographical region	• No direct conflict with other instruments • Permanence might not serve changing conservation needs • Opportunity costs and forest owner rights reduce attractiveness	• Can serve as a regulatory threat when implementing PES or other voluntary instruments • Requires a large one-off budget
Protected areas	• Targeted areas with specific features of regional or national importance	• With instruments targeting dispersed valuable sites of local importance • With instruments setting aside habitats for a fixed term	• With instruments targeting the same ecological features in the same geographical region	• No direct conflict with other instruments • Little acknowledgement of forest owner rights • Weighing opportunity costs is non-systematic	• Can serve as a regulatory threat when implementing PES or other voluntary instruments • Requires a large one-off budget
Forest Act habitats	• Targeted habitats in managed forests	• With instruments securing connectivity and conserving large areas of regional and national importance	• Not identified	• No direct conflict with other instruments • Do not address connectivity or species dependent on large valuable habitats • Little acknowledgement of forest owner rights	• Serve in sharing conservation responsibility with forest-owners • Budgetary requirements depend on compensatory interpretation

Forested Nature Conservation Act habitats	• Targeted habitats in managed forests	• With instruments securing connectivity and conserving large areas of regional and national importance	• Not identified, other than increasingly using up funds allocated to PES	• No direct conflict with other instruments • Do not address connectivity or species dependent on large valuable habitats	• Serves in engaging forest-owners in conservation of endangered protected species and features • Can increase opposing conservation and reduce interest in PES • Budgetary requirements are low but land-owners carry costs
PES: Permanent private protected areas	• Voluntary permanent protection	• With instruments securing connectivity and conserving large areas of regional and national importance • With instruments setting aside habitats for a fixed term	• Not identified, other than uses up conservation budget	• No direct conflict with other instruments • Relies on voluntariness, so does not preserve systematically	• Serve in engaging forest-owners in conservation • Can increase the legitimacy of conservation in general • Requires budget for conservation
PES: Fixed -term contracts	• Voluntary set-aside	• With instruments securing connectivity and conserving large areas of regional and national importance	• Not identified, other than uses up conservation budget	• No direct conflict with other instruments • Relies on voluntariness, so does not preserve systematically • Does not protect permanently	• Serve in engaging forest-owners in conservation wit low commitment • Can increase the legitimacy of conservation in general • Requires budget for conservation with a need for repeated investments

Source: Finland Coarse Grain Case Study (Primmer et al, 2013b)

3.3.3 Norway

Voluntary nature reserves become a part of the public nature reserve system in Norway. A GIS analysis of spatial overlap of nature reserves with other conservation instruments was carried out. It showed that nature reserves are found to overlap in 30% of nature reserve area within mountain forests, which also have environmental constraints. 10% of nature reserves are within wilderness areas, which are likewise protected from infrastructure development such as forest roads (but not from forestry per se). Private voluntary forest conservation in these areas would be expected to be less effective than on previously unprotected land. Furthermore, 40% of nature reserves are created in areas which are not commonly considered economical for forestry (net return<50 NOK/m3). In theory, these reserves provide no additional impact at current timber prices and forestry costs.

Table 3.5. Evaluation of potential functional roles of conservation instruments - overlap (%) between different environmental constraints and "zero areas".

Environmental constraints (EC)	Percentage of total productive forest	No EC overlap	Environmental concerns (EC) in forestry (percentage overlap)									"Zero areas" in forestry (percentage overlap with environmental constraints)			Timber volume excluded by EC *
			National Park	Nature Reserve	Protected Landscape Area	Key Habitats (MiS)	Buffer zone	Wilder-ness areas	Mountain forest	Outdoor recreat. area	Swamp forest	Net present value<0	Net return <0	Net return <50	
National Park	0.70 %	8 %		0 %	0 %	0 %	11 %	66 %	68 %	0 %	8 %	11 %	62 %	76 %	100 %
Nature Reserve	1.90 %	53 %	0 %		0 %	1 %	8 %	10 %	30 %	5 %	2 %	10 %	30 %	40 %	100 %
Protected Landscape Area	1.40 %	20 %	0 %	0 %		1 %	11 %	24 %	68 %	3 %	2 %	9 %	45 %	62 %	85 %
Key Habitats (MiS)	1.30 %	72 %	0 %	1 %	1 %		2 %	4 %	19 %	3 %	4 %	4 %	15 %	25 %	83 %
Buffer zone	7.00 %	68 %	1 %	2 %	2 %	0 %		4 %	21 %	1 %	7 %	3 %	17 %	25 %	75 %
Wilderness areas	3.10 %	23 %	16 %	6 %	11 %	1 %	10 %		64 %	0 %	1 %	18 %	62 %	75 %	100%**
Mountain forest	17.10 %	72 %	3 %	3 %	5 %	1 %	8 %	11 %		0 %	2 %	11 %	40 %	53 %	30 %
Outdoor recreation area	1.70 %	85 %	0 %	5 %	3 %	2 %	3 %	0 %	1 %		2 %	0 %	3 %	4 %	30 %
Swamp forest	3.10 %	72 %	2 %	1 %	1 %	1 %	16 %	1 %	9 %	1 %		1 %	10 %	15 %	30 %

Source: based on (Barton et al. 2013) in Norway Fine Grain Case Study

The VCA process has achieved a much lower disapproval rating (10%) among forest owners than command-based public protection (75%) (Skjeggedal et al 2010). Voluntary forest conservation is a clear example of a *'sequencing'* of instruments, with VCA now working as a substitute to earlier conflictive public conservation of forest. There is still a level of disagreement from environmental NGO's who have lost their position of early participation in identifying and selecting priority areas. The extent to which there are functional interactions between VCA and other instruments is therefore a matter of forest owners' or environmental NGOs' perspectives. According to forest owner's association, forestry certification is *synergistic and complementary* with voluntary conservation by protecting threatened habitats, until a forest owner decides to adopt VCA. Environmental NGOs argue that VCA does not target the most valuable forests first. The Ministry of the environment applies a 'policy mix' approach by arguing that both "threat" and "value" are criteria for selecting VCA locations. Forest owner associations also see *physical inaccessibility*

(especially in Western Norway) as inherent protection, which is complementary to forestry certification in protecting threatened habitats, in valuables areas not currently in nature reserves. Environmental NGOs are more sceptical to the role of 'zero economic areas' in forest conservation (Skjeggedal et al 2010).

Environmental authorities do not have explicit targets for the spatial distribution of VCA between Counties, targets per priority forest type, nor the proportion which should be covered by VCA[7]. Further detailed analysis of voluntary forest conservation in Figure 3.2 shows that voluntary forest

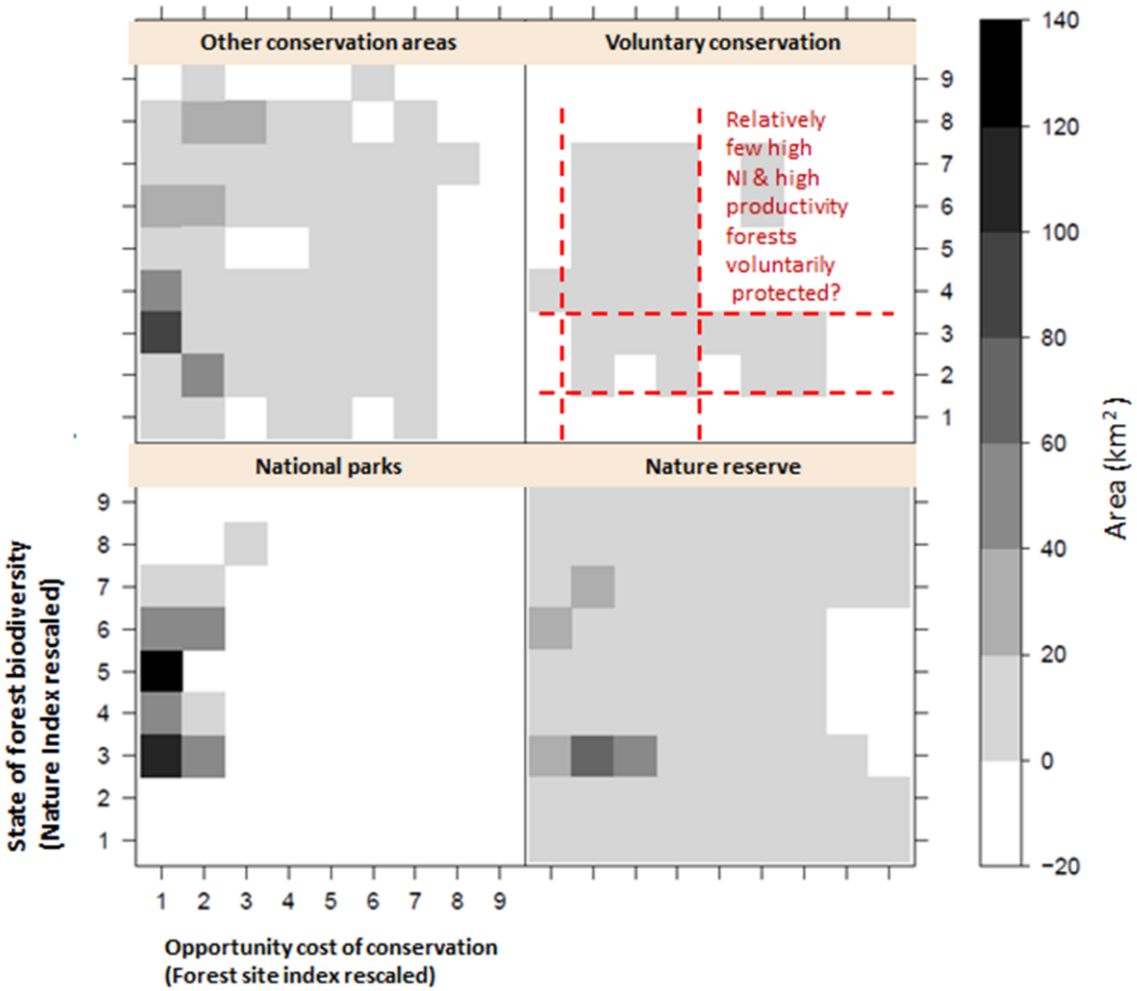

Figure 3.2 Spatial distribution and complementarity of forest conservation instruments in Norway

reserve conservation is found in landscapes that have higher opportunity costs than e.g. national parks. Private nature reserves have some redundancy with publicly initiated nature reserves and other conservation areas. Public nature reserves are complementary to private reserves by also covering landscapes with high opportunity costs and relatively high biodiversity index values.

3.4 Impact evaluation of PES

Of the three case studies only Costa Rica used formal before-after-control-impact (BACI) methods to evaluate PES. Methodological comparisons are difficult, but the approaches chosen also show how multiple methods can shed light on different aspects of PES impacts:

- Institutional fit (Finland, Costa Rica: determinants of participation)
- Effectiveness (Costa Rica: forest cover)
- Efficiency (Finland: determinants of compensation levels, Norway & Costa Rica; transaction costs)
- Equity (Norway: conservation conflict levels, sense of justice. Costa Rica: socioeconomic impact of reforestation and conservation contracts).

3.4.1 Costa Rica

A review of a number of impact evaluation studies of PES and National Parks in Costa Rica using BACI find that PES effectiveness has at its best been as good as the average effectiveness of national parks in avoiding deforestation in the decades before PES (Porras et al 2013). More recently, tentative results from PES in proximity to national parks by Robalino et al (Chacón-Cascante 2013) show the incremental effectiveness of PES is lower in buffer zones around national parks, than far from parks. Robalino et al (Chacón-Cascante 2013) find no synergy effects between PES and national parks and conclude that they are substitutes in terms of incremental effect on forest cover.

Rugtveit et al (Chacón-Cascante 2013) review and evaluate transaction and implementation costs of PES, finding considerable variation, with a ceiling on costs for contracting and MRV regulated by authorities at 18,0% +0,6% of the PES contract amount.

Chacón-Cascante (2013) found that reforestation and conservation contracts in Hojancha do not have a significant socioeconomic impact in terms of consumption level and changes in living conditions (perception of beneficiaries). Results also show that families participating in the PES program are better endowed than their counterfactuals. This situation reduced the potential socio-economic impact the programme might have since it is not reaching the smallest and probably most vulnerable families.

Other studies have found that properties with the lowest opportunity costs are also the most prone to participate. This is mostly the case for conservation contracts. However, for reforestation modality, a minimum closeness to market must be guaranteed to ensure proper commercialization of the products. This is probably the reason explaining why for our data set, participating farms are in average closer to San José and have better car access (during the dry season).

Although results do not show a significant socioeconomic impact of any of the two modalities analysed, conclusions should take into account the limitations mentioned beforehand in terms of the availability of indicators to perform the analysis.

3.4.2 Finland

Of some relevance for valuation methodologies, the Finnish case study analysed the altruistic and self-interested motivations by analysing the degree to which different motivations and perceptions explained low or high payment requests (Tainio et al, manuscript). A low payment request was predicted by expectations regarding improved quality of nearby watercourses, improved welfare of family and duty of humans to protect nature. In addition, temporariness of the contract and being an agricultural or other entrepreneur lowered the payment request. Importance placed on economic gain and equal opportunity to contract increased the payment request. Methodologically, the Finnish case study has advanced the joint testing of the influence of altruistic green motivations and strategic seeking of information rents with a rigorous analysis of perceptions regarding the benefits and costs of conservation in a quantitative fashion. The Finnish authorities evaluated transaction costs to be 300 EUR / hectare, which would average at less than 25% of the amount of the payment (Sironen et al, manuscript). The analyses of the Finnish non-industrial private forest owners' perceptions and their effect on past PES contracting showed that social and moral normative justifications decreased the likelihood to enter into a contract, signaling a potential crowding out risk of PES type contracts (Primmer et al 2013d).

3.4.3 Norway

The information on impact of VCA in Norway is based on Skjeggedal et al (2010). No formal before-after-control-impact (BACI) studies have been conducted of VCA in Norway. The POLICYMIX project was also unable to carry out a BACI, despite having this as one of the objectives of the case study. A number of reasons for this lack of BACI studies may be:

- Surveys of participating forest owners has been relatively frequent (2006, 2009) and have led to low response rates

- Biodiversity indicators of forest quality at forest stand level cannot be observed without field surveys.

- Lack of panel data. Surveys of forest owners with VCA, command-based public protection and forest owners have not been carried out before and after participation.

The voluntary forest conservation process has in a few years achieved a much higher legitimacy among forest owners than the forced public conservation of the 80s and 90s. Areas offered voluntarily for conservation in the first period 2005-2009 exceeded environmental authorities' target of 200 km^2 under VCA, and has exceeded available funding almost every year since VCA's inception. In terms of total area, VCA has been more effective than command-based protected areas. In terms of quality of sites, Skjeggedal et al (2010) argue that the VCA process has not been worse than the

system of public creation of protected areas prior to VCA. In the former, a long list of nature value priorities was reduced by dropping area with the highest level of conflict. In practice, then, sites were selected based on an iterated *effectiveness-cost* 'rule of thumb'. In the VCA this heuristic approach is reversed with low cost sites more likely to be offered voluntarily, and then authorities selecting those with highest conservation value (*cost-effectiveness*) [1].

At property level there are some qualitative indications that VCA has a greater potential for effectiveness. In VCA forest owners' proposal for what parts of the forest are to be protected is not necessarily consistent with the desire to establish connectivity with adjacent protected areas. Again, this has been pointed out as a problem with the command-based protected area process. Impact analysis is complicated by '*neighbourhood sequencing effects'*, where an initial forest owner willing to enter VCA initiates – with the help of forest owner association and County authorities - additional owners to participate in the process, thereby achieving greater connectivity over time.

Environmental organisations have claimed that effectiveness of VCA is limited because only low opportunity cost (low productivity) and low biodiversity sites will be offered for conservation. Our mapping of VCA (Figure 3.2) shows that also high (productivity) site index locations participate in VCA. Skjeggedal et al. (2010) argue that since VCA compensation is based on negotiated full compensation of foregone forestry income, opportunity costs are not necessarily a reason for low effectiveness. They argue that high forestry productivity sites also have a long logging history, reducing their biodiversity values. Figure 1 shows that high productivity, high biodiversity sites are less frequent in VCA. This coarse level analysis provides support for the argument that there may be relatively few high biodiversity, high site index locales available for voluntary conservation outside existing protected areas.[2]

Sense of justice has been suggested as another dimension of social impact analysis. Voluntary forest conservation has also had improved 'sense of justice' of forest conservation procedures, as forest owners have gained a much greater knowledge about conservation as participants in, rather than involuntary parties to, the conservation process. Conversely, environmental NGOs have a reduced 'sense of justice' due to their exclusion from the negotiation between forest owner association, County environment department and the Environment Agency.

Skjeggedal et al (2010) quote Norwegian authorities that transaction costs for VCA are around 20% of the compensation amount, down from 35% under forced public protection.

[1] The distance to conservation targets of the two approaches is not immediately obvious and could be tested using conservation planning tools such as Marxan with Zones.

[2] Mapping of the distribution of available areas for conservation would be an important preliminary step to conservation planning scenarios using Marxan.

3.5 Lessons learned by the São Paulo PES case study

The case study for the Brazilian Atlantic Forest - the Cantareira-Mantiqueira Corridor region, mainly located in the state of São Paulo - was also focused on a PES scheme. However, the Brazilian case study differs from the others for at least two reasons: (1) it is not a national or even state level PES programme; (2) the PES policy for the Cantareira-Mantiqueira Corridor region is a potential/proposed instrument since it is not yet an existing policy for the region. For these reasons, this Brazilian case was not included in the comparison using IAD conducted for the Finnish, Norwegian and Costa Rican cases. Nevertheless, some prospective conclusions can be drawn from the case study (see appendix to this report).

The study for the Cantareira-Mantiqueira Corridor region was mainly focused on assessing one successful PES experience in a small portion of the region. It is the case of Extrema municipality, which is known as the very first local PES experience in Brazil. The case study was aimed at assessing the conditions necessary to scale up this local experience to a regional or even state level. The characteristics of the PES can be summarized as follows (Table 3.6):

Table 3.6 – Main hypothetical characteristics of a prospective PES in PES in Cantareira-Mantiqueira Corridor

Instrument	PES in the Cantareira-Mantiqueir Corridor region
Ecosystem services provided, characteristics and beneficiaries	Water provision for at least 8 million inhabitants - very crucial. Also the maintenance the sustainability of Atlantic Forest and its related biodiversity and services - Very diffuse beneficiaries
Main rural activities	Cattle raising, Silviculture, Potatoe cultivation
Goal	Compensate / Incentivize landowners to maintain natural vegetation to ensure water provision (quality and quantity)
Actors addressed	Private (land users) and the public sector
Baseline and policy context	Land-use practices under national forest code without incentives from PES schemes
Conservation effectiveness	Low to high – depending on instrument design regarding baseline, and additionality, leakage, permanence and participation
Associated costs and proxies for cost-effectiveness	Medium to high – finding funding sources, establishing arrangements with landowners and monitoring costs
Social impacts	Medium – High – usually the projects are focused on small properties and also provide technical assistance for other activities
Legal and institutional requirements	Medium to high – definition and enforcement of property rights is key for program success, more effective programs require high up-front costs for baseline setting, negotiations, fund- and awareness raising

Source: Romeiro et al. 2013

1) *What were the main factors precluding the establishment of a PES scheme at the regional/state levels? What can be learned from the Extrema case?*

The analysis performed for the Cantareira-Mantiqueira Corridor region indicates there are some limiting factors for implementing a PES policy in the region:

- there is not a clear consensus about who are the ecosystem services buyers. Moreover, the public sector has demonstrated an insufficient involvement with the issue, which is compounded by the fact that this region of Cantareira is divided between two different states;
- lack of coordination among state agencies and municipalities. This is a case of an "institutional mess" and there is an urgent necessity to define roles and functions for different organizations;
- due to heterogeneous social and ecological characteristics in the region, the stakeholders are not sure about the main goals to be pursued to tackle the environmental problems faced by this region;
- after reaching a common understanding about the challenges to be addressed, stakeholders have pointed out the relevance of considering a number of other instruments rather than only PES;
- a heterogeneous socio-economic context throughout the region, which hampers the debate about the value of compensations.

According to Puga (2013), Extrema's experience from the standpoint of institutional design appears to be the result of the evolution of different municipal environmental policies, allied with several factors that led to the introduction of the PES. Analyses about this programs' success should take into account the political institutional framework in which Extrema is inserted. Despite the similarity with other cities in the region, the process of industrialization in Extrema and the consequent rural exodus, coupled with political stability and increased government revenues, have facilitated PES implementation. This is not the case for other cities, which have important challenges regarding budgetary matters. Furthermore, the proximity of policymakers with contractors was very important to the program's results.

The centrality of the city government, taking on the lead role in driving the program and seeking only external additional supporters differs from the way that other programmes have been designed. Previous studies show that the majority of surveyed landowners in the Cantareira-Mantiqueira Corridor region are aware of PES initiatives, especially the "Conservador das Águas" (Extrema's program). However, the low participation of municipal technicians in rural communities demonstrates the distrust of the population regarding PES policies. This is due to historical policies implemented in the region by external agents, which have not been taken forward.

The need for reforestation in the Cantareira-Mantiqueira Corridor region and the peculiarities of this region indicates that organizations and traditional ways of action were not supported and were not sufficient for good local environmental governance. The actions of various entities and organizations in the same physical space has tended to generate overlapping policies. Thus, there is the need for integrative initiatives. Good governance must act in a way that benefits from complementarity among the municipal, regional (within the watershed committee) and the state level.

2) *What lessons derived from POLICYMIX cases can be applied to a (potential) regional/state level PES in São Paulo?*

The POLICYMIX project has pointed to some general policy lessons for PES by comparing three national cases (Norway, Finland and Norway). To what extent can the Brazilian case benefit from this comparative review? As a potential instrument to be applied in the regional/state level, a PES scheme in the Cantareira-Mantiqueira Corridor region should take into account the following aspects:

- **Different stages of the conservation policy mix:** In the Amazon, for example, the principal policy mix goal is to provide the necessary incentives in order to keep the natural forest cover, thus avoiding further deforestation. In the case of the Atlantic Forest the main goal is to foster forest recovery in order to enhance ecosystems services provision. The use of different modalities can be considered in a state level PES in São Paulo since this state shows heterogeneous reforestation phases;

- **The role of regulatory mechanisms:** the existence of the Forest Code in Brazil should be taken into account when analysing the institutional environment for PES implementation. The Costa Rican case may provide important insights on how to prevent the negative interaction between direct regulation and PES. This historical path of non-compliance with the Brazilian Forest Code and the high opportunity costs in São Paulo state do indicate that regulation can reduce the perceived opportunity costs of conservation;

- **Budget matters and the role of intermediaries:** the analyses performed by the three national cases show the relevance of intermediaries in determining the existence of transaction costs. The Costa Rican *"regente"* system should be avoided as it hinders additionality. The possibility of re-application (as occurs in Costa Rica) may be applied to the São Paulo case (regional and state levels).

- **Pre-existing economic instruments:** the ICMS-E instrument (already in place in São Paulo) has, by definition, the role of compensating those municipalities which have protected areas. Also, the criteria for the compensation amount to be received are the size of the protected area and the level of protection, defined by the category of SNUC (National System for Conservation Units). So, both instruments interact in a complementary way, where the ICMS-E works as a financial incentive/compensation for the protected areas. PES would work complementarily to ICMS-E as the former focuses on private areas, while ICMS-E complements local government budgets.

3.6 Summary: case lessons learned on effectiveness of PES in an instrument mix

Methodological lessons

Regarding the nested diagnostic approach of using the Institutional Analysis and Development (IAD) framework and 'rules-in-use' within the Policymix analysis framework, we conclude that

- the IAD framework captures more differences in voluntary forest conservation instrument characteristics than previous reviews of PES. Prior PES analyses have been most complete regarding the description of 'payoff rules', i.e. the focus has been largely on design of direct incentives. Using Wunder et al. (2008) as a point of comparison, the IAD helped address issues that were only partially or not all discussed, such as position rules that define relevant stakeholders in PES (e.g. multiple intermediaries, monitoring and verification); boundary rules (e.g. spatial prioritization criteria, contract renewal and cancellation criteria); information rules (e.g. prior consent); aggregation rules (for establishing priority-setting criteria); scope rules (e.g. conservation target and budget setting); choice rules (e.g. prohibitions, guarantees and obligations of PES); payoff-rules (e.g. transaction costs).

- each rule-in-use identified as being part of PES has a potential for interaction with other instruments. The wider scope of an IAD approach thus increases the potential for identifying interactions with other policy instruments.

- the IAD framework makes it possible to identify rules-in-use that may be acting as indirect incentives affecting landuse (in addition to direct payoff rules).

- in all three countries the role of intermediaries is large, but distinct. The IAD framework lacks a finer distinction of the multiple rules governing intermediaries in PES, and the compatibility of those rules with other incentives of the instrument. In particular, the roles of intermediaries are not easily determined from formal documents, which suggests that informal 'rules-in-use' deserve much greater attention than in our analysis.

- the rules-in-use framework is a useful classification system, but does not in itself provide theories of interdependencies between the different rules. For example, to what extent are the rules found in the PES contract (scope, choice, payoff rules) conditional on the institutional context rules 'external' to the contract (position rules, information rules, aggregation rules)?

- The rules-in-use framework was cumbersome to apply consistently across case studies, because of the broad range of formal rules-in-use describing PES schemes, and perhaps any policy instrument. Different instruments share a number of institutional characteristics, making it difficult to determine in advance what are 'significant' characteristics that may be determining interactions with other instruments.

- A complication of functional role analysis of instruments using the IAD framework is that the potential multi-way interactions of PES' rules-in-use with the rules of other instruments, are themselves subject to multiple stakeholder interpretations. An interaction's 'sign' is difficult to determine objectively as it is interpreted as positive or negative in terms of the stakes affected.

General policy lessons for PES - policy mix hypotheses

In the discussion above we focused on differences between voluntary forest conservation in Finland, Costa Rica and Norway. Here we try to synthesize some lessons on policy interactions from the three countries. The lessons do not necessarily apply to all countries, but can be understood as hypotheses generated from the comparative review that could be subject to further research.

PES plays different roles in the conservation policy mix at different stages of the forest transition. A PES instrument designed for a context of deforestation requires redesign as a landscape moves into a reforestation phase. Multiple types of PES instrument 'modalities' may be required at the same time as a landscape in a forest transition can be a mosaic of deforestation risks and reforestation opportunities.

Regulatory conservation is a precondition for the success of PES. In other words, the mutual dependence of public regulation and voluntary transaction discussed in the context of 'cap-and-trade' rules in biodiversity offsets is also relevant for PES. However, the 'theory of change' or causal explanations between regulation and voluntary transaction vary between case study institutional contexts.

Perceived threat of regulation determines the supply of voluntary conservation sites. In Norway there has been no politically feasible regulatory alternative to voluntary forest conservation during the past decade. Near mandatory forestry certification reduces the opportunity costs of conservation, but set-asides for conservation as part of certification do not typically exceed 1% of productive forest, in which case they are also compensated. Compensation is calculated based on an established inventorying system for calculating forestry rents. Compensation is settled by courts if not agreed between the forest owner and authorities. This entails uncertainty for both the landowner and authorities, so forest inventorying is generally interpreted in the landowner's favour, so that negotiated compensation amounts have been as much as 10% higher than in expropriation cases. Norwegian landowners retain hunting and fishing rights on the land. In contrast to Norway, command-based protection is seen by landowners in Finland as a "regulatory threat" if forests are not protected voluntarily. This is expected to lower perceived opportunity costs, at least on land that has high conservation value. The Finish data also indicates that compensation has been higher than foregone forestry returns under voluntary METSO. Similar to Norway, Finish landowners retain hunting and fishing rights. This can be contrasted with the Costa Rican case where a forest land use change ban (Forest Law) and a hunting ban (Wildlife Law) lower the perceived net opportunity costs of forest conservation. A study also shows that the real value of conservation PES has fallen by

roughly half since the beginning of the programme while the number of PES applicants is higher. This would support the interpretation that perceived opportunity costs are proportionally lower in Costa Rica due to the restriction of forest use rights.

Perceived opportunity costs determine PES programme scale when budgets are limited. Forestry regulation reduces perceived opportunity costs of conservation, reduces required compensation amounts and increases the potential area that can be covered by a limited budget for voluntary conservation.

Forestry certification schemes were a necessary precursor to PES in establishing a cadre of forestry professionals/intermediaries that could easily adapt to a voluntary scheme with similar monitoring methodologies. Forestry certification schemes continue to be a spatial complement to Public protected areas, and PES, on low biodiversity high forestry value land.

PES mode of compensation is conditional on the rights regime. A regime that maintains landowners' rights to non-forestry land uses is more likely to make one-time site specific compensation acceptable (Norway, Finland), in comparison to a regime where landowners have no land use rights for forest ecosystem services. In the latter case annual time-limited payments (Costa Rica), is the only approach that will give landowners some land use option value.

The perceived and relative distribution of conservation opportunity costs across landowners determines compensation demands as much as absolute levels of opportunity costs. In Costa Rica PES is given priority on as yet unexpropriated land within protected areas. Outside protected areas the forest law banning land use change also protects forests. In principle these situations are equivalent in absolute opportunity costs terms - the state expropriates landowner rights in both cases, but only prioritises compensation in the protected area case. In practice, deforestation opportunities are lower within a protected area because enforcement is higher on the ground than outside. A fundamental difference is equity in the distribution of opportunity costs. In the protected area case, only particular landowners are targeted for conservation – and it is legally defined as expropriation -, while in the case of a general ban on land use change, all landowners are in principle affected equally, and it is not legally defined as expropriation. A tacit admission that enforcement is not effective outside protected areas may be a further reason to not define the ban on land use change as equivalent to expropriation and subject to full compensation.

The best can be the enemy of the good in PES design. The choice of conservation effectiveness measures at property level - in terms of proxies for biodiversity or ecosystem services - is determinant of many if not most other aspects of PES instrument design. Simple proxies achieve poorer targeting, but have lower transaction costs and allow for wider application.

Qualifying general high level policy advice

We summarise our findings from the PES studies in Costa Rica, Norway and Finland using the questions identified in the review of high level policy documents (CBD, EC, UN, OECD, TEEB). We

discuss whether our case studies disagree with or qualify the general recommendations commonly given regarding conservation instruments.

High-level policy guidance	**Comparative POLICYMIX findings**
Economic instruments are not always appropriate; viability **preconditions of PES**	PES and voluntary forest conservation grow out of prior forest regulation. Economic instruments that do not take advantage of pre-existing rules-in-use will have high implementation costs.
A clear and realistic understanding of the **baseline conditions** is crucial	When should the baseline be established to evaluate policy success? Economic instruments such as PES often transition over time from incentives-based predecessors. PES schemes adapt over time (e.g. PES priority-setting criteria). An understanding of where in the landscape transition a country is located may be useful in designing impact evaluation programmes. Introduction of other conservation instruments such as national parks, or changes in forestry and landuse regulations change forest cover trends. Baselines are a moving target, which may mean that policies should be evaluated against conservation benchmarks - contribution to targets - as an alternative to evaluating effectiveness.
A **combination** of regulatory, economic and voluntary approaches is required	Instruments are often not possible to segregate. Payments for ecosystem services are compositions of rules-in-use where economic payment is one of a number of rights, responsibilities, obligations and sanctions that act as combined incentives. For this reason PES needs to be analysed as a policy mix itself, as well as be seen within a wider mix of conservation instruments.
Existing **perverse incentives** should be identified and reformed/removed as early as possible	Subsidies for development of forestry may make sense in principle in areas with low conservation value and high forestry productivity. When adequately targeted in a heterogenous landscape forestry subsidies need not be perverse, but part of an 'intelligent policyscape'.
The roles and responsibilities of actors involved should be well defined and their **roles and**	Formal roles and responsibilities may be easy to identify, while norms / informal rules-in-use may be significant, but invisible to outsiders.

responsibilities clearly agreed before designing the instrument	
Economic instruments need to recognize and properly address **opportunity costs** and environmental externalities	The choice of trying to adjust payments to opportunity costs depends on the costs of obtaining spatially explicit information, and whether it is accurate enough for targeting and determining payment levels. Opportunity costs and biodiversity value may be positively correlated in which case there are few win-win or cost-effective targeting options.
Set clear targets and indicators; to the extent feasible, incentive measures should have targets that are specific, measurable, time-driven, and based on an analysis of their effects	Specific, dynamic conservation targets are also expensive to measure.
Predictability - instruments should have clear rules, the goal is to establish a predictable path of controls for participants. This facilitates long-term planning and investment, increasing efficiency	Funding is unpredictable in all countries, but more so in Norway and Finland than Costa Rica. Costa Rica's PES scheme has sacrificed some effectiveness for flexibility, and perhaps as a result is the longest running national PES programme in the world.
Sustainable economic instruments are **adaptable to changing ecological and economic contexts**; therefore, periodically revisions of instrument's design are recommended in order to adapt to changing conditions and to ensure that they continue to be effective	Time limited contracts allow for a more flexible PES programme, where conservation can 'migrate' across a landscape. This may be more relevant in the context of climate change.
The **possibility to re-design economic incentives over time** based on changing conditions lowers the pressure to get the	Small incremental changes to an existing incentive scheme reduce set-up costs, but require a long term strategic conservation objective to avoid incremental changes being 'captured' by special interests.

initial design perfect. This is relevant, for instance, to overcome technical challenges such as establishing appropriate tax/charge levels on resource users or polluters	
Managing, monitoring, and enforcing are keystones	The distribution of roles between the buyer, intermediary and seller are very important. Authorities should place a lot of attention on making incentives for intermediaries compatible with the strategic objectives of the programme. The key role of intermediaries makes PES systems vulnerable to rent-capture.
Disclosure and transparency are necessary	Disclosure and transparency may need to be restricted in order to bring forest owners voluntarily to the table. Freedom of information regarding public goods must be balanced against individuals rights to privacy. Commercial competitiveness interests challenge rights of disclosure in voluntary forest conservation.
Measures should avoid increasing **external dependency**	Global ecosystem services such as climate regulation and biodiversity conservation in forestry, require transfers from a global community to countries and individual landholders. External interdependency is an inherent characteristics of PES institutions rather than something to be avoided per se.
Incentive measures are more likely to be sustainable if presenting low **transaction, enforcement and participation costs**	Increased targeting to attain cost-effective conservation will mean higher MRV costs. Higher implementation costs will often mean higher effectiveness. Higher opportunity costs may come at the expense of programme legitimacy. Although there are few clear win-win alternatives, some potential for cost-effectiveness can be found in making policy mixes suited to the landscape (policyscape).

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4 Cross case comparison of agro-environmental measures (AEM)

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4.1 Introduction

In this chapter we compare three national level AEM schemes studied in the POLICYMIX project, including two European countries, Portugal (Santos et al 2012) and Germany (Lienhoop et al 2013), and Brazil (May et al 2012). Costa Rica's PES scheme includes support for silvopastoral measures such as live fences, but this is covered under the chapter on PES.

Agro-environmental measures (AEM) were first introduced in the EU Common Agricultural Policy (CAP) during the late 1980s and since 1992 their application has been compulsory for EU Member States, although they remain optional for farmers. In essence, AEM are designed to encourage farmers to protect and enhance the environment on their farmland: farmers sign a contract with the administration and receive payments that compensate for additional costs and foregone income resulting from applying specific environmentally friendly farming practices. Examples of commitments covered include environmentally favourable extensification of farming, management of low-intensity pasture systems, support for traditional farming systems and the use of native species, integrated farm management and organic agriculture, afforestation, and the conservation of high-value habitats and their associated biodiversity.

In Brazil, the federal Forest Code first passed in 1965 establishes the framework for AEM, as it establishes limitations as to the extent of private lands that may be used for productive purposes (20% in the Amazon; 65% in the *Cerrado*; 80% in the Atlantic Forest), and also designates specific lands as permanently protected (APP). Such lands include streambanks, steep slopes and hilltops. Although many landowners have historically evaded their responsibilities under the Forest Code, revisions recently passed into law (although not yet regulated) provide for flexibility, motivating greater commitment from the agribusiness sector while responding to equity concerns by exempting smallholders from the more rigorous requirements. Economic instruments were instated for Transfer of Development Rights (CRA) within the same state and biome. Sequentially, landowners must first register in a state Rural Environmental Cadaster (CAR) and plan steps to achieve their compliance within at most 20 years, whether through restoration or CRA. It is, however, unclear how the law will affect agrarian reform beneficiaries.

The case study in Portugal started with an ex-post analysis of the implementation of AEM at the national level, based on existing documented information. This analysis was further refined with a local case study on the left bank of the Guadiana River in the southeast of Portugal, where the reasons for the lack of success of the ITI scheme (Integrated Territorial Intervention, an AES that uses a site specific approach applied to areas of special conservation interest, such as Natura 2000 sites), were investigated in a survey conducted with farmers and other relevant stakeholders.

The Portuguese study also included an ex-ante analysis component, with a targeting exercise, using Marxan with zones, to identify the most promising areas for implementation of a specific ITI measure (grazing extensification and *montado* regeneration) and a choice experiment to investigate how compensation levels and other contract design features (e.g. contract duration, percentage of farm area allocated to the measure, density of cork trees) influence farmers' willingness to participate in this voluntary contract. This measure is particularly relevant for the conservation of the *montado* ecosystem in southeastern Portugal.

The case study in Germany focused particularly on an ex-post analysis of an existing, but unsuccessful, agro-environmental scheme for afforestation. This study assessed the importance that landowners in Western Saxony place on different ecosystem services and biodiversity aspects and investigated how these affect the decision to participate in the scheme. A choice experiment and a follow-up questionnaire were used to investigate the compensation required by landowners for converting some of their land into forest and other relevant contract design features (e.g. contract duration, provision of technical advice, opportunity to return to agriculture after the contract ends).

The agro-environmental analysis in Brazil examined the effectiveness of a sequence of Integrated Development and Conservation projects (ICDPs) and respective Agro-Environmental Measures (AEM) promoted for deforestation mitigation, in Northwest Mato Grosso (NW MT), a region approximately the size of Panama. The agro-environmental measures, focused on beneficiaries of agrarian reform settlements and smallholders in colonization projects within a broader mosaic of agroecosystems, private forests and populations living in buffer zones or inside Protected Areas and Indigenous Lands. Such programmes sought to introduce environmentally appropriate production practices and value added processing activities to settlers whose principal land use models were slash and burn agriculture, followed by extensive ranching, representing the regional baseline of rapid deforestation at the Amazon frontier. The analysis did not undertake ecological modelling, but rather sought to identify those measures that appeared to have been most effective at the individual household or lot level, and at the "policyscape" scale in settlements, using data from programme evaluations, sequential satellite imagery, farmer interviews and focus group discussions.

4.2 Conflicts and synergies between functional roles of AEM and other instruments

AEM play a role in biodiversity policy mixes that is complementary to regulatory instruments, their main purpose being to compensate landowners and farmers for the opportunity and management costs associated with practices leading to biodiversity conservation or the increased provision of ecosystem services. In the European AEM schemes these practices are established on top of existing legal requirements and established 'good farming practices' and therefore they act as an additional incentive for biodiversity conservation action.

The aim of the ITI that was studied in Portugal was to provide additional incentives to biodiversity friendly farming and forestry practices (beyond legal compliance) specifically targeted to farmers and landowners located in Natura 2000 sites, thus having a complementary role, and hopefully a synergistic effect, with the existing nature conservation regulatory framework. Also, in Germany, it is established that since regulatory instruments for afforestation (forest law and planning) alone do not motivate afforestation, additional policy instruments creating financial incentives, such as the AES, play an important role.

ICDPs in Brazil were designed to counter the narrow focus of conservation and development policies, which were tailored towards specific outcomes, e.g. protected area creation. The instruments were developed in a participatory fashion, seeking to stimulate the emergence of local leaders and hybrid institutions that could manage the challenges of adapting their conventional farming practices into intensive multi-layered agroecosystems with forest components. Financial stimuli were not as important to this process as the presence of continuous technical support and the establishment of new remunerative market channels for non-timber forest products and ecosystem services. When faced with the prospect of receiving cash payments for conservation, farmers here were more hopeful that innovative value chains, institutional purchases in the region such as school lunch supply, and certification would enable them to compete with the reigning wealth creation paradigm at the frontier, in which beef cattle dominate.

The ex-post analysis showed that, in some cases, other economic incentives in place may have a conflicting role with AEM and biodiversity conservation objectives in general. For instance, adhesion to ITI measures targeting forestry in areas of particular conservation interest in Portugal (e.g. Natura 2000) implies the loss of another existing broad based agricultural incentive – the AEM Single Payment Regime – that is much less demanding in terms of allowed practices and commitments than the ITI and provides, at least to some landowners, higher revenues per hectare. This reduces the incentive for landowners to apply for silvo-environment measures, thus reducing their effectiveness. Even amongst AEM incentives, applying for several measures in the same period may reduce the overall incentive, as the combination of measures leads to penalties (e.g. the incentive provided by measures such as biological production or compensation for maintaining some specific crop systems, will be reduced if landowners also apply the measures specifically tailored for the ITI). For this reason, there is a risk that AEM include within themselves potential conflicting objectives and cross incentives that reduce their overall effectiveness for biodiversity conservation. AEM can themselves be considered to act as a policy mix, in the sense that they combine different incentives/measures with diverse goals.

There is also a conflict at different levels of governance due to poor communication and interaction, but also due to an overlap of managing institutions. Depending on the activity (e.g. forestry, cattle raising, crop production), a landowner may have to deal with several institutional bodies and a multiplicity of land use planning tools with several conflicting objectives and methods. This mismatch between institutions and their goals induces confusion among landowners and reduces the credibility of the instruments and of the authorities that manage them.

In Germany, in the past years new afforestation projects have been implemented through other incentive schemes such as offset measures (in Saxony new forests are often used to compensate for environmental damages caused by developments) and foundations. Nevertheless, there is no conflict between these different afforestation instruments, meaning that they can co-exist. The only fundamental barrier is that the forest law does not allow the conversion of forests into other land uses and thus clashes with farmers' strong preferences to have the option to return to agricultural land uses after the end of the contract. It can be argued that the ban significantly lowers perceived opportunity costs of already forested land (no option value), while increasing perceived opportunity costs of potentially forest land (by increasing perceived option value relative to already forested land). On the other hand, in the follow-up survey, farmers mentioned that there are too many other measures available, so the AEM for afforestation has to compete with a variety of measures, such as support for biofuel and short rotation forestry. Given the numerous funding opportunities for farmers, the AEM for afforestation is not very visible.

Two important policy instruments in use in the Brazilian Amazon should be better coordinated with ICDPs to ensure their joint effectiveness in biodiversity conservation and income enhancement. These include credit provided to land reform beneficiaries and family farmers to foment agricultural and livestock production under the PRONAF rubric, and rural environmental licensing as required by the Forest Code. Credit has only been available for annual crops and cattle herd expansion and related costs of pasture establishment, and not to support agroforestry systems. Such credit limitations are due to the difficulty in presenting simplified cash flow estimates to local bankers unwilling to accept risks associated with long-term investments in forest assets. Licensing remains confusing to land reform beneficiaries who have been informed they should contract both individual and settlement level licenses to facilitate credit access and avoid fines for deforestation. At the same time, small farmers have been informed they are exempt from forest reserve requirements under the new Forest Code, but must abide by permanent protection rules.

4.3 Sequencing and implementation of AEM

Agro-environmental measures have been applied on top of existing regulations for nature conservation (such as protected areas and Natura 2000 sites in agro-forest systems) and try to influence established farming and land use management practices. The sequencing of these different policy instruments can explain some of the observed results. For example, the perceived lack of fairness and poor participation of local actors in the design and implementation process of Natura 2000 sites in Portugal contributed to reduce landowners' inherent bond to biodiversity and affected their commitment with conservation efforts. This has reduced their willingness to adhere to the ITI measures.

The conclusions from the Mato Grosso case study also suggest that although some advances were made, particularly in introducing agroforestry practices among settlers, and developing community enterprises based on non-timber forest products, at the landscape (settlement) level, settlers are

path dependent on the regional land use paradigm that embraces forest degrading beef cattle ranching. The cattle industry receives intense public policy support through credit and global markets, while alternative products suffer from discontinuities in technical support and financial assistance and face risky market channels. In this context, the "stick" of command and control measures to punish deforestation has so far been more effective at a regional level than the "carrot" of AEMs. A policy mix that permits flexibility within land use constraints established by the new Brazilian Forest Code coupled with institutional arrangements to support alternative land uses would be a powerful combination for avoiding further deforestation.

One important aspect in AEMs is the duration of the contracts celebrated with the farmers (and the option to revert to the land use existing before) and the sequencing of the rural development programmes where the AEM are integrated. The coarse grain ex-post analysis that was undertaken for Portugal showed how the objectives and rules of the different Rural Development Programmes have evolved in time, sometimes with a new programme introducing quite radical changes in relation to the previous one. This (at least apparent) erratic pattern of changes in regulations introduces a perception of lack of control and policy stability in targeted actors that reduces adhesion to these voluntary contracts. This result was confirmed in the interviews performed with farmers and other relevant stakeholders in the scope of the fine grain study. Farmers expressed their difficulty in dealing with uncertainty and do not believe in the effectiveness of the measures in the medium and long term.

4.4 Impact evaluation of AEM

The evaluation of the impact of AEM in Portugal was based mostly in the analysis of the programs' outputs (e.g. number of contracts signed and amount of payments), since there is no data available on outcomes (actual delivery of biodiversity conservation objectives) at a national level. The coarse grain analysis in Portugal showed evidence of poor implementation and uptake of the studied AEM (ITI – Integrated Territorial Intervention) leading to an overall low effectiveness. This is due mainly to the rather complex eligibility requirements established and the insufficient financial compensation, associated with a lack of technical support, administrative barriers and unfavorable economic conditions.

The German case study also found that, in the current design, the agro-environmental scheme for afforestation in Saxony (programme period 2007-2013) is not attractive. Major reasons for this poor uptake are low subsidy payments, partial reimbursement of investment costs and complicated application procedures. We also found that farmers are reluctant to get involved in something completely new. Having no experience with afforestation and the commitment required to irreversibly plant a forest are aspects that are not addressed by the AEM, hence leading to very low enrolment rates.

With regard to agro-environmental measures adopted in ICDPs assessed in Northwest Mato Grosso (Vivan et al 2013), it is clear that no one instrument adopted can be effective in defeating the contradictory incentives to deforestation without a juxtaposition with other instruments. These included a combination of law enforcement (Forest Code), with credit, extension and technical assistance, and access to remunerative market channels. Before the adoption of ICDPs, law enforcement had been much more lax, while in combination with other instruments, it was possible to intensify land use and avoid further deforestation on homestead lots. Impact measurement and evaluation of AEM effectiveness requires a reconsideration of the use of biophysical indicators and their spatial scale, to track land use changes, Agroforestry Systems (AFS) adopted on one hectare per farm is invisible at a landscape scale, though from an economic perspective it had substantial impact on labour use and financial viability. The impacts on reorganizing workforce and land use logics may also be imperceptible from a short-term perspective, because they take time and a complex rearrangement of political, economic, ecologic and social variables.

Considering the desirable analysis of temporal scale of impacts, an AFS will take 3-5 years to reach full economic maturity, and it is expected that positive impacts in halting deforestation rates would occur after 6 or more years at farm level if contradictory public policies do not interfere (not the situation in the Amazon). Potential impacts at a landscape scale will strongly depend on how other instruments (environmental law and its enforcement, alternative productive chains, technical assistance, local governance of resources and collective enforcement of common rules) achieve functionality and impact. The joint effectiveness of such instruments, besides being context specific, needs to be evaluated in i-space, where “i” is the number of instruments, rather than in two-way combinations.

4.5 Ex ante scenario analysis of AEM

In Saxony, the ex-ante analysis has investigated the conditions under which landowners would be more interested to engage in the agro-environmental scheme for afforestation. These conditions include economic issues (i.e. compensation payments, contract length), social and institutional issues (i.e. technical advice, reversibility to agricultural use) and ecological issues (farmer’s interest in forest-related ecosystem services, i.e. providing recreational access, timber production, enhancing biodiversity). Two methodological approaches were used to assess the demand for different contract alternatives and thereby identify the institutional-economic aspects that hamper and/or motivate landowners’ to enroll in afforestation schemes: (1) choice experiments (CE) with farmers, and (2) qualitative follow-up interviews with a small number of CE respondents. It was found that the subsidy level was rated as the third most important attribute influencing farmers’ choice between contract alternatives in the CE, meaning that the attractiveness of the scheme cannot be enhanced by solely raising the subsidy level. More importantly, farmers have a strong utility if the scheme offers technical advice and the option to return to agriculture after the end of the contract (they would even accept lower levels of subsidies). Furthermore, they have a disutility for large forests and

long contracts. Younger and more educated farmers were generally more interested in afforestation contracts.

The ex-ante analysis of AEM in Portugal focused on improving the design of a specific ITI measure, combining the use of spatial modelling, using Marxan, to provide a more cost-effective spatial allocation of the incentive and a choice experiment to assess farmers preferences regarding different contract design attributes. Preliminary results show that farmers choices were mostly dependent on two attributes: (1) cattle density limit, as the measure implies losses in a very important source of income for farmers, and (2) number of trees to maintain by the end of the contract, as this implies reducing grazing and farming areas and also due to fear of penalties for non-compliance, as the current disease of holm oak trees is rapidly spreading in the region. Farmers have shown no interest in long-term contracts and in applying the measure to large areas of the farm.

The apparent homogeneity of the selected case study area, used as an argument to apply this measure equally within the studied Natura 2000 site, is contradicted by the results from both the choice experiment and spatial modeling. The opportunity costs generated by the analysed AEM-ITI measure (grazing extensification and *montado* regeneration) as well as the ecological features vary within the case study area. These results influence the outcomes of the spatial targeting, which revealed areas, particularly inside the Natura 2000 site, where it is not cost-effective to implement this measure. Farmers' contracting preferences also vary significantly within the area. Overlapping these results shows, for instance, that non cost-effective areas for this measure match with farmers respondents who refused all contract options included in the choice experiment or that consistently selected the alternative with the highest payment level. This indicates that a voluntary scheme such as AEM has the potential to enhance biodiversity conservation in a cost-effective way.

In synthesis, the implementation of this ITI measure is mostly affected by the demanding commitments that lead to revenue loss, which are not compensated by the existing incentives. At some extent, and in specific areas, (e.g. priority areas identified in the Marxan analysis), increasing the incentive might lead to increased participation. Additionally, institutional aspects such as bureaucracy and lack of capacity of local authorities to rapidly decide upon farmers applications and respond to technical support needs, were pointed to as relevant aspects hindering this measure attractiveness.

In Mato Grosso, our analysis of deforestation rates within agrarian reform settlements was based on satellite imagery and on-site interviews regarding motivations and engagement with ICDPs. The results of this analysis indicate that participation in the mix of interventions can be a powerful incentive to on-farm decision-making, but was insufficient to counteract path dependency in land use at a settlement scale, adhering to the regional trend toward extensive pasture conversion of native forests. Although we did not undertake ex ante simulation of AEM effectiveness in future land use scenarios, it is clear that the combination of collective reserve creation within settlements with ongoing extension, technical assistance and market channel development for forest-based enterprises represent a potentially cost-effective means to surmount the contradictions inherent in the cattle dominant economy of NW MT.

4.6 Summary: case lessons learned on effectiveness of AEM in an instrument mix

General policy recommendations

A number of policy recommendations have emerged from the Portuguese, German and Brazilian case studies on AEM addressed in POLICYMIX that can contribute to increase the effectiveness and efficiency of this instrument. These conclusions do not necessarily apply equally to all cases, but correspond to relevant aspects that should be considered in policy design and application.

Understanding of the rationale underlying the adoption of a given measure and establishing the linkages between the implementation of the prescribed actions and the expected outcomes in terms of conservation of biodiversity and ecosystem services seems to be a key point for the stakeholders interviewed in the case studies. Therefore, **providing an explanation why measures are important and offering technical advice for farmers on the implementation of agro-environmental measures** is one of the most important policy recommendations that has emerged from our study.

Complex application procedures and too restrictive eligibility conditions that discourage potential candidates were found to be a major bottleneck in adhesion to AEM schemes. In this respect, efforts should be directed towards the **simplification of application procedures and the reduction of the administrative burden** to farmers and landowners. The provision of technical support for filling up application procedures and the organization of dedicated helpdesk services can also contribute to overcome this barrier.

Careful design of the contracts and ex-ante evaluation of the expected results are also very important aspects to consider. The combination of biophysical data regarding the spatial distribution of biodiversity values, with economic data on profitability and opportunity costs at the farm level and information about social aspects and stakeholders' values and attitudes towards biodiversity conservation is fundamental **to correctly target the proposed measures and establish appropriate compensation levels**. Different tools should be used in combination to support this assessment, such as spatial optimization methods, stakeholder interviews, surveys and economic valuation techniques.

It is important to guarantee some form of **policy stability and ensure predictability in the conduction of biodiversity conservation policies** to targeted stakeholders, in particular in the definition of agro-environmental programmes. In the past, the design of AEM has been evolving, following the adoption of different conservation priorities and the integration of new sources of information and knowledge. Although adaptiveness in the design of environmental policy instruments is a desirable feature, care should be taken to avoid that targeted stakeholders perceive these changes as a seemingly erratic pattern of policy experimentation. Policy stability is even more relevant when adhesion to a specific AEM implies the commitment of farmers and forest managers to prescribed practices and actions with a lifetime of several years, which is very often the case.

AEMs are integrated in a complex mix of policy instruments (policy mix) that shape human actions with impacts in the landscape. In general, AEM play a role in biodiversity conservation policies that is complementary to command and control instruments, such as farming and forestry regulations and land-use restrictions in land designated as conservation areas, aiming at encouraging targeted actors to go beyond these legal requirements. On the other hand, there is a risk that AEM conflict with other incentives, such as broad based agricultural and forest policy incentives, reducing their overall effectiveness for biodiversity conservation. It was found that sometimes, these conflicting signals are included within the same program. **It is therefore important to foster potential complementarities between policy instruments for biodiversity conservation and avoid counteracting incentives.**

Qualifying general high level policy advice

We summarise our findings from the AEM studies in Germany, Brazil and Portugal using the questions identified in the review of high level policy documents (CBD, EC, OECD, UN, TEEB). We discuss whether our case studies disagree with or qualify the general recommendations commonly given regarding conservation instruments.

High-level policy guidance	**Comparative POLICYMIX findings**
Economic instruments are not always appropriate; viability **preconditions of AEM**	The main purpose of AEM is to compensate landowners and farmers for the opportunity and management costs associated with practices leading to biodiversity conservation or increased provision of ecosystem services. Usually in AEM schemes these practices are established on top of existing legal requirements and established 'good farming practices'. They are appropriate to act as an additional incentive and a complement to a C&C approach for biodiversity conservation (e.g. designation of conservation areas, farming and forest regulations) that is properly defined and implemented (enforced). A viability precondition is also the agreement among stakeholders on clear and enforceable contract attributes.
A clear and realistic understanding of the **baseline conditions** is crucial	The baseline for existing AEM schemes may be interpreted as the biodiversity conservation status and the established good farming/forestry practices. A clear and realistic understanding of the baseline conditions is crucial for contract design, including the choice of the contract attributes and compensation values. A clear incentive can only be provided when there is a balanced relationship between the contractual compensations (that usually take the form of payments received by farmers/forest owners) and the efforts required to enhance the baseline situation,

	leading to biodiversity conservation or the increased provision of ecosystem services.
Institutional and economic capabilities, as well as political support, should be realistically assessed	The assessment of the set of local formal and informal rules that exist in conjunction with the economic incentive and capacity building among farmers and conservation authorities are key aspects for the success of AEM schemes oriented for specific objectives at a landscape level. It is essential to find effective means of voluntarily increasing cooperation among farmers, and between them and authorities, to make a more effective use of available limited financial resources of AEM programs and enhance the achievement of shared local socio-environmental goals.
A **combination** of regulatory, economic and voluntary approaches is required	AEM schemes are a perfect example of a combination of voluntary, economic and regulatory approaches. They are voluntary instruments containing an economic incentive (payment), and are established on top of existing legal requirements and established 'good farming practices'. They are necessarily part of a policy mix, and can themselves be considered to act as a policy mix, in the sense that they combine different incentives/measures with diverse goals.
Existing **perverse incentives** should be identified and reformed/removed as early as possible	In the analysis of AEM case studies it was found that general agricultural and forestry subsidies (e.g. EU-CAP single agricultural payments) often provide incentives that are counteracting the goals of biodiversity conservation policies. Schemes should be designed in such a way that the incidence of these conflicting incentives in targeted areas for biodiversity conservation is avoided. The incidence of policy instruments in the landscape should be adjusted to the spatial heterogeneity of ecosystems and of the associated conservation targets.
The roles and responsibilities of actors involved should be well defined and their **roles and responsibilities clearly agreed** before designing the instrument	AEM may act as a way to promote the active engagement of private landowners and land-managers in biodiversity conservation practices. In order to achieve this, AEM contracts should clearly specify the responsibilities of private actors entering the contracts, as well as the role of the supervising authority. Clearly defined roles and responsibilities in contract design minimizes the risks of conflicts and misunderstandings in later stages of policy application.

Economic instruments need to recognize and properly address **opportunity costs and environmental externalities**	The degree of coverage of opportunity costs is an essential feature of contract design in AEM schemes. The ex-post surveys conducted in Portugal and Germany showed that insufficient payment levels, in relation to opportunity costs, were reported as one the main reasons for the low uptake of existing schemes among farmers and foresters. Positive externalities associated with the provision of ecosystem services is not referred as a relevant issue to calculate compensation values by the stakeholders interviewed in the three case studies. The discussion about how should the value of these externalities be considered in the design of AEM (and incentive schemes in general) should be the object of further research.
Set clear targets and indicators; to the extent feasible, incentive measures should have targets that are specific, measurable, time-driven, and based on an analysis of their effects	AEM schemes can combine different incentives corresponding to different objectives that can even be conflicting (e.g. prioritization of a given species/habitat, may imply the reduction of habitat suitability for others). It is important to prioritize objectives and make clear the targets, as well as the indicators to monitor the instrument effectiveness and justify potential adjustments over time. However, specific, dynamic conservation targets are also expensive to monitor, increasing the transaction costs associated with AEM implementation.
Predictability - Instruments should have clear rules, the goal is to establish a predictable path of controls for participants. This facilitates long-term planning and investment, increasing efficiency	The ex-post analysis of the case studies showed that the design of AEM has been evolving in time, following changes in conservation priorities. This may reduce the perception of predictability in targeted stakeholders and lower their willingness to establish a contract. AEM funding is in some way unpredictable, since it is guaranteed by public revenues and dependent on an allocation of resources that may change in time. However, EU-CAP AEM programs are characterized by a relative pluri-annual stability.
Sustainable economic instruments are **adaptable to changing ecological and economic contexts**; therefore, periodically revisions of instrument's design are	Adaptiveness, allowing the progressive integration of new sources of knowledge and results from monitoring data, is a desirable property of AEM schemes, in particular considering the complex functioning of ecological systems and the evolution in conservation priorities. However, it entails several risks and costs, such as adaptation

recommended in order to adapt to changing conditions and to ensure that they continue to be effective The **possibility to re-design economic incentives over time** based on changing conditions lowers the pressure to get the initial design perfect	costs for farmers and forest managers, increase in transaction costs, risk of policy capture by particular interests, reduced predictability of policies and lower perception of control by targeted stakeholders.
Managing, monitoring, and enforcing are keystones Incentive measures are more likely to be sustainable if presenting low **transaction, enforcement and participation costs**	Increased targeting and the adoption of 'deep and narrow' AEM to attain cost-effective conservation will mean higher Monitoring, Reporting and Verification (MRV) costs. Managing, monitoring and enforcing are key tasks in AEM, since some of these schemes (specially the 'deep an narrow' ones) include very specific measures that require close monitoring 'on the ground'. Experience in Portugal has shown that the effectiveness of monitoring and enforcing can be improved by the designation of multi-stakeholder accompanying committees, including representatives from nature conservation authorities, local authorities, farmers/forest managers, ONGs and experts.
Disclosure and transparency are necessary	Disclosure and transparency are important in implementation of AEM. Farmers/foresters frequently contest the prescribed measures and do not understand how will a given measure contribute to biodiversity conservation of the provision of ecosystem services. Providing an explanation of why measures are important and disclosing program monitoring information on a regular basis may contribute to foster stakeholder engagement in AEM schemes.
Measures should avoid increasing **external dependency**	Global ecosystem services such as climate regulation and biodiversity conservation in forestry/agro-forest ecosystems, justify transfers from higher to lower governance levels, including individual landholders. External interdependency is an acceptable characteristic of AEM rather than something to be avoided per se.

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5 Cross case comparison of ecological fiscal transfers (EFT)

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Ecological fiscal transfers (EFT) were first created in Brazil in 1992 in the state of Paraná and are now operative in 13 of the country's 27 states, as well as in Portugal (nationwide in 2007). EFTs act as a mechanism for redistributing central tax revenues to decentralized governments, based in part on their surface areas dedicated to conservation and the degree of protection established (Ring et al 2011). Our case study in Brazil (May et al 2012) sought at a coarse scale to measure the impact to date of the mechanism on creation of additional protected areas (ex post). In Portugal (Santos et al 2012), due to the recent implementation of EFT, the work focused on analysing the rationale behind the instrument design and evaluating the magnitude of the incentive provided to municipalities as a compensation for land designated as conservation area. Our case study in Germany (Schröter-Schlaack et al 2013) sought to simulate the impacts of newly introducing conservation indicators into intergovernmental fiscal transfers from the national to the state level (ex ante). We also sought at a local fine grain scale in NW Mato Grosso and on the left margin of the Guadiana river in SE Portugal, to identify factors which might improve the instrument's effectiveness and equitable distribution. EFT are discussed in the Norwegian context (Barton et al 2012) as a possible response to suggestions that state-to-municipal transfers for nature conservation be increased, due to a decline in earmarked support for environmental positions in local government in recent years. Norway has also practiced compensation to local governments for protected area creation on an ad hoc basis, as a possible model for a general revenue transfer policy.

5.1 Conflicts and synergies between functional roles of EFT and other instruments

The Brazilian EFT scheme, called the "ICMS Ecológico", derives its financing from a proportion of the federally designated value-added tax revenues that is by law redistributed back to municipalities of origin. Such revenues correspond to a 25% share of total ICMS revenues received by the state, of which one-fourth may be allocated according to state-determined formulae, while the remaining three-quarters is allocated in accordance with local production and circulation of goods and services. Each state has determined its own share of ICMS revenues to allocate on environmental grounds, but the result is fiscally neutral. In Portugal, EFT are integrated in the annual transfers from the national to the local level (municipalities), its finances being supported by the general budget. They were introduced with the 2007 amendment of the Portuguese Local Financing Law, and as part of an overall change in the criteria adopted to allocate the total fiscal transfers among the municipalities. The criteria adopted to define the total fiscal transfers amount were also changed with the 2007 amendment but this change is not related with the introduction of EFT. So, the rationale behind

Portuguese EFT was not to provide additional resources to local governments in aggregate, but instead to originate a different allocation among them. In this sense they are also fiscally neutral as in Brazil.

Conflict and uncertainty prevail regarding the implementation of environmental policies at different levels of governance in Brazil, due to the incomplete constitutional definition of roles in the hierarchy. This uncertainty extends to the allocation of ICMS-E revenues. The lack of knowledge even by local government officials regarding how municipalities receive resources is common and reflects the lack of a direct local government role in addressing fiscal policy. Officials interviewed in Mato Grosso, for example, were unable to discriminate between those resources received due to conservation status (ICMS-E) and those received due to business as usual (ICMS and other fiscal transfers). The policy contains no earmarking and resources are instead used for general purposes with greater local socioeconomic priority (e.g. road maintenance), which may instead stimulate greater deforestation.

There is a serious lack of communication, information and interaction between entities and managers at different levels of governance. These observations were largely echoed in Portugal, where the lack of knowledge by local government politicians and officials regarding EFT is common and earmarking is also non-existent, although EFT resources use did not appear to have negative implications for conservation status. In Norway, on the other hand, while officers at the Ministry of Finance also frown upon earmarking, the lack of municipal budgets and professional capacity to comply with their environmental management obligations has led environmental NGOs and analysts to propose restoration of a system very similar to ecological fiscal transfers to compensate for additional administrative costs of environmental responsibilities.

The justification for EFT creation results from a clear mismatch between those who bear the costs and those who benefit from conservation actions, since their benefits flow beyond local, regional and in some cases even national borders. Conservation costs are unevenly spread, with some local public and private actors facing costs related to protected areas or conservation activities required by EU and/or national regulations. EFT in both Brazil and Portugal were hence initially designed to, explicitly or implicitly, compensate for the opportunity costs of biodiversity conservation, namely in terms of lost tax revenues for local governments faced with lands removed from productive use for conservation.

In Brazil, the allocation of part of ICMS revenues in part on environmental grounds led some municipalities to receive greater revenues than they would have had without conservation, while others faced a drop in revenues. But most municipalities which received a greater share than previously were relatively poor, rural and isolated, while the losers were urbanized, agribusiness dominant and relatively wealthy. A similar result was obtained for the Portuguese case. Since the ICMS-E and the EFT scheme in Portugal are fiscally neutral instruments, rather than adding new revenues to the overall resources to be distributed, winners are compensated by losers. However, despite the apparent Pareto optimality inherent in this reallocation, it leads to some tension among

municipalities, affecting the political viability of proposals for further reallocation to reinforce the conservation benefits secured.

In both cases with implemented EFT schemes, increased revenues from conservation indicators allocated to local governments have begun to serve as incentives to both augment areas under protection and to enhance their management. Such a result is mostly reliant on local initiative, however, since the instrument design and lack of earmarking militate against this incentive. To achieve greater synergy toward conservation effectiveness, a proactive role is needed on the part of state or federal government, recognizing complementarities with other instruments and policy objectives.

For example, Portuguese EFT complement the existing policy mix, since they are based on and have a clear potential synergy with the existing protected area regulations at different levels. EFT aim to contribute to the maintenance or increase of classified areas' quantity and quality. However, they were not specifically designed and implemented with a concern to capture potential synergies with other regulations beyond protected area regulations, and incentives with impacts on land use decisions.

Particularly, EFT in Portugal currently do not promote potential synergies with other instruments such as AEM, that address private actors' costs. The alignment of incentives between local public and private actors is important, and can be achieved by designing and implementing EFT as part of an articulated policy mix with reinforcing cross incentives (Santos et al 2013, submitted manuscript). The main potential outcome of such an integrated approach would be the creation of a new spirit of collaboration and partnership between the two main actor groups that influence the success of biodiversity conservation measures at a local level: public authorities and private actors such as landowners, farmers and foresters. In some Brazilian states, ICMS-E already triggered new forms of public-private interaction. For example, in Paraná municipalities use part of the ICMS-E revenues to cooperate with land user associations (RPPN networks and owners of common property reserves known as *faxinais*), providing them with in-kind contributions to better manage private conservation lands (May et al 2002, Ring 2008).

In Germany, there is a clear potential synergy between EFT and protected area regulation, as the size and level of land use restriction of designated protected areas are proposed as indicators to allocate transfers to the states (Schröter-Schlaack et al 2012). Moreover, EFT may provide resources to the states' conservation policy in two ways. On the one hand, thus far often underfinanced public conservation activities may benefit from additional resources due to EFT. On the other hand, the states are the principal actors in Germany to implement EU co-funded state conservation support programs and AEM. State conservation support programs address both local public (municipalities, district governments) and private actors (landowners, land care associations), while AEM are geared to serve private landowners. A potential increase in such measures will most probably have an influence on the performance of the respective states in terms of biodiversity conservation goals and may in turn make states eligible for higher transfers from EFT.

Although the ex ante simulation of EFT from federal to state level in Germany chose a scenario resulting in non-earmarked transfers, in contrast to local governments in Portugal and Brazil states in Germany are well aware of exactly how much they receive in relation to which indicator in the transfer formulas. Therefore, any suggested revision in the financial constitution or fiscal equalization law is closely followed by the states, so that states with above-average conservation performance will certainly know what EFT amount is to be expected by a reform of the transfer system. In addition, EFT could also be integrated into the German fiscal equalization system in the form of supplementary federal grants in relation to specific policy sectors in need of acknowledged additional finances (Schröter-Schlaack et al 2012; Möckel 2013). In this latter case, the link between conservation performance and received transfers would be completely transparent. Lastly, a policy window has now arisen for a restructuring of financial equalization due to the end of the Solidarity Pact between the West German and Eastern German states. Introduced after the German reunification, the Solidarity Pact provides extra financial resources for infrastructure development in East Germany to catch up with living standards in the West. These grants are currently phased out until the year 2019 and will stop being paid in 2020. For this reason, politicians of all parties are now discussing options for redesigning financial equalization in Germany, including options for considering ecological fiscal transfers. However, introducing ecological indicators in order to create EFT slightly reduces the relative importance of the existing indicators. Hence, EFT would be potentially in conflict with providing resources necessary to fulfil other public responsibilities that reside at state level such as education or the provision of traffic infrastructure, in particular for states with low conservation performance.

Finally, in Norway, researchers have questioned the assumption of a correlation between municipal protected area expenses and protected area size. Håkonsen and Lunder (2009) show that only 0,162% of average municipal expenditure can be identified as environmental management expenditure. They question whether a revision of the existing fiscal transfer scheme is justified by such a small portion of potential shift in municipal spending. At the same, variation in municipal land area per capita is very large, and they recognise that the link between protected area and management expenditure has not been weel enough documented. An additional concern in Norway is that distributional implications of ecological fiscal transfer factors must be seen in light of municipal finances more broadly. One should also consider potential income correlated with (but not necessarily caused by) protected areas, as well as management expenditure and opportunity costs. In Norway, Håkonsen and Lunder (2009) found that a prospective ecological fiscal transfer based on protected area within the municipality would also favour municipalities with large tax income from hydropower concessions. This is because aea per capita is highly correlated with hydropower production by municipality. Hydropower reservoirs are also often found in upland mountainous areas which are disproportionately within protected areas compared to lowland more densely population areas (Barton et al. 2013).

Lessons regarding the functional role of EFT in combination with protected area policies may be drawn from the comparison of the Brazilian and German cases. As both Brazil and Germany are federal states, the German coarse grain/fine grain case study on EFT dealt with the inclusion of ecological indicators in national-level fiscal transfers to the states. Although such an approach has not yet been adopted in Brazil, the inclusion of ecological aspects in fiscal transfer at a national level has begun to be debated among politicians. In Germany, such discussions are at a very early stage in the political arena, confined mostly to environmental politicians and the German green party. In Portugal, the EFT policy applies to national-to-municipal government transfers, with no intermediary instance at the state level.

5.2 Sequencing and implementation of existing EFT schemes

In Brazil, in light of our analysis of the ICMS-E, it is clear that the initial allocation benefits have little impact on additional protected area designation or management. In Portugal, the instrument design also renders little incentive for local governments to assume a proactive role to improve protected area management.

The fact that the Portuguese EFT scheme does not take into account the quality/ level of protection of different categories of protected areas, or the environmental benefits provided by areas outside nature conservation networks should be perceived as acceptable in a first stage of implementation. An appropriate sequential order of instrument implementation should avoid that schemes be initially overly complex, permitting a progressive change in the mindset of decision-makers and other relevant stakeholders as benefits are perceived. A review of the Portuguese Local Finance Law, aiming at improving EFT's effectiveness, should consider the inclusion of new ecological indicators that could better link financial compensations to the positive externalities each municipality provides to society.

A sequence of EFT strengthening, in Brazil as in Portugal, would provide for inclusion of quality-based incentives to motivate progressively greater commitment to protection and management. Such progression could also reward those municipal governments which take the initiative to dedicate resources from EFT to support complementary objectives such as indigenous territorial protection, streambank restoration in line with the forest code and agro-environment measures.

However, the ICMS-E in Brazil and EFT in Portugal clearly are not sufficient on its own, nor are they intended in the first place to finance biodiversity conservation in private lands, which requires additional funding sources and the articulation with other incentive instruments (e.g. AEM). In Brazil, resources derived from licensing of rural activities and environmental fines are now being designated to fortify local governance, while other instruments, notably Transfer of Development Rights as called for under the new Brazilian Forest Code, are contemplated as measures that will reinforce improvement in land use practices (Bernasconi et al 2014). An ex ante simulation of the effectiveness of TDR (Cota de Reserva Ambiental) showed the potential to meet multiple objectives for biodiversity

conservation and reduced cost in meeting Forest Code reserve requirements in Brazil (Romeiro et al 2013). It is up to local government authorities to articulate such measures so as to create positive cross-incentives.

An interesting result of the ICMS-E allocation in part of the study area in Brazil refers to sub-allocation of part of the proceeds as project finance to indigenous communities whose lands were the principal source of the additional funds. However, the proportionate share so allocated (less than 3% of the total) does not do justice to the significance of indigenous protection afforded to remaining forests in the study region. The establishment of a more direct link between the source and destination of such allocations is impossible absent earmarking or conditionality in EFT expenditure. At present, such initiatives require an annually renewed municipal budget provision to provide for such proactive sub-allocation. When the progressive mayor who pressed for indigenous groups to receive a share of ICMS-E allocations left office, this measure was eliminated.

In contrast, the state of Pará has recently passed legislation creating an ICMS-E mechanism that increases municipal revenue sharing based on the proportion of private lands that have been environmentally licensed. A similar approach is proposed for EFT in Portugal (Santos et al 2014), to create greater synergy with AEM and private landowner decision-making, for example, by offering an EFT premium to municipalities which have a higher proportionate share of area within AEM schemes.

The principle adopted for ecological fiscal transfers in Portugal is non-earmarking, meaning that beneficiaries (local governments) are free to decide upon their use. A potential improvement to the effectiveness of this instrument would be to channel part of EFT's funds from the receiving local authorities to specific conservation measures or to private actors, for instance to support conservation programs and actions giving an opportunity to align local public and private actors' incentives. The acceptance by local authorities of such conservation-related obligations would be increased if the earmarked funds from EFT corresponded to an additional transfer in relation the amount that they would receive anyway as compensation for opportunity costs associated with biodiversity conservation regulations. This might require increasing the overall amount of fiscal transfers available for distribution through increased taxes, charges or other levies. In this way, one can avoid diverting flows allocated to other local public functions and considering other social criteria, which is a difficult political choice (Santos et al 2013-submitted, Santos et al 2014).

The legitimacy of EFT, will also depend on the existing distribution of municipal finances. In Norway, for example, municipalities with large conservation areas are often also large recipients of resource rents from hydropower concessions, and have higher municipal income on a per capita basis than more urban areas. In Brazil and Portugal the converse is true, so EFT policies that favour rural municipalities with large conservation areas are more legitimate from a redistributional standpoint, than in Norway.

5.3 Impact evaluation of existing EFT schemes

In general, the ex post assessment of policy instrument effectiveness in creation of new protected areas was inconclusive at the coarse grain level in Brazil, even when states in the same biome and similar levels of protected area management were compared with others which had not created EFTs, over the time period since implementation. The existence of EFT in a particular state was not a primary factor in the pace of expansion in protected areas. Clearly, other factors are at work. In some cases these factors are related to the design of the instrument itself, and in others to the policy context in each state in which it is established.

At a municipal level, where revenues are differentiated on ICMS-E criteria, the instrument should have been most effective at stimulating local conservation actions. The national data on municipal protected area creation was insufficient to test this hypothesis, but in Mato Grosso, there was a clear spurt in municipal protected area creation immediately after creation of the instrument in 2002. However, due to a resurgence of agribusiness control of state government shortly thereafter, protected areas came under fire through efforts to diminish their scale and to undermine instruments that had stimulated their creation. The instrument continues to operate in Mato Grosso to compensate areas protected by federal or state governments, particularly indigenous territories but here too agribusiness opposition has stymied proactive efforts toward greater protection.

In some cases, the synergy with other instruments present within the law that established the National System of Protected Areas (SNUC) in Brazil could be decisive in leveraging greater efforts to create protected areas. These include resources obtained by protected area managers to decisively implement management plans, expropriate landowners, equip and train managers, etc., obtained in compensation for the impacts anticipated from major infrastructure projects. In effect, to obtain better-protected area management, states had to “seal a pact with the devil” and absorb high impact development investments. Not implemented yet, water use payments could be made for resources derived from catchments within or surrounding protected area units. Furthermore, REDD+ financing could be directed toward states that create new protected areas, as a barrier against deforestation pressures.

The impact assessment provided evidence that the Portuguese EFT scheme discriminates positively those municipalities that harbour more than 70% of their land designated as conservation area. In general this group includes rural and poor municipalities, with a per capita income lower than the national average, but it is not possible to conclude that these municipalities are overall poorer and with a lower per capita municipal budget than other municipalities with a lower protected area coverage. The effectiveness of the Portuguese EFT as an incentive for the designation of new protected areas, or improvements in the management of existing areas, is not so clearly demonstrated as yet, primarily because the scheme is too recent for results to be visible.

EFTs’ effectiveness as an instrument to promote additional biodiversity conservation has been hindered by the complexity of the overall Portuguese Local Finance Law and the changes simultaneously introduced in other funds and allocation criteria in the 2007 amendments. Crossover

effects that arise as a result of the different changes, the introduction of smoothing rules to avoid drastic fluctuations, reduced overall transfers due to the financial crisis in Portugal and the small magnitude of the ecological component, contribute to hide the financial incentive offered to municipalities by the ecological signal. The lack of earmarking of the transferred funds to biodiversity conservation activities and the poor communication and engagement of interested parties also reduced its effective implementation. However, an important outcome is the creation of a new mind-set that is more favorable to biodiversity conservation among public authorities. This aspect is somewhat difficult to assess, but we could find some evidence of change in the viewpoints expressed by some of the mayors interviewed. The same sort of problem is anticipated to arise in Norway, where local governments are generally not the initiators of protected area creation.

5.4 Ex ante scenario analysis of suggested EFT schemes

The ex ante scenario analysis of ecological fiscal transfers (EFT) at federal to state level in Germany focused on three major steps (Schröter-Schlack et al 2013): 1) development of ecological indicators that reflect the different conservation activities of German states, 2) options for the integration of such indicators into the existing fiscal transfer scheme from a legal and institutional viewpoint, and 3) the simulation of EFT distribution based on the indicators developed in step 1 and the selected integration option derived from the analysis in step 2. With respect to indicators, the case study developed a stepwise approach considering area-based indicators as well as qualitative indicators, e.g. related to landscape fragmentation and the state's national responsibility to provide habitat for especially threatened and thus protected species. Regarding integration of indicators the case study tested an approach that followed a previously implemented modification of the transfer scheme to consider extraordinary per capita costs of sparsely populated states in providing infrastructure. Following this approach, the newly introduced conservation indicators increase or decrease the fiscal need of the relevant state, depending on whether the state performs above or below the national average regarding the conservation indicator. Finally, the adjustment payment a state receives or has to pay, depends on the coverage ratio of its fiscal capacity (tax revenues) and fiscal needs. Simulation results for the EFT scenarios suggest that although transfers based on ecological indicators would make up only a small share of total transfers distributed, they still represent significant amounts in absolute terms for those states that would be among the winners with a new EFT scheme, especially if compared to public funds usually available for conservation programs at state level. Therefore, it is argued that in the long term EFT may encourage a shift in land-use decisions towards protected area designation, as benefits are obtained from the latter. Moreover, EFT could be important not only in terms of increasing the number of protected areas, but to improve protection, as a high protection status increases the distribution index.

In the case of Norway, a policy mix could center on an earmarked EFT to compensate local conservation commitments, complemented with a dedicated trust fund and state regulation. After reviewing alternatives to fiscal equalisation of expenditures such as earmarking of transfers, discretionary transfers, local trust funds and regulation Håkonsen and Lunder (2009) conclude that

environmental expenditure equalization of fiscal transfers is possibly too coarse an instrument to address the multiple objectives of nature and environmental management activities at municipal level. They propose a municipal policy mix whereby earmarking of transfers are used to incentivize specific (new) municipal environmental responsibilities during phase-in periods. State-imposed regulations are used in combination with local development trust funds to compensate for loss of municipal income from protected area establishment in achieving national policy objectives (because these protected areas are exceptional). They argue that systematic adjustments in fiscal transfers would be justified to address expenditures increases due to general environmental responsibilities that apply to all municipalities. Furthermore, the simulations by Håkonsen and Lunder (2009) showed that additional municipal expenses due to additional protected area were low in absolute terms. But even small additional transfers that are sufficient to increase professional environmental staff at municipal level could make a qualitative difference in management (Barton et al. 2013).

5.5 Summary: case lessons learned on effectiveness of EFT in an instrument mix

The potential for EFT to serve as a lever to influence state and local governments to better protect and manage protected areas in their jurisdictions appears significant, but there are several factors which limit their effectiveness on their own. When EFT are combined with other instruments, they can potentially generate resources that can be dedicated to reinforce the synergy between private and public conservation efforts. We found that both in Portugal and Brazil, cross-incentives between AEM and EFT could create new synergies for conservation in public as well as private areas. Because earmarking of EFT is not constitutionally allowable in any of the cases reviewed, strengthening such synergies will depend upon action at state as well as local government level to legislate allocative preferences in tune with state and local priorities.

At the state level, complementary measures that would strengthen biodiversity conservation in the productive landscape are justified by the limited role of EFT in incentivizing private land use practices. In Germany, the EFT mechanism is based on federal to state allocations, respectively, rather than state to local as in Brazil. The role of federal revenue sharing is distinct from that adopted at the state level, where more provincial concerns prevail. There is considerable potential for conditioning the federal fund for state and municipal participation on the subnational jurisdictions' commitments to biodiversity conservation and other collective benefits.

Regarding EFT to the local level, the following has to be considered: since a proportionally greater share of the area dedicated to conservation is outside local control, having been created by state or federal fiat, there are conflicts between local development objectives and efforts to reinforce protected area creation. Local stakeholders may then perceive as unfair the dedication of funds obtained, in principle to compensate for spillover benefits or the opportunity costs of such land use, toward improvements in conservation rather than in other investments of local socio-economic benefit. Increasing efforts on the parts of states to stimulate greater protected area management

through use of quality indices to reward more effective use of EFT funds represents one way to correct this, associated with the need to fortify policy coherence between state and local governments. For Brazil, another approach is to include private or indigenous protected areas as legitimate recipients of a share of the funds allotted in part due to the presence of these protected areas. Such approaches require stakeholder mobilization and responsive local government.

Legitimacy of EFT redistributive effects will also depend on the pre-existing per capita municipal budgets compared to responsibilities. Municipal obligations are determined by a policy mix prescribing municipal services, and EFT conservation incentive effects may be 'diluted' in such a mix. When opportunity costs to municipalities serve as a justification for EFT, it has to be noted that these are also contentious because the land development baseline used to justify foregone municipal tax income due to conservation may not be commonly accepted. The land use development baseline is determined by land use development policies (such as subsidies for road building, tenure rights for forest clearing, land tax exemptions), and so the legitimacy of EFT is intimately related to the wider economic policy mix. The differences in forest/agro-forest land use development baselines for the Latin American and European case studies is very large, ranging from forest regrowth (Norway), maintenance of the landscape mosaic (Portugal) to deforestation (Mato Grosso), implying the need for different compensation principles in EFT depending on the stage of the forest transition. However, legitimate arguments to introduce EFT schemes differ from country to country. In Germany, for example, opportunity cost arguments are not valid for changing the fiscal transfer system. Here, justifications for introducing EFT partly build on spillover benefits, but mainly on extra-ordinary per capita costs of the relevant public goods and services to be provided by conservation.

Regarding transaction costs of EFT and municipal benefits of protected areas, further research seems merited. Regarding transaction costs, a hypothesis discussed in POLICYMIX is that EFT can be an efficient way of providing conservation incentives to municipalities, because the fiscal transfer system is already in place (low implementation costs). However, in the Norwegian case we saw that implementation costs were used by some researchers as an argument against introducing EFT, because new state designated protected areas requiring compensation is expected to take place only exceptionally in future, with most forest conservation now based on voluntary schemes. This position assumes that already established state protected areas are not perceived as entailing substantial net opportunity costs for municipalities. The focus of compensation discussions is relative to the current status quo. The extent to which existing protected areas provide non-extractive recreation and tourism benefits that exceed income losses from bans on extractive uses such as logging remains poorly documented in our case studies in Brazil, Portugal or Norway, where opportunity costs (would) serve as a rationale for implementing EFT.

Below, we compare our findings with the guidance provided by high-level policy documents (EC, OECD, CBD, TEEB, UNEP) reviewed at the outset of the paper.

High-level policy guidance	Comparative POLICYMIX findings
Economic instruments are not always appropriate; viability **preconditions of EFT**	Existing EFT schemes have typically been legislated to compensate local public actors for positive externalities generated in other jurisdictions (spillover benefits) by protected areas imposed on local governments (local costs). The instrument is particularly adequate to complement a Command & Control approach focused in the designation of conservation areas. A viability precondition is the agreement on clear and enforceable allocation indicators with regular monitoring (e.g. land designated as conservation area). Their fiscal neutrality may cause attrition between local governments as there are always winners and losers.
A clear and realistic understanding of the **baseline conditions** is crucial	The baseline for existing EFT schemes may be interpreted as the amount of protected area when the instrument is newly introduced. However, the baseline may be different, if other conservation indicators are chosen for integration in fiscal transfer schemes. As block grants, EFT may not be noticeable to local government officials who then treat them as general revenues. EFT may become an incentive if there is an adequate understanding of the relationship between revenues and proactive efforts to enhance the baseline situation by creating new protected areas or enhancing their classification. In case opportunity costs of conservation serve as a justification for EFT: an accepted definition of a land development baseline that determines foregone municipal tax income, may not be possible when land development policies are heavily contested.
Institutional and economic capabilities, as well as political support, should be realistically assessed	It is clear in the case of EFTs in Portugal and Brazil that local rule setting can be an effective means of voluntarily making more innovative use of the instrument to further local socio-environmental goals. This requires capacity building among municipal authorities, as well as pressures to spend EFTs resources wisely. The institutional family of rules that exist in conjunction with the economic incentive will enhance flexibility in the local use of non-earmarked revenues. Opportunities for such flexibility vary between Brazilian states, and among Brazil, Portugal, Germany and

	Norway, depending on the broader institutional framework.
A **combination** of regulatory, economic and voluntary approaches is required	This is certainly true for EFT schemes as they are a combination of an economic instrument with protected area regulation. However, EFT have the danger of being treated as a black box with limited perception of the origin of EFT resources obtained by some municipalities at the expense of others. To be most effective in conservation, such revenues should be channeled to reinforce the positive externalities that originated them. The primary purpose of EFT is to provide decentralized public actors with the financial resources needed to provide more or better conservation-related public goods and services, as the public conservation sector is underfinanced in many countries. However, EFT can also complement and synergistically strengthen economic instruments addressing private actors. They can complement AEMs, PES, credit and land use restrictions if revenues from EFT can be used to assist landowners to coordinate their land use practices, enhancing connectivity and cross-municipal environmental services.
Existing **perverse incentives** should be identified and reformed/removed as early as possible	EFT do not act as an incentive toward greater conservation unless they are specifically targeted by the local government in that direction, since they are not earmarked. We found in Mato Grosso for example that additional funds obtained from the ICMS-E were diverted to road maintenance rather than environmental management, in accordance with local priorities. However, depending on the wider policy mix and institutional settings, EFT may also lead to reducing or abolishing existing perverse incentives such as commuting allowances in Germany, favoring urban sprawl. As EFT schemes contribute to increasing public budgets based on conservation indicators, this shift in mindset to better acknowledge conservation activities may also lead to a reform of (perverse) incentives negatively impacting on conservation objectives.
Economic instruments operate by realigning rights and **responsibilities of public and private actors**	Any existing or new indicator for tax (re-)allocation in a fiscal transfer scheme always involves an incentive effect for the governments addressed, as different indicators in transfer formulas necessarily involve different winners and losers for a given tax revenue. Acknowledging public conservation responsibilities through conservation indicators in fiscal transfer schemes closes a gap in the conservation policy mix in most countries, as conservation thus far is rarely relevant for general tax distribution. However, EFT do not by definition act as an incentive

	for conservation. There is no specific targeting of funding toward conservation or more equitable allocation unless the state or local government decides to modify baseline budgetary priorities for this purpose, or to leverage additional conservation investment by higher levels of government. It may be a task of local actors concerned with better land use governance to pressure public agents to realign their responsibilities in this fashion.
The roles and responsibilities of actors involved should be well defined and their **roles and responsibilities clearly agreed** before designing the instrument	Roles and responsibilities of public actors at different governmental levels are clearly defined in constitutions and laws (formal institutions), as is the basic design of intergovernmental fiscal relations. However, laws and relevant executive regulations may assign responsibilities in providing public goods and services to decentralized governments without at the same time providing the financial resources necessary to fulfill these responsibilities. Underfinancing of conservation policies has been reported for many countries and EFT may provide extra resources for the public conservation sector if used in this sense. At a more specific level, in EFT schemes, allocation is fixed by the instrument as legislated, the allocation formula being one point of entry for design decision. Actors may intervene at this stage to ensure greater allocations toward specific environmental factors, such as biodiversity, water services, etc. Formal roles and responsibilities may be easy to identify, while norms / informal rules-in-use may be significant, but invisible to outsiders. In EFT, once formal allocation is assigned, the informal bargaining over use of funds can be crucial in improving effectiveness and equity, but context specific.
Economic instruments need to recognize and properly address **opportunity costs** and environmental externalities	EFT can be designed to compensate for the opportunity costs of lands allocated to protection in terms of lost revenues from land development for other purposes. They can also be designed to compensate for the conservation and management costs incurred by public actors to provide conservation goods and services involving spillover benefits beyond their own jurisdictional boundaries (positive spatial externalities). We found in Mato Grosso that the value of EFT per hectare in terms of additional revenues in some cases was in fact greater than the value added taxes they would have obtained had the land been

	kept under pasture. The biodiversity gained by protection is usually not valued as highly by local society, as it is valued by state, federal, European and global governance levels. If opportunity costs of conservation increase (e.g., due to speculative land prices, increased beef prices, etc.), and local taxes would have been higher than EFT revenues, the municipality would be better off doing without protection. This may require that the EFT allocation be increased over time. EFT incentives can also be diluted with success in creating new protected areas, since the overall revenue base may not expand as rapidly as protected areas, thus further pulverizing resources.
Set clear targets and indicators; to the extent feasible, incentive measures should have targets that are specific, measurable, time-driven, and based on an analysis of their effects	In EFT schemes, the incentive effect relates to the quantity and quality of the conservation indicator chosen. If protected areas serve as an indicator, all protected areas categories of a given country should ideally be included, although with different weightings that take into account conservation strictness and thus land-use restrictions involved. For national to state-level schemes, protected area categories may be aggregated to a certain extent to decrease transaction costs. For EFT schemes to the local level, the different PA categories are recommended to be weighted differently according to their conservation value/strictness. At the local level, the quality of protected area management should also be made part of EFTs allocation indices. This can lead local governments to perceive that efforts to promote environmental quality can be a means to enhance revenues, and serve as a basis for monitoring progress toward biodiversity targets. However, specific, dynamic conservation targets are also expensive to monitor, increasing the transaction costs associated with EFT implementation.
Predictability - instruments should have clear rules, the goal is to establish a predictable path of controls for participants. This facilitates long-term planning and investment, increasing efficiency.	EFT are predictable, since the revenue distribution between states or municipalities is fixed according to the allocation formulae and conservation status. However, they vary in relation to overall tax revenues in any one year (budget) in the state or national economy. The more protected areas designated to protection, the less each municipality will receive if it does not increase conservation area, or if general economic growth does not lead to increased tax revenues from year to year.
Sustainable economic	This clearly also holds for EFT schemes. They can initially be

instruments are **adaptable to changing ecological and economic contexts**; therefore, periodically revisions of instrument's design are recommended in order to adapt to changing conditions and to ensure that they continue to be effective The **possibility to re-design economic incentives over time** based on changing conditions lowers the pressure to get the initial design perfect. This is relevant, for instance, to overcome technical challenges such as establishing appropriate tax/charge levels on resource users or polluters	introduced in a more basic and simple way and then be revised and improved when new knowledge becomes available or monitoring schemes recommend revisions. For example, the Portuguese EFT scheme started with no weighting of different protected area categories. Only the share of protected areas above or below 70% in relation to overall municipal area serves as a distinction for higher or lower EFT per hectare protected area. Revisions may relate to increased differentiation between different protection categories, or to add quality factors. Other revisions may provide for allocations to social groups who protect biodiversity. All these revisions represent adaptations in EFT that respond to changing concerns in society. When the relation between opportunity costs of conservation and fiscal capacity of local governments changes over time this may require that the EFT allocation be also adjusted. Fine tuning is desirable but unnecessary tinkering may confuse local actors and over-emphasize the instrument's character as a "black box".
Managing, monitoring, and enforcing are keystones Incentive measures are more likely to be sustainable if presenting low **transaction, enforcement and participation costs**	EFT, once legislated, tend to be fairly automatic and with low transaction costs (although this may depend on the complexity of the indicators adopted, and the need for greater monitoring capacity), since transfers occur directly to state and local government without intermediation. Their conservation effectiveness, however, will depend on well-informed and responsible receiving governments as well as on intervention of citizenry to ensure that resources derived from biodiversity resource protection are turned to environmentally sustainable use. Increased targeting to attain cost-effective conservation will mean higher Monitoring, Reporting and Verification (MRV) costs. This is also true in EFT schemes, where use of quality indices requires regular monitoring and indicator legitimation. However, regular quality monitoring is obligatory for the Natura 2000 network in Europe anyway, so that synergies between regular conservation monitoring and possible EFT quality indices exist. When EFT are implemented for the first time, it is important to make the scheme simple to change the mindset of local public actors and increase their acceptability and sustainability. EFT cost-

	effectiveness can be increased in a progressive way, regarding the instrument on its own, and in the course of creating synergies with other instruments in the conservation policy mix.
Disclosure and transparency are necessary	As EFT are distributed as block grants, especially local level actors may often not even know that they receive fiscal transfers based on their conservation performance. Hence, public information and transparency regarding fund allocation according to EFT can be a decisive tool to influence local governments to dedicate some part of their additional resources to enhance conservation effectiveness.
Measures should avoid increasing **external dependency**	The fact that EFT are derived from general tax revenues (VAT/ICMS revenues in Brazil), at local, state and national levels provides for independence from "external" dependency. However, poorer jurisdictions with low fiscal capacity are more dependent on fiscal transfers than richer jurisdictions with substantial own tax income. Therefore, it is a general public finance principle for fiscal transfer schemes to equalize public revenues between jurisdictions only to the extent that the motivation both for rich jurisdictions (losing income through equalization) and poor jurisdictions (gaining income through equalization) is maintained to continuously look after their individual revenue sources. In another perspective, looking beyond national boundaries, EFT can complement external resources, or – as proposed in Indonesia – serve as the mechanism for allocation of REDD+ resources, to strengthen local conservation commitments.

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6 Conclusions

By Rui Santos, Peter May, David N. Barton and Irene Ring

6.1 Contrasting high level policy guidance and POLICYMIX findings

In this section we return to the review of high level policy guidance documents and contrast them with our impressions from the comparative case study analysis.

On POLICYMIX definitions and analytical approach

"A policy mix is a combination of policy instruments which has evolved to influence the quantity and quality of biodiversity conservation and ecosystem service provision in public and private sectors".

International organizations now recommend the adoption of a "policy mix" approach. However, policy mixes cannot by our definition above be 'adopted'; they are only a 'design principle' in as much as they point out that no single instrument is a panacea. Policy mix design principles are complicated by instruments being constituted at different levels of governance (local, state, federal).

Our working definition of a 'policy mix' raises further research questions. A pragmatic working definition like this makes no normative claim. Can policy mixes by their very complexity be planned, or are they by definition an 'emergent' result of a series of ad hoc policy decisions? Can we find design principles that identify more effective, legitimate, equitable and efficient policy mixes from a conservation perspective?

In the POLICYMIX project we proposed a three-step framework for assessing and designing policy mixes for biodiversity conservation and ecosystem service management (see Table 6.1) (Schröter-Schlaack and Ring 2011: 184, Ring et al 2011). In a first step and scoping phase, policy mix analysis needs to identify challenges and context of the relevant problem. The second step on identifying gaps and choosing instruments for analysis has a focus on evaluating the functional role of instruments in the policy mix. With these two steps, we already provided a number of issues to be considered in making a policy mix more coherent and suitable to achieve a conservation goal. Finally, actual policy evaluation and design in the third step aims at impact evaluation for existing instruments and scenario analysis for new instruments thus far missing in the policy mix. This report had a specific focus on steps 2 and 3, looking at functional roles, impact evaluation and scenario analysis across Latin American and European case studies.

Table 6.1. A three-step framework for assessing and designing policy mixes for biodiversity conservation and ecosystem service management (Schröter-Schlaack and Ring 2011: 184)

First Step	Assessment category	Issues to consider
Identifying challenges and context Scoping phase	Characteristics of biodiversity and ecosystem services	Potential trade-offs between biodiversity and ecosystem services
		Irreversibility of biodiversity loss
		Tipping points and threshold effects
		Lacking property rights for biodiversity and many ecosystem services
		Defining ecosystem service in question
	Objectives regarding biodiversity conservation and ecosystem service management	Range of ecosystem services utilisation
		Trade offs between different ecosystem services
	Drivers of biodiversity loss and ecosystem degradation	Direct and indirect drivers from various sources / better "sectors" than sources?
		Negative impact of drivers amplified by sectoral policies
	Actors and governance levels	Public and private actors
		Local to global level actors
		Alteration of decision-making processes and inputs across scales – and thus necessary policies
	Cultural and constitutional settings	Local knowledge and traditional practices
		Relative appropriateness of monetary valuation and market-based conservation in cultural context
		Constitutional options and constraints
Second Step	**Assessment category**	**Issues to consider**
Identifying gaps and choosing instruments for analysis Evaluating the functional role of instruments in the policy mix	Policies in place versus new instruments under consideration	Policy mix across sectors and governmental levels (national/federal versus regional/local)
		Experience with policy instruments
		Persistence of existing instruments
	Context-specific strengths and weaknesses of instruments	Dealing with uncertainty and ignorance
		Lacking property rights
		Spatial targeting of instrument
		Additionality
		Type of ecosystem service
	Instrument interactions	Inherently complementary interaction
		Inherently negative interaction
		Sequencing/path-dependency
		Context-dependent interaction
Third Step	**Assessment category**	**Assessment criteria**
Policy evaluation and design Impact evaluation for existing (ex post) and scenario analysis for new instruments (ex ante)	Conservation effectiveness	See WP3 guidelines
	Cost-effectiveness and benefits	See WP4 guidelines
	Distributive impacts and legitimacy	See WP5 guidelines
	Institutional options and constraints	See WP6 guidelines

In the POLICYMIX project we define 'economic instruments' wider than market-based instruments, in the sense that they do not necessarily work through establishing conditions for trade and market prices, but more generally affect, through changes in prices or financial transfers, the costs and benefits facing private and public agents' conservation decisions. Pannell's (2008) public private benefits framework distinguishes instruments only by the extent to which they change the positive or negative net benefits of land use change decisions, analysing 'economic instruments' in the same framework as regulation and informational instruments. This framing of the problem opens up the possibility for much more overlap, complementarity and redundancy of policy instruments than the 'market-based' versus command and control dichotomy. Notably, Pannell's public private benefits framework does not address common property resource management institutions, indicating an avenue for further development of analytical frameworks.

'Pricing' is used rather widely in high level policy documents to mean making costs and benefits of decisions clear to agents, rather than a narrower definition of prices established through voluntary exchanges of rights. We find many situations where economic instruments have established costs and benefits of land use change decisions, without valuation or voluntary exchange establishing prices.

In POLICYMIX we have concluded that "there are three main determinants that influence the composition of the mix and that define the role of different instruments within the policy mix, namely the performance (and composition) of the existing policy (mix), the context-specific strengths and weaknesses of the individual approaches and lastly the interaction of the instruments within the policy mix" (Ring et al 2011: 10).

We recognise that further work could be done to distinguish the descriptive (positive) and theoretical (normative) aspects of policy mix analysis. Because policy mixes have evolved, the composition of instruments is both the result of a successful mix (successful instruments 'survive' and evolve) and a cause of policy mix performance. Furthermore, the concepts of 'role' and 'interaction' are sometimes blurred. An instrument's role can be defined independently (targeting a complementary part of the landuse mosaic), or in terms of interactions with other instruments (reducing costs of another instrument through cross-compliance). Instrument 'role' is possibly more normative in that it should be defined in relation to policy objectives (whereas 'interaction' may be defined as present or absent without defining policy objectives).

We feel that much remains to be done in exploring the extent to which normative policy mix 'design principles' can be defined. The definition of instrument functional role is multi-dimensional because it may vary in relation to different measures of policy outcome and process efficiency.

However, we feel we have made substantial progress in how to characterize policy mixes (not implying causality) in terms of Figure 6.1:

- Dimensions of instrument interaction
- Geometries of instrument interaction
- Functional roles of instruments

- Stage in the policy cycle (in which functional roles of instruments are evaluated)

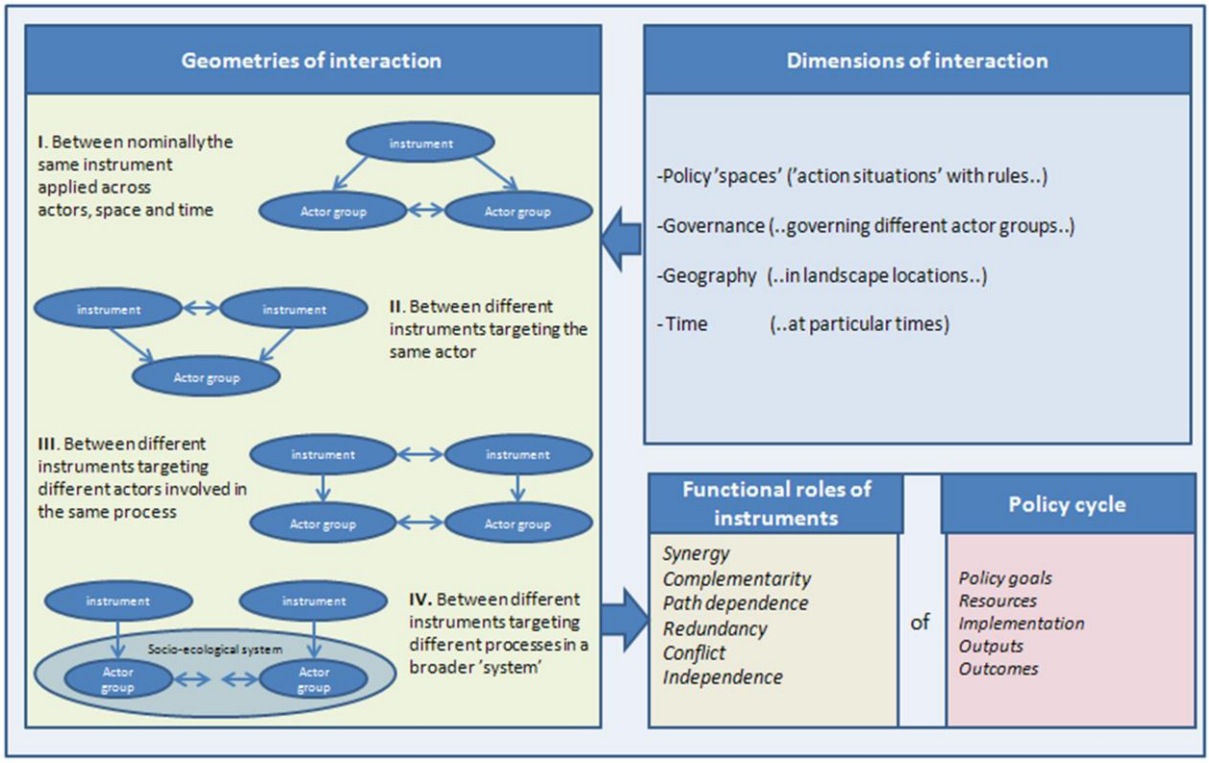

Figure 6.1 - Characteristics of instrument interaction and functional roles

Source: Barton et al (2014) based on Flanagan et al (2010) and Gunningham and Sinclair (1999), Ring and Schröter Schlaack. (2011b).

On functional roles and rules-in-use

The high level policy documents review concluded that, "no single policy approach or instrument will be sufficient to meet the complex objectives of biodiversity conservation". The existence of long-standing PES schemes that address multiple policy objectives, contradicts the optimisation literature, which states that there should be only one policy instrument per (independent) policy objective in order to achieve optimal policy design. While this may be correct for optimisation, evidence from policies in practice – such as long standing PES schemes – indicates that multiple policy objectives are needed for an instrument to achieve the legitimacy that will allow for its initial introduction and then sustained use. Likewise, effectiveness may require that more than one policy instrument be in place to achieve a given objective.

A single instrument is in fact a collection of rules-in-use, and it may still be possible to argue that each policy objective requires at least one rule, although in practice rules are mutually dependent and reinforcing in long-standing policy instruments. A further research question for developing the IAD framework and "rules-in-use" is then, 'which rules determine legitimacy preconditions for an instrument? Which rules require other rules to be functional?' If these questions can be answered then design principles may be generated for economic instruments 'as policy mixes in their own right', akin to the way Ostrom (1990) has found in the design of CPRM institutions.

The high-level policy review concludes, "a balanced combination of positive incentives to enhance biodiversity conservation and disincentives to discourage biodiversity damaging behaviours is required". Pannell's (2008) public-private benefit framework suggests that 'balance' is achieved through spatial targeting of positive and negative incentives according to public-private net benefit ratios. In this interpretation, having 'balanced' policy mixes is quite different from the aim of optimal or efficient policy.

On policy design and evaluation challenges

High-level policy documents acknowledge the need to make policies adaptive because of the complexity and dynamic nature of conservation. Acknowledgement of adaptive policy design as a principle, is also an admission that policy optimisation for efficiency is a lost cause from the outset. This recognition should help to avoid unrealistic expectations of formal methods for ex post impact evaluation on any single policy effectiveness indicator.

Adaptiveness, allowing the progressive integration of new sources of knowledge and results from monitoring data, is a desirable property of AEM schemes, in particular considering the complex functioning of ecological systems and the evolution in conservation priorities. However, we found it is also important to guarantee some form of policy stability and ensure predictability in the conduction of biodiversity conservation policies to targeted stakeholders, for example in the definition of programmes that imply the commitment of farmers and forest managers to prescribed practices and actions with a lifetime of several years. Lacking additionality of PES is a well-known 'risk' defined as PES implemented on land that would comply with conservation regulation anyway. One problem is that what might be lacking additionality at micro property level, may prove to be additional at the political economy and macro policy level. For example, PES may be necessary to give a regulation enough political legitimacy for its introduction. PES has financial additionality at a macro level (is cost-saving for a given level of overall programme effectiveness), if the regulation would not have been passed without PES, and if at aggregate level PES does not fully compensate for opportunity costs. Regulation also lowers perceived opportunity cost, making it possible to reduce incentive payments and extend the programme to more participants.

High-level policy documents also acknowledge that incentive measures are more likely to be sustainable if presenting low transaction, enforcement and participation costs. We found that increased targeting and the adoption of 'deep and narrow' instruments (e.g. AEM) to attain cost-effective conservation will mean higher Monitoring, Reporting and Verification (MRV) costs.

Our review of high level policy documents reveals a considerable level of ambiguity regarding instrument design and in particular the role of securing tenure rights for the functioning of economic instruments. The high-level policy review concludes, “before designing the instrument all involved actors must have their rights and responsibilities clearly agreed, and the rules need to be well defined from the beginning”. A Coasean view is that voluntary exchange and market prices cannot be determined without clear definition of rights. A strict legal definition of ‘clear rights’ may miss conservation opportunities. As Costa Rica has shown, if PES can be awarded based on simple documentation of ‘possession rights’ by squatters, payments may be used to finance obtaining legal property titles.

The high level policy review also concludes that “the instrument should also be designed to exclusively address the environmental problem to be solved, avoiding overly complex measures”. PES eligibility criteria are often used to target specific groups for equity reasons. Such rules may be needed to ensure the legitimacy of the instrument, and its wider societal acceptance, before focusing on cost-effectiveness aspects of design. While this is not as cost-effective on paper as unconstrained targeting, the real policy alternative may be that no instrument is adopted at all.

Despite high level guidance recommending policy mixes for biodiversity conservation, it is our impression that much of the academic literature on evaluating economic instruments in biodiversity conservation – particularly PES – has been dominated by ‘single instrument’ analyses (e.g. Wunder et al 2008, Pattanayak et al 2010, Muradian et al 2010). This focus is understandable, as cross-case comparisons across many interacting dimensions most often cannot be supported by data from each site. However, this has also led to a relative gap in development of methodologies to analyse and compare policy mixes. The high level policy review goes on to conclude that, “all relevant stakeholders should be effectively involved in the policy instrument design process, in order to build political support, institutional capacity and social legitimacy”. This statement is at odds with another statement from the same review, i.e., stakeholder involvement may be perceived as merely costly and time consuming if the transaction costs of the alternative are not properly placed on the table as well. Stakeholder involvement and agreement on ‘rules-in-use’ aims at achieving significant social control and self-enforcement.

6.2 Payments for Ecosystem Services

Despite large differences all countries started their conservation policy mix with large public protected areas in remote areas, followed by public reserves targeting more specific types of habitats. Public protected areas on productive private lands have always created conflict, but these conflicts gave way to voluntary conservation on private lands with economic compensation in the late 90’s early 2000’s in all three countries. In all three countries forest conservation on previously unprotected lands is currently based almost entirely on voluntary participation.

Despite broadly similar development in the focus of forest conservation measures, and voluntary forest conservation broadly working with the same type of institutional structures (described by position rules) and broadly similar requirements for disclosure (information rules), we found a large number of differences in rules-in-use defining for example who could participate (boundary rules), targeting of PES (scope rules), land use rights and responsibilities of the owner (choice rules), and in the economic incentives themselves (payoff rules).

Implementation of PES. Our analysis of differences advises against copying PES contract design wholesale between countries. There are a number of institutional design differences that have developed over time, and condition implementation, although they are not necessarily reflected in the contract terms between the landowner and the 'buyer'. A study of rules-in-use and the IAD framework for a wider institutional characterization of PES and relationships to other instruments.

Functional roles of PES. PES as incentives for land use change cause a redistribution of costs and benefits among stakeholders. A complication of functional role analysis of instruments is that the potential multi-way interactions of PES with other instruments are themselves subject to multiple stakeholder interpretations. Still, a few general observations across case studies can be made.

In all three countries the targeting of similar habitats with different instruments seems to take place. Whether this is interpreted as conflicting, redundant or complementary depends on the context. Limited budgets allocations for any particular instrument may mean that multiple instruments are required to cover more of the same priority habitats. In this sense PES may complement public protected areas across the landscape. This was observed in Finland and Norway. In some cases, regulation is not sufficient to achieve a desired level of protection, and PES is added as an additional incentive, such as in Costa Rica. This is interpreted by different sides of the debate as either redundant (non-additional) or complementary. To the extent that multiple instruments are required for protection on the same land, they may lose legitimacy, lead to administrative burdens for landowners and be considered conflictive. We did not find that the latter was a general issue in any of the three case studies.

In all three countries regulatory conservation using protected areas preceded voluntary conservation and PES. In each of the case study countries, the role of regulation vis-à-vis PES was perceived as slightly different. In Norway, voluntary forest conservation is discussed as the only viable forest conservation instrument at present; but in fact once the contract terms have been agreed to by the forest owner, the process follows the established administrative procedure of creating public Nature Reserves. In Finland, the threat of regulatory protection on priority habitats makes voluntary fixed term contracts more attractive; fixed-term contracts have worked as a gateway for later considering permanent conservation contracts. In Costa Rica, only fixed term contracts are offered, but a general regulatory ban on forest conversion lowers opportunity costs of conservation, making PES a more attractive proposition. In all three countries, the existence of a regulatory instrument is crucial – but in different ways - for the success of the voluntary instrument.

Impact evaluation of PES. A general problem has been to find programs with a large enough group of participants (national schemes) with periods of implementation when programme characteristics have remained relatively unchanged. A further challenge has been obtaining data on forest quality – rather than just forest cover - for non-participant control group sites.

In Costa Rica researchers have conducted formal before-after-control-impact evaluations of the PES programme. Studies have been limited to a period of relative stability in eligibility and targeting criteria, and focused on forest cover as a measure of impact. In Finland, competitive PES has been discontinued. In Norway, the voluntary forest conservation now has a good 10 years of experience and has been subject to evaluation. However, BACI techniques have been difficult to apply because conservation effectiveness must be measured in terms of key woodland habitats and species which can only be surveyed on the ground. Such on-site surveys are only carried out in connection with forest management or conservation plans, meaning that there is no systematic collection for unmanaged sites from which to draw a control group.

6.3 Agro-environmental measures

AEM instruments were compared among three case study countries, in particular AEM payments integrated into the EU Common Agricultural Policy (CAP) framework, analysed in the case of Portugal and Germany, and the adoption of integrated conservation and development projects in agrarian reform settlements in Brazil. The studied AEM schemes were created in different contexts and with specific environmental objectives, originating instruments with different characteristics, role and impact. However, a common rationale of AEM in the three case studies is to compensate farmers/landowners for additional costs and foregone income resulting from applying specific environmentally friendly farming practices.

Implementation of AEM. AEM are compulsory for EU member states, though optional for farmers, while in Brazil the framework for AEM emerged from credit, technical assistance and licencing instruments complementary to the compulsory private land use restrictions present in the national forest code. In EU, AEM have been applied on top of existing regulations for nature conservation and try to influence established farming and land use management practices. The baseline regulations contribute to guarantee AEM legitimacy while transferring public funds to private actors, since farmers/landowners are providing benefits beyond the required obligations.

The sequencing of the different policy instruments can explain some of the observed results. For example, the perceived lack of fairness and poor participation of local actors in the design and implementation process of Natura 2000 sites in Portugal contributed to reduce landowners' inherent bond to biodiversity and affected their commitment with conservation efforts. This has reduced their willingness to adhere to the ITI measures.

The obtained results advises against copying AEM contract design wholesale between countries or even between measures with different objectives. Although some common lessons can be identified, the specific ecological conditions and objectives (e.g. maintenance of a landscape mosaic like montado or increase afforestation) and socio-economic contexts (e.g. tenure, properties dimension, opportunity costs, policy predictablity) require that tailored contracts are designed for each case.

Functional roles of AEM. The analysis of the functional role of AEM is complex, like in PES, due to its potential interactions with several other instruments. Whether AEM are interpreted as conflicting, redundant or complementary to other instruments depends on the context, specific sequencing and characteristics of the policy mix where they are integrated. Since AEM combine different incentives/measures with diverse goals, acting as a policy mix, there is also a risk that they include within themselves potential conflicting objectives and cross incentives that reduce their overall effectiveness for biodiversity conservation, as it was observed in the Portuguese case.

The aim of the ITI that was studied in Portugal was to provide additional incentives to biodiversity friendly farming and forestry practices (beyond legal compliance) specifically targeted to farmers and landowners located in Natura 2000 sites, thus having a complementary role, and hopefully a synergistic effect, with the existing nature conservation regulatory framework. However, other economic incentives in place may have a conflicting role with AEM and biodiversity conservation objectives in general. For instance, adhesion to this ITI measure implies the loss of another existing broad based agricultural incentive – the AEM Single Payment Regime – that is much less demanding in terms of allowed practices and commitments than the ITI and provides, at least to some landowners, higher revenues per hectare, thus reducing AEM effectiveness.

The case study in Saxony revealed a clash between forest law that prohibits deforestation and farmers' reluctance to enroll in irreversible afforestation projects that do not allow them to return to other land-uses in the future. This conflict between these two policy instruments could only be solved by relaxing the forest law's prohibition, i.e. allowing young forests to be cut. Since the required long-term commitment is one of the main factors demotivating participation it would be worthwhile to investigate the transaction costs of changing policy law, so that this barrier to enrolling in the AEM can be removed. However, from the perspective of forest policies and laws, the protection and permanence of forests is so deeply rooted as a principle that such an endeavour will most probably not be successful, even though desirable from a farmers' perspective.

In Brazil, AEM schemes applied as components of pilot integrated conservation and development projects showed the need for a consistent framework of support to smallholder farming systems to reduce deforestation pressures associated with agrarian reform. However, such commitment was rarely attainable, given the strength of contradictory policy instruments promoting cattle ranching. In such a context, AEM measures applied at a landscape (settlement) level, rather than on individual farmers' lots, could be more effective to promote differential rates of land use change. Continuous technical assistance, material support (e.g., seedlings for agroforestry systems), product certification and marketing channels were combined with the structures of the national Forest Code at

settlement scale to assure permanent forest conservation and enhance settlers' incomes while retaining intact forests. Two important policy instruments in use in the Brazilian Amazon should be better coordinated with ICDPs to ensure their joint effectiveness in biodiversity conservation and income enhancement. These include credit provided to land reform beneficiaries and family farmers to foment agricultural and livestock production under the PRONAF rubric, and rural environmental licensing as required by the Forest Code.

A common finding in the Portuguese and Brazilian case studies is the conflict at different levels of governance due to poor communication and interaction, but also due to an overlap of managing institutions. In all cases, the factors that appear most important to successful implementation of AEM include participatory design and continuous technical support to disentangle the complexity of multiple land use incentives and practices. This is particularly true in a policy environment in which changes are introduced erratically over time, and discontinuities in funding prevail, provoking uncertainty and unwillingness to adopt permanent measures.

Impact evaluation of AEM. The undertaken ex-post analysis showed evidence in all the three case studies of poor implementation and uptake of the studied AEM leading to an overall low effectiveness. This can be due to several different factors, such as, the rather complex eligibility requirements and application procedures established, the insufficient subsidy payments, the lack of technical support, administrative barriers and unfavourable economic conditions, or reluctance to get involved in something completely new.

With regard to agro-environmental measures adopted in ICDPs assessed in Northwest Mato Grosso, it is clear that no one instrument adopted can be effective in defeating the contradictory incentives to deforestation without a juxtaposition with other instruments. In the Brazilian case, the "stick" of command and control measures to punish deforestation has so far been more effective at a regional level than the "carrot" of AEM. A policy mix that permits flexibility within land use constraints established by the new Brazilian Forest Code coupled with institutional arrangements to support alternative land uses would be a powerful combination for avoiding further deforestation.

In Portugal, farmers tend to prefer single AEM payment schemes over the more inflexible specific and narrow AEM measures targeted for conservation areas (ITI), adopted to complement the designation of conservation areas; in Germany they are reticent to afforest areas they cannot later use for other purposes due to permanence rules.

Ex ante simulations and choice experiments with beneficiaries in both Portugal and Germany found that introduction of instrument modifications (e.g., contract options, spatial targeting) have the potential to make AEM both more cost effective and attractive to farmers.

6.4 Ecological Fiscal Transfers

EFT may constitute a more readily transferred instrument than others in the conservation instrument toolbox reviewed in these studies. The fact that it is destined toward public governmental units as a compensatory transfer, rather than seeking to redirect incentives toward private land users, assists in this role. Public finance already makes use of fiscal transfers for other purposes; therefore the aggregation of another purpose for such transfers does not detract from its delivery nearly free of transactions costs once a formula for local allocation is defined by law. Nevertheless, to date EFT schemes are very rarely implemented and often represent a gap in the policy mix. Most existing economic instruments clearly address private actors, businesses and land users, rather than public actors such as local and state governments in their role for providing public goods and services.

Because the structure of EFT implementation has been principally top-down, although legitimized politically at the state or federal level, it is perceived by local government beneficiaries mostly as a "black box" demanding little local involvement, although this varies, with German municipalities pronouncing themselves quite aware of the sources of their revenues. On the other hand, the fact that revenues obtained in this way may not be earmarked masks opportunities for considerable flexibility. Besides spending on matters of general local or regional socio-economic concern, there abound a number of possible uses of the additional resources so obtained by beneficiary governments that could serve purposes complementary to biodiversity conservation and sustainable use. These include their allocation to support efforts to improve private land management, e.g., leveraging actions in buffer zones of protected areas, private land use licensing consistent with conservation objectives, project assistance to indigenous peoples, etc. Further research regarding means to institutionalize options for better use of EFT should be promoted.

In addition, the role of EFT in the state and local policy mix as a means to stimulate additional biodiversity protection remains an incognito. Since each state or nation has its own allocation formula and inclusion of different conservation types, it is difficult to identify the marginal conservation-related impacts of shares of ecological fiscal transfers in comparison with total transfers or revenues from all sources. Here there is certainly scope for further analyses that trace the relationships between instruments in a policy mix in association with EFT that may leverage further conservation effort.

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Appendix: Case study summaries

Norway (PES)

BY HENRIK LINDHJEM AND DAVID N. BARTON

CONTEXT

Forests cover around 40% of the Norwegian land area of which only around 10% are owned by the state or municipalities. The rest is owned privately or by local common property institutions. Currently 2.7% of productive forests are protected, while a much cited biological evaluation recommended 4.6% as a minimum to achieve biodiversity/landscape protection goals. 10% has recently been proposed as a goal for 2020 by conservation NGOs. Norway has signed up to the Convention of Biological Diversity, and struggles (like other countries) to reach the so-called Aichi biodiversity targets by 2020 under the Convention. These include conservation targets of 17 percent for terrestrial land (Target 11) and halve or bring close to zero the rate of loss of natural habitats, including forests (Target 5). The biodiversity conservation targets are mostly set at the national level in Norway. To speed up progress, much more effort will have to go into involving and motivating non-industrial private forest (NIPF) owners in conservation. The main challenge in Norway is thus to create incentives for private forest owners to take biodiversity and ecosystem services into account, beyond what they would otherwise do, in their forestry and other land-use activities.

CASE STUDY LOCATION AND CONSERVATION CHARACTERISTICS

The main study area of the Norwegian fine grain case study is in the South- Central part of Norway (see map).

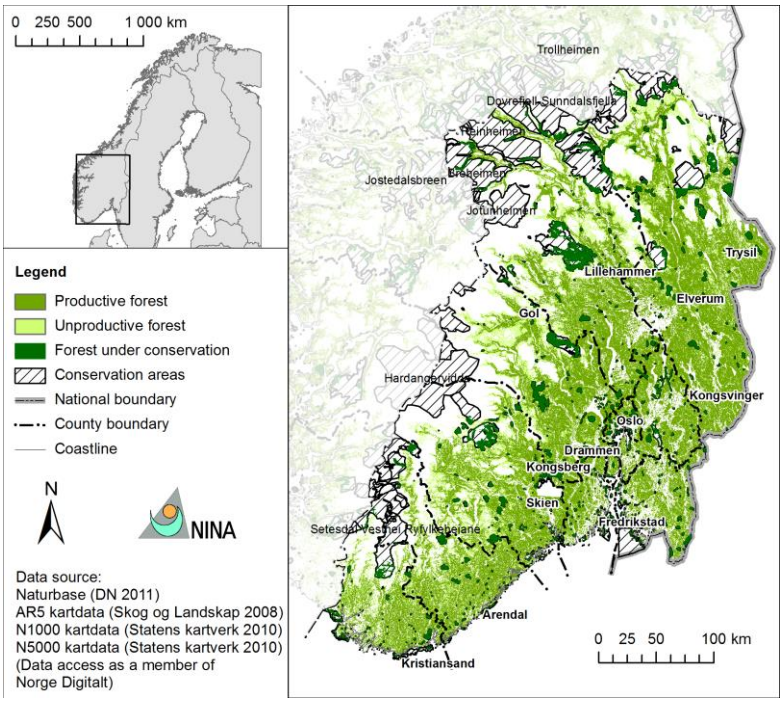

Figure A.1: Study area, forest cover and protected area network in South- Central Norway. Note: "Conservation areas" are the total areas, while "forest under conservation" is the part that is forest

Studies of local impacts of public nature reserves and voluntary forest conservation were conducted around the Trillemarka Nature Reserve in the County of Buskerud.

Reserve site selection modelling using ecosystem service maps in Marxan with Zones software is ungoing.

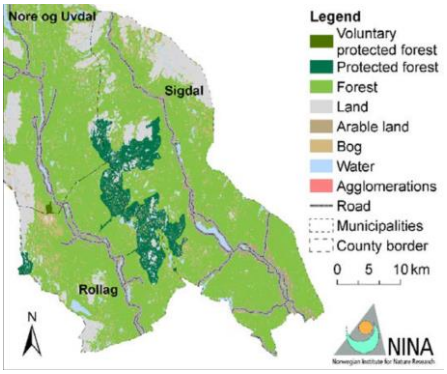

Figure A.2 – Trillemarka Nature Reserve in Buskerud County

Economic instruments assessed in the case study area

In June 2009, Norway established a Nature Diversity Act, which includes all previous laws related to land use and biodiversity in one act. This act is the most important legal framework for all future regulatory and economic instruments. The dominating instrument of forest conservation is the voluntary conservation approach proposed in 2000. Forest owners report to areas available for protection, which are then negotiated with the state (or county). Forest owners are compensated for loss of timber values. There are currently few, if any, "pure" economic instruments in use in forestry conservation in Norway. Compensation (at the county level) can be obtained for setting aside areas of 'Complementary Hotspot Inventory' ("MiS" in Norwegian). Forest owners with biodiversity hotspots covering at least 1% of the productive forest area in their property can receive compensation. In addition, grant schemes are proposed under the act outside protected areas to stimulate the conservation of what the act terms "priority species" and sustainable use of "selected habitat types". This is not compensation, but "positive incentives" that are meant to stimulate landowners, rights holders, organizations and municipalities to take care of these species and habitat types. The funds pay for active operational management or other measures that will help to maintain or restore the ecology of the area. A large part of forests that are actively managed are under certification (under the European Program for the Endorsement of Forest Certification Schemes). Certification is primarily a market-driven process, though government has to some extent been involved in setting the criteria. Finally, there are broader economic instruments, such as subsidies for forestry activities that may run counter to conservation objectives.

The voluntary conservation approach in Norway has been successful in terms of increasing legitimacy and the participation of private land owners. Currently, there is a lack of government funds to pay all the forest owners interested in participating. The Ministry of Environment halted further applications for voluntary conservation in 2013 and has proposed a budget freeze for 2014 for voluntary conservation. Forest owner association claims that an additional 150 million NOK would be needed to address the backlog of applications from forest owners interested in voluntary conservation. The effectiveness of the scheme in targeting high biodiversity areas has been called into question [1]. In this light, there may be a role for more "traditional" regulatory instruments to ensure conservation outcomes.

Currently, biodiversity offsetting is practiced implicitly as part of forest certification, whereby important woodland habitats (IWH) found on highly productive forest land may be dropped in favour of compensating set-asides of IWH in economically marginal forest within the same property. The norm is that landowners should not be required to set aside more than a total of 1% of productive forest. Further research on this implicit set-aside/off-setting practice, compared to a formalised biodiversity offsetting scheme that took advantage of biodiversity and opportunity cost differentials across forest owners could be explored further with the NFI data already available (provided IWH data can be supplemented to this).

Norway also has a unique instrument among the case studies in its Forest Fund, which taxes timber sales, the proceeds of which are kept in escrow for the specific forest owner to invest in replanting, infrastructure and forest inventorying.

The new Nature Diversity Act provides the general framework for economic instruments affecting biodiversity and forests for the near to medium term. Other economic instruments may be conceivable for the longer term. There is no allowance under the act for general compensation – fiscal ecological transfers (EFT) – to municipalities affected by protected areas. However, there is interest in exploring an EFT-type instrument that makes part of the current government transfers to municipalities depend on their contribution to a positive performance for the recently constructed Norwegian Nature Index. For the longer term, three types of instruments may be most relevant for increased biodiversity conservation: (1) continued use and development of the *voluntary conservation* approach (backbone of current conservation policy); (2) *habitat banking* and *biodiversity offsets*; and (3) *subsidy reform* (related to support schemes that run counter to conservation objectives).

CONFLICTS

Based on a forest economic model Barton et al (2013) find that 75% of national park' forest area is not profitable in their first harvest (short term). Large shares of nature reserves (40%) and protected landscape areas (52%) forest are also not profitable for forestry. In the short term these instruments would appear to be redundant in the economic sense. However, assuming a 100 year analysis horizon and allowing for improved stocking decreases the unprofitable forest areas substantially in all protected area categories.

Some forest have multiple environmental constraints outside protected areas, such as protected mountain forest of which 75% lies within wilderness areas. Subsidies for forest roads have a potentially conflicting role with the conservation of these forests.

Wilderness areas are by definition more than 5 km from roads, so 75% of wilderness areas are not profitable for forestry in the short term, while that drops to 18% on the long term analysis. Forestry is not banned in areas designated wilderness, but permission for building forest roads is supposed to be practiced restrictively by County government. In practice, subsidies for forest road construction and management in steep terrain have been approved without proper evaluation in a majority of cases as reviewed by NGOs. Barton et al.'s analysis did not account for the effect of forest road subsidies which would make less than 18% of wilderness areas economically inaccessible.

Furthermore, the Office of General Auditor has pointed out that the Ministry of Agriculture is not fulfilling the forest sectoral aims of increasing production. In light of this general observation and the fact that forest road subsidies have not to date undergone systematic evaluation, the overlapping designations of mountain and wilderness forests can be expected to be mutually reinforcing conservation instruments vis a vis forestry expansion.

Table A.3. Evaluation of potential functional roles of conservation instruments - overlap (%) between different environmental constraints and "zero areas".

Environmental constraints (EC)	Percentage of total productive forest	No EC overlap	Environmental concerns (EC) in forestry (percentage overlap)									"Zero areas" in forestry (percentage overlap with environmental constraints)			Timber volume excluded by EC *
			National Park	Nature Reserve	Protected Landscape Area	Key Habitats (MiS)	Buffer zone	Wilder-ness areas	Mountain forest	Outdoor recreat. area	Swamp forest	Net present value<0	Net return <0	Net return <50	
National Park	0.70 %	8 %		0 %	0 %	0 %	11 %	66 %	68 %	0 %	8 %	11 %	62 %	76 %	100 %
Nature Reserve	1.90 %	53 %	0 %		0 %	1 %	8 %	10 %	30 %	5 %	2 %	10 %	30 %	40 %	100 %
Protected Landscape Area	1.40 %	20 %	0 %	0 %		1 %	11 %	24 %	68 %	3 %	2 %	9 %	45 %	62 %	85 %
Key Habitats (MiS)	1.30 %	72 %	0 %	1 %	1 %		2 %	4 %	19 %	3 %	4 %	4 %	15 %	25 %	83 %
Buffer zone	7.00 %	68 %	1 %	2 %	2 %	0 %		4 %	21 %	1 %	7 %	3 %	17 %	25 %	75 %
Wilderness areas	3.10 %	23 %	16 %	6 %	11 %	1 %	10 %		64 %	0 %	1 %	18 %	62 %	75 %	100%**
Mountain forest	17.10 %	72 %	3 %	3 %	5 %	1 %	8 %	11 %		0 %	2 %	11 %	40 %	53 %	30 %
Outdoor recreation area	1.70 %	85 %	0 %	5 %	3 %	2 %	3 %	0 %	1 %		2 %	0 %	3 %	4 %	30 %
Swamp forest	3.10 %	72 %	2 %	1 %	1 %	1 %	16 %	1 %	9 %	1 %		1 %	10 %	15 %	30 %

Source: Barton et al. 2013b

OBJECTIVES AND MAIN RESEARCH QUESTIONS OF THE CASE STUDY

1) Prioritization of new conservation areas

- Assess the impacts of forestry instruments (especially support for forest road building, harvesting in steep terrain, and VCA) with specific emphasis on areas that are not generally profitable for forestry activities ("zero areas").
- Assess the effects on biodiversity from further conservation in "zero areas" compared to other, underrepresented areas and the opportunity costs of forestry under different conservation scenarios.
- Assess the sensitivity of the conclusions by assessing the value of carbon sequestration and other ecosystem services (where data is available).

2) Forest owners' and public preferences for voluntary forest conservation

Ex post assessment:

- What are the experiences ("impacts") with voluntary forest conservation (VFC) in Norway? Main hurdles, challenges and opportunities?
- How do the actual compensations paid under the VFC compare with the government lead compensations?
- How do actual participation rates among forest owners compare with stated compensation rates?

- How can the VFC program be improved? Alone or in combination with other instruments? Are auctions an option?

Ex ante assessment:

- What would motivate forest owner participation and how can more cost-effective targeting of areas be achieved?
- What would be the forest owners' stated levels of compensations, would they be willing to forego timber revenue for protection and how does the compensation depend on observable characteristics of forest owners and their forests?
- What are people's preferences and willingness to pay for forest conservation – is more necessarily better?
- Comparing costs and benefits, what is the "optimal level" of voluntary forest conservation, in terms of percentage protected?
- What are people's and forest owners' preferences regarding alternative instruments?

3) **Legitimacy and social impacts of instruments**

- What is the variation and are there patterns in the ways that the planned protected area was narrated during the conflict?
- Is there a change in the local production of narratives that indicates a changing "sense of justice" and legitimacy of the conservation?

METHODOLOGICAL APPROACHES

1) Prioritization of new conservation areas

GIS overlay analysis of protected areas, forestry environmental regulations and potential forestry productivity
Three-way spatial correlation analysis of protected areas, forestry site index and biodiversity index
Opportunity cost of forest conservation mapping
Marxan with Zones, reserve site selection software
Benefit-cost analysis of protected areas

2) Forest owners' and public preferences for voluntary forest conservation

Contingent valuation survey
Interviews

3) Legitimacy and social impacts of instruments

Interviews. Transect interviews.

METHODOLOGICAL CHALLENGES

A large methodological challenge has been to choose or develop analytical frameworks that would be non-trivial for analysis of conservation policy interactions on the ground. Defining the spatial jurisdiction of an instrument is relatively simple, and paves the way for spatial overlay analysis and the formulation of hypotheses regarding which instruments may interact with one another. Direct interactions through conflicting or synergistic conservation objectives is also relatively simple to identify. However, indirect interactions may occur through the socio-ecological system – multiple rules may act together to change the motivational structure of landusers – one instrument may condition the response to another. Demarcating the institutional 'boundaries' of an instrument – defining an instrument – has been less straightforward than expected. When instruments are broken down into their component 'rules-in-use' it becomes evident how 'market-based' instruments in fact are built on a number rules shared in common with regulatory and informational instrument - economic incentives are in fact 'regulation-based'. Finding which rules determine interaction between instruments could be a poor framing of the policy mix analysis problem. Policy mix analysis may also be framed as an analysis of whether existing or proposed economic incentives are well-anchored in the other instruments in place (to use a Lego analogy, whether the instrument lego brick is connected at multiple places or not to the underlying institutional structure.

The principal data challenge has been obtaining spatially representative indicators of biodiversity that can be used in evaluating the relative effectiveness of different forest conservation instruments. Spatial coordinates of biodiversity data from the national forest inventory is kept confidential by the institution responsible for data collection, greatly complicating integration with other spatial datasets.

The national conservation target of attaining 4,6% forest conservation has not been distributed to county level by conservation authorities. The difficulty in defining politically agreed upon forest conservation targets at regional or local level, has required the use sensitivity analysis of conservation objectives in reserve site selection modelling.

TRANSFERABILITY AND COMPARABILITY OF CASE STUDY RESULTS AND METHODS

Effectiveness of instrument mixes on outcome variables

Barton et al (2013) used the Norwegian Nature Index for forests and the site productivity index to evaluate the cost- effectiveness of different protected area designations in Norway. They find that relatively high nature index, high opportunity cost sites are less well represented in voluntary nature reserves. This is a surprising finding as nature reserves are supposed to be identified by public authorities as area with high conservation value. The weakness of the Nature Index as an indicator of biodiversity conservation value has to be considered, for example the fact that NI has a municipal level resolution. Further development in the study by validate this finding.

In addition, the county of Sør-Trøndelag, to the north of the main fine grain study area, was analysed in an associated paper (Bunikyte 2013). The usually large national parks are considerably less important for protection of forest habitats in Sør-Trøndelag than can be expected based on the total size of the area protected. Even though nature reserves embrace much of the habitat diversity, other common protection forms (e.g. landscape protected areas and national parks) tend to be complementary in terms of the kind of forest habitats protected, primarily high altitude deciduous forest.

Conflicts and synergies between economic instruments

Voluntary nature reserves become a part of the public nature reserve system in Norway. A GIS analysis of spatial overlap of nature reserves with other conservation instruments was carried out (Table A.3). It showed that nature reserves are found to overlap in 30% of nature reserve area is within mountain forests which are also have environmental constraints. 10% of nature reserves are within wilderness areas which are likewise protected from infrastructure development such as forest roads (but not from forestry per se). Private voluntary forest conservation in these areas would be expected to be less effective than on previously unprotected land. 40% of nature reserves are created in areas which are not commonly considered economical for forestry (net return<50 NOK/m^3). In theory these reserves provide no additional impact at current timber prices and forestry costs.

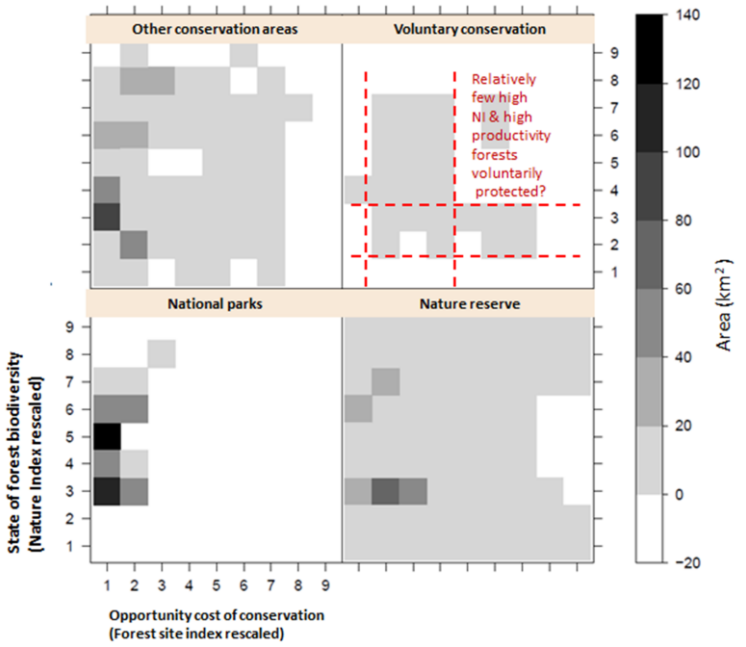

Figure A.4 Spatial distribution and complementarity of forest conservation instruments in Norway

Source: Barton et al. (2013a)

The VCA process has achieved a much lower disapproval rating (10%) among forest owners than command-based public protection (75%) (Skjeggedal et al 2010). Voluntary forest conservation is a clear example of a *'sequencing'* of instruments, with VCA now working as a substitute to earlier conflictive public conservation of forest. There is still a level of disagreement from environmental NGO's who have lost their position of early participation in identifying and selected priority areas. The extent to which there are functional interactions between VCA and other instruments is therefore a matter of forest owners or environmental NGO perspective. According to forest owner's association,

forestry certification is *synergistic and complementary* with voluntary conservation by protecting threatened habitats, until a forest owner decides to adopt VCA. Environmental NGOs argue that VCA does not target the most valuable forests first. The Ministry of the environment applies a 'policy mix' approach by arguing that both "threat" and "value" are criteria for selecting VCA locations. Forest owner associations also see *physical inaccessibility* (especially in Western Norway) as inherent protection which is complementary to forestry certification in protecting threatened habitats, in valuables areas not currently in nature reserves. Environmental NGOs are more sceptical to the role of 'zero economic areas' in forest conservation (Skjeggedal et al 2010).

Environmental authorities do not have explicit targets for the spatial distribution of VCA between Counties, targets per priority forest type, nor the proportion which should be covered by VCA (Skjeggedal et al 2010). Further detailed analysis of voluntary forest conservation in Figure A.3 shows that voluntary forest reserve conservation is found in landscapes which have higher opportunity costs than e.g. national parks. Private nature reserves have some redundancy with publicly initiated nature reserves and other conservation areas. Public nature reserves are complementary to private reserves by also covering landscapes with high opportunity costs and relatively high biodiversity index values.

Impact evaluation and valuation methodologies

The information on impact of VCA in Norway is based on Skjeggedal et al (2010). No formal before-after-control-impact (BACI) studies have been conducted of VCA in Norway. The POLICYMIX project was also unable to carry out a BACI, despite having this as one of the objectives of the case study. A number of reasons for this lack of BACI studies may be:

- Surveys of participating forest owners has been relatively frequent (2006,2009) and have led to low responses rates

- Biodiversity indicators of forest quality at forest stand level cannot be observed without field surveys.

- Lack of panel data. Surveys of forest owners with VCA, command-based public protection and forest owners, have not been carried out before and after participation.

The voluntary forest conservation process has in a few years achieved a much higher legitimacy among forest owners than the forced public conservation of the 80s and 90s. Areas offered voluntarily for conservation in the first period 2005-2009 exceeded environmental authorities target of 200 km^2 under VCA, and has exceeded available funding almost every years since VCA's inception. In terms of total area VCA has been more effective than command-based protected areas. In terms of quality of sites Skjeggedal et al (2010) argue that the VCA process has not been worse than the system of public creation of protected areas prior to VCA. In the former, a long list of nature value priorities was reduced by dropping area with the highest level of conflict. In practice, then sites were selected based on an iterated *effectiveness-cost* 'rule of thumb'. In the VCA the approach this

heuristic is reversed with low cost sites more likely to be offered voluntarily, and then authorities selecting those with highest conservation value (*cost-effectiveness*) [3].

At property level there are some qualitative indications that VCA has a greater potential for effectiveness. In VCA forest owners' proposal for what parts of the forest are to be protected is not necessarily consistent with the desire to establish connectivity with adjacent protected areas. Again, it has been pointed at as a problem with command-based protected area process. Impact analysis is complicated by '*neighbourhood sequencing effects'*, where an initial forest owner willing to enter VCA initiates – with the help of forest owner association and County authorities - additional owners to participate in the process, thereby achieving greater connectivity over time.

Environmental organisations have claimed that effectiveness of VCA is limited because only low opportunity cost (low productivity) and low biodiversity sites will be offered for conservation. Our mapping of VCA (Figure 1), shows that also high (productivity) site index locations participate in VCA. Skjeggedal et al (2010) argue that since VCA compensation is based on negotiated full compensation of foregone forestry income, opportunity costs are not necessarily a reason for low effectiveness. They argue that high forestry productivity sites also have a long logging history, reducing their biodiversity values. Figure 1 also shows that high productivity, high biodiversity sites are less frequent in VCA. This coarse level analysis provides support for the argument that there may be relatively few high biodiversity, high site index sites available for voluntary conservation outside existing protected areas[4].

Sense of justice has been suggested as another dimension of social impact analysis. Voluntary forest conservation has also had improved 'sense of justice' of forest conservation procedures, as forest owners have gained a much greater knowledge about conservation as participants in, rather than involuntary parties to, the conservation process. Conversely, environmental NGOs have a reduced 'sense of justice' due to their exclusion from the negotiation between forest owner association, County environment department and the Environment Agency.

Skjeggedal et al (2010) quote Norwegian authorities that transaction costs for VCA are around 20% of the compensation amount, down from 35% under forced public protection.

Similarities and cross-case comparison

[3] The distance to conservation targets of the two approaches is not immediately obvious and could be tested using conservation planning tools such as Marxan with Zones.

[4] Mapping of the distribution of available areas for conservation would be an important preliminary step to conservation planning scenarios using Marxan.

Further comparative study of different potential sources for forest conservation financing is of interest for further research. Norway has a unique instrument among the case studies in its Forest Fund, which taxes timber sales, the proceeds of which are kept in escrow for the specific forest owner to invest in replanting, infrastructure and forest inventorying. The extent to which such an approach could work in Latin American countries such as Costa Rica would be of interest, given the continued struggle to identify sources of funding for PES.

The historical development of voluntary forest conservation, including payments for ecosystem services, in Costa Rica, Finland and Norway shows some broadly similar patterns. Despite large differences all countries started their conservation policy mix with large public protected areas in remote areas, followed by public reserves targeting more specific types of habitats. Public protected areas on productive private lands have always created conflict, but these conflicts gave way to voluntary conservation on private lands with economic compensation in the late 90's early 2000's in all three countries. In all three countries voluntary forest conservation or PES on private lands are the only schemes currently encompassing previously (formally) unprotected areas. Forest conservation in all three countries is currently based almost entirely on voluntary participation.

While Costa Rica removed subsidies for forestry in the 1990's, it is noteworthy that in Norway that subsidies for forestry in steep terrain and for forest roads have been in place simultaneously with promotion of voluntary conservation. In that sense, the policyscape in Norway is more heterogenous than in Costa Rica in terms of simultaneous incentives for and against forest conservation. Finland falls between these two, as some of the subsidies for sustainable forestry target timber production and harvesting, and have been evaluated as harmful for biodiversity.

In Norway, the voluntary forest conservation programme is similar to parts of METSO 'administrative PES', where forest owners with of particular characteristics are invited to offer their forest as private forest reserves or for acquisition by the State. After negotiation regarding compensation forests enters into the normal procedure for public nature reserves. Norway does not have the fixed-term PES modality, which is also present in Finland and Costa Rica's PES. In Costa Rica, participation is entirely voluntary; nonetheless, a matrix of selection criteria mixing biodiversity and socio-economic criteria is defined on a yearly basis as to better target how payments are allocated.

Lessons from POLICYMIX case study countries that use some kind of payment for ecosystem service scheme (e.g. Finland, Costa Rica) may be the most relevant for comparison with the current voluntary conservation scheme in Norway. Other lessons more for potential future instruments may be drawn from using EFT (Brazil and Portugal) or using biodiversity offsetting schemes (Brazil).

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Finland (PES)

BY EEVA PRIMMER

CONTEXT

Finland is a highly forested country, with at least two thirds of the land covered with productive forests. Out of these 20 million hectares, two thirds are owned by over half a million small-scale non-industrial private forest owners. A great share of Finland's biodiversity and also endangered species dwell in these commercially managed forests that concentrate in the southern parts of the country. Only about 2% of forest land is preserved in Southern Finland but because of private ownership and a history of conservation conflicts, designating new areas for conservation is almost exclusively done through voluntary mechanisms. These payments for ecosystem services (PES) mechanisms have been developed, piloted and institutionalized during this millennium under the Southern Finland Forest Biodiversity Programme. The PES instruments include both permanent contracting and fixed-term compensations. The current policy mix is a result of institutional evolution where previously dominating regulatory instruments assigning protected areas and protecting small-sized habitats in the managed forests have been supplemented by PES that are marketed and supported by the environmental and forestry administration (Primmer et al 2013a). It appears that the economic instruments need a home of regulatory instruments and a family of information instruments.

CASE STUDY LOCATION AND CONSERVATION CHARACTERISTICS

The case study area, South-Western Finland, is densely populated and has a diverse economy for the generally very rural Finland. The area has 1 million hectares forest land, out of which private people own 80%. These 37 000 non-industrial private forest holdings are generally small in size, averaging at 21 hectares. Compared to the rest of the country, forest owners in the area have acquired ownership actively and only a third has inherited the land. Typical of southern Finland, the forests in the area are fertile, productive and intensively managed, which means that the status of biodiversity is dependent on what happens in these managed forests. The same forests are used for recreation, berry and mushroom picking and hunting.

South-western Finland has low conservation coverage, with 2.5 percent of the forest area strictly protected and 0.4 percent of private forests designated as Forest Act habitats. In addition to insufficient protected area, the conservation challenges include the quality and representativeness of the protected forest sites and the low structural and functional connectivity of the valuable forest areas. The decrease of the amount of dead wood and decrease of old forests are among the important impoverishing structural features that have a negative impact on forest biodiversity in the entire landscape, between the formally protected sites (Tikkanen et al 2009). The challenge of policies is to protect these features and improve connectivity of valuable sites with the limited conservation budget and a commitment to voluntariness.

CONFLICTS

Forest biodiversity conservation in Finland has been considered to constrain forestry and the operational freedom of forest owners (Rantala and Primmer 2003). The case study area has experienced severe conservation conflicts in the 1990s, leading to such extremes as hunger strikes by forest owners resisting new conservation programmes, and the European Union Natura 2000 in particular (Hiedanpää 2005). These conflicts have actually spurred the innovation of voluntary PES that originates in the case study area (Paloniemi and Tikka 2008).

The voluntariness of the PES as well as its joint implementation by environmental and forestry authorities during the pilot in 2002-2007, and continued collaboration between the authorities have been the success factors of the PES. The underlying ideas of managed forests serving for timber production and conservation taking place through developing a network of protected sites continue to dominate as cultural-cognitive institutions and maintain a conflict between forest use and conservation (Primmer et al 2013a). In addition to the informal institutions carried by the forestry and environmental administration, also formal constraints from the EU state aid law have limited developing payments that would rewards for valuable characteristics (Raitanen et al 2013). The new arising conflicts that can potentially influence forest biodiversity, arise from the climate change mitigating policies advancing forest-based bioenergy (Makkonen et al, in review).

ECONOMIC INSTRUMENTS ASSESSED IN THE CASE STUDY AREA

The current policy mix in Finland is the result of institutional evolution process, in which PES has gained a strong role during the last decade. Currently, the formal Finnish forest biodiversity conservation policy mix includes regulatory instruments and economic instruments, as well as information and extension services. The traditional national parks, strict nature reserves and nature conservation programme areas (including the European Union Natura 2000) are supplemented with Forest Act habitats and Forested Nature Conservation Act habitats.

Private protected areas are presently established almost exclusively through positive economic incentives attracting voluntary offers from forest owners, in a PES fashion. This protected area contracting is the responsibility of the environmental administration. PES contracts are also made for a fixed term by the forestry administration, under the Act for Financing Sustainable Forestry. The two PES-like mechanisms merge the ideas and practices of the PES contracts piloted jointly by the environmental and forestry administration in 2002-2007 and the pre-existing environmental subsidy that compensates for timber income loss (Primmer et al 2013a). The current PES arrangement captures Finland's forest biodiversity conservation policy mix, placing the responsibility of recruiting new areas on the two sectors of administration with a limited budget.

As they payments based on voluntariness is a starting point and the current forest biodiversity conservation policy is based on this principle, the Finnish case study took the PES and its institutional context into the focus, analyzing in particular:

1. PES in a sequence and their institutional evolution; and

2. PES in a policy mix and the influence of forest owner perceptions on contracting as well as spatial conservation area configurations under policy mix scenarios.

OBJECTIVES AND MAIN RESEARCH QUESTIONS

The Finnish case study was set out to understand the institutional conditions for establishing and implementing new policy and the institutional configurations that eventually produce conservation outcomes and other impacts. Additionally, the case study aimed to analyze the potential impacts of PES and different policy mixes. To these ends, the Finnish case study asked the following questions:

1. How has the PES mechanism evolved over time and in which ways has it been conditioned by the past policy mix?

2. How have forest owners' perceptions about PES preconditions and impacts influenced their contracting in the past and how do they influence their willingness to contract or their payment requests in the future?

3. What impacts do different policy mix scenarios identify?

METHODOLOGICAL APPROACH AND CHALLENGES

The case study used four principal methods and data sources: a review of published reports and secondary material, a forest owner survey, workshop development of policy mixes and multicriteria analysis combining statistics, data from administration and the survey data.

The forest inventory data were not as accessible as assumed at the start of the project and consumed a significant amount of time and resources. These challenges conditioned and delayed the multi-criteria analysis. The survey was designed and conducted in 2011, which constrained matching all the questions with the later developed multi-criteria analysis. The steering group workshop produced the policy mixes for the multi-criteria analysis. The realistic scenarios did not highlight the differences in impacts in ways that exaggerated alternatives would have.

TRANSFERABILITY AND COMPARABILITY OF CASE STUDY RESULTS AND METHODS

Effectiveness of instrument mixes on outcome variables

The analyses of the forest-owner survey showed that the perceived positive ecological effects explained both past contracting and future willingness to make a PES contract (Primmer et al 2013b). Willingness to contract was also importantly explained by expected welfare effects. These PES effects should be interpreted against the backdrop of the institutional evolution where PES has entered the instrument mix as an alternative favoured by the forest owners (Primmer et al 2013a).

Methodologically, the Finnish case study advanced coupling of perceptions regarding conservation benefits and costs with institutional and legitimacy aspects in a quantitative fashion.

The multi-criteria analyses of the effects of different policy mixes showed that the instrument mixes built on voluntariness produced the largest overall benefit while the enforced spatially concentrated permanent conservation and voluntary permanent conservation with active nature management produced lower overall benefits (Sironen et al., manuscript). Analysing realistic policy mixes with scenarios did not highlight differences in the scenarios, which can put more weight on interpretation and reduce the interest of some audiences.

Conflicts and synergies between functional roles of economic instruments

Compared to the other case studies, the Finnish case study addressed a context where forest owners were relatively powerful through their collective advocacy and had resisted nature conservation policies successfully. However, as individual decision-makers they had been shown to be heavily reliant on expert advice be steered to support centrally designed forest policy and also conservation was centrally designed and implemented. The PES system broke this institutionalized setup, as it placed high emphasis on voluntariness. Although the change was radical in that nature conservation was marketed and made an attractive alternative for forest owners, the forestry administration and environmental administration kept carrying out forest biodiversity conservation largely relying on their traditional skills and roles (Primmer et al 2013a).

The different policy instruments in the current policy mix appeared to complement each other in potentially attracting different types of forest-owners (Primmer et al 2013b); more preservation oriented owners would choose a permanent PES contract leading to establishing a private protected area and more forestry income oriented ones would choose the fixed-term PES contract. According to the stakeholders, fixed-term contracts had functioned as a gateway for forest-owners to enter a conservation contract, attracting them to consider also permanent conservation. The conservation programmes preceding the PES era provided motivation for taking up less restrictive instruments, by posing a regulatory threat. The existence of a regulatory instrument can be crucial for the success of a voluntary instrument.

Ecologically, the different instruments complemented each other in that national parks and conservation programmes was designed to protect important areas permanently, sometimes covering large tracts while habitat conservation by law secures small-sized patches. The PES complemented these regulatory instruments by protecting small patches and somewhat larger areas either permanently or for a fixed term. The fixed term PES allowed targeting conservation budgets in an adaptive fashion, responding to environmental and social changes.

The most important cause of redundancy between instruments was generated by the significant overlap between the instruments in the habitat types and ecological criteria they addressed (Primmer et al, 2013c). Redundancy may be a particular concern in cases where the same ecological characteristics are protected in the same geographical area with different instruments. The national

level analysis of the policy sequence demonstrated that the same habitat types had been addressed with almost every new policy instrument (Primmer et al 2012). The targeting of similar habitats with different instruments is a signal of a failure to protect habitats and is likely due to limited budgets. Redundancy demonstrates in the difficulty in addressing future policies as well (Sironen et al, manuscript).

The instruments were in conflict mostly through their characteristics of not meeting ecological or social goals (Primmer et al 2012). Regulatory instruments had less legitimacy as they limited the forest owners' rights, while small set-asides and voluntary PES did not support reaching ecological connectivity targets or conserving large sized habitats. The introduction of PES always has the risk of crowding out some forest-owners who would have conserved their sites without compensation.

Impact evaluation and valuation methodologies

Impact evaluation was not conducted other than the above described multi-criteria analysis of policy mixes.

Of some relevance for valuation methodologies, the Finnish case study analysed the altruistic and self-interested motivations by analysing the degree to which different motivations and perceptions explained low or high payment requests (Tainio et al, manuscript). A low payment request was predicted by expectations regarding improved quality of nearby watercourses, improved welfare of family and a duty of humans to protect nature. In addition, temporariness of the contract and being an agricultural or other entrepreneur lowered the payment request. Importance placed on economic gain and equal opportunity to contract increased the payment request. Methodologically, the Finnish case study has advanced the joint testing of the influence of altruistic green motivations and strategic seeking of information rents with a rigorous analysis of perceptions regarding the benefits and costs of conservation in a quantitative fashion.

Similarities and cross-case comparison

In the POLICYMIX project context, the Finnish case study area stands out as an area where multiple use or multifunctional forest management has a very long tradition and a broad range of ecosystem services are produced in the same area and forest owners have multiple goals that they want to address. The forest owners are numerous and as a group their rights and autonomy are respected.

It is possible that in the Finish context, new instruments are generally planned well in advance and their implementation is carried through the pre-existing relatively stable governance structures (Primmer 2011, Primmer et al 2013a). Compared to the other case studies, the information instrument type mechanisms utilised by the forestry and environmental administrations are systematic, yet very reliant on local-level negotiation by professionals (Primmer 2011, Primmer et al 2013).

Due to the relatively uniform policy environment in Finland, the Finnish case demonstrates less experimenting than the case studies considering completely novel instruments, like the fiscal

transfers in Germany (Schröter-Schlaack et al 2012) the REDD+ instruments in Costa Rica (Chacón-Cascante et al 2012) or the water quality PES in São Paulo (Romeiro et al 2012) and also general impacts across the entire landscape than the agri-environmental or fiscal transfer instruments (Santos et al 2012, Schröter-Schlaack et al 2012).

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Germany (EFT & AEM)

BY NELE LIENHOOP, CHRISTOPH SCHRÖTER-SCHLAACK AND IRENE RING

CONTEXT

The German case study comes with two different foci: Firstly, it looks at different aspects of integrating ecological indicators in the German fiscal transfer system, such as the development of appropriate conservation indicators, the detailed discussion of ex ante scenario modelling results, or the legal and institutional options and constraints for introducing ecological fiscal transfers.

As Germany is a federal country with its states being responsible for implementing nature and forest conservation policies, a second major focus of the case study relates to the topic of afforestation and related ecosystem services at state level, in particular in Saxony. Here, the economic, institutional and ecological incentives for afforestation in West Saxony were investigated.

CASE STUDY LOCATION AND CONSERVATION CHARACTERISTICS

The territory of Germany covers 357 021 km^2 and is influenced by a temperate seasonal climate. With more than 80 million inhabitants it is the most populous member state of the European Union and amongst the most densely populated countries on a global comparison (Federal Ministry for the Environment 2010: 5). Agriculture is the dominant land use type (~52 %). Though increasing in recent years, forest cover in Germany (~31 %) is substantially lower than European average (~45 %) (Federal Statistical Office Germany 2012). Conserving biodiversity is among the central elements of Germany's National Sustainability Strategy adopted in 2002 (Bundesregierung 2002). In 2007 Germany also adapted a National Strategy on Biological Diversity (Federal Ministry for the Environment 2007). The Biodiversity Strategy contains 16 indicators for monitoring current status and trend of biological diversity, roughly 330 objectives with timeframes and about 430 measures calling the various governmental and non-governmental actors to action. There are five main goals of the strategy, namely (1) biodiversity conservation, (2) its sustainable use, (3) reducing environmental pollution, (4) conservation as well as access and equitable sharing of benefits of genetic resources, and (5) raising social awareness for biodiversity conservation as one of the top priorities for society. From an instrument perspective it is interesting to note that the strategy places strong emphasis on regulatory instruments, i.e. protected areas like national parks, biosphere reserves, nature conservation areas or Natura 2000 and interlinkage between critical biotopes, and the well-functioning management of these sites and corridors.

Another major focus is on stimulating sustainable use of ecosystems, i.e. cultivated landscapes used for agriculture and forestry, with a particular focus on the provision of habitats critical for the survival of endangered species or species for which Germany has a particular conservation responsibility. Against this background, the German case study can be seen as an effort to support the aims of the National Strategy on Biological Diversity and to facilitate the national TEEB-process by contributing to

a better understanding of the interaction of policy instruments for biodiversity conservation with a particular emphasis on the role of economic instruments.

CONFLICTS

Implementing nature conservation is a task of the German states. They need to provide the necessary administrative capacity and funding to (at least partially) endow support programmes for private landholders. Annual costs for implementing and managing e.g. the Natura 2000-network were estimated to be around € 5.1 billion for the EU27 and around € 620 million for Germany (Gantioler et al 2010). Hence, nature conservation is a costly activity for the states, whereas at least some of the benefits provided are of national if not international importance. What is more, in nearly all instances nature conservation decreases public budgets as it diminishes tax income generating activities. All tax income for Germany's governmental levels is generated either by economic activity (VAT, income and corporate taxes) or by land development (property taxes). Hence, setting land aside for protected areas or reducing economic activity causes costs in terms of foregone tax revenues whereas assigning land to development is a rational strategy at state and municipal level to compete for new residents and economic development – and thus for additional income.

Moreover, existing fiscal transfers are devoted to promoting economic growth in rural areas by subsidising traffic infrastructure investments or the development of industrial zones. In turn, this also promotes urban sprawl and an increasing dependence on car use for travel and transportation. In this regard it is interesting to find that in Germany on average more than 60 per cent of the resources provided by the European Agricultural Fund for Rural Development (EAFRD) – a major building block of the shift of European development policies towards sustainability – are spent on issues other than improving the environment and the countryside (see Table A.2 below), such as improving the competitiveness of the agricultural and forestry sectors, improving the quality of life in rural areas and diversification of the rural economy, and LEADER that helps to implement local development strategies through public-private partnerships (Council of the European Union 2005).

State	Population (Mio.)	Total EAFRD resources in million €	of which spent on axis 2 "improving the environment and the country-side" in million €	Axis 2 budget in per cent of total EAFRD resources	Axis 2 budget in € per capita
Baden-Wuerttemberg	10.775	1,789.6	1,054.1	58.9	97.8
Bavaria	12.546	3,501.9	2,069.6	59.1	165.0
Brandenburg and Berlin	5.973	1,385.0	428.0	30.9	71.6
Hamburg	1.790	71.3	11.3	15.9	6.3
Hesse	6.068	722.4	279.6	38.7	46.1
Mecklenburg-Western Pomerania	1.638	1,157.4	275.5	23.8	168.2
Lower Saxony and Bremen	8.461	2,125.6	410.2	19.3	48.5
North Rhine-Westphalia	17.836	803.5	434.7	54.1	24.4
Rhineland-Palatinate	4.000	677.9	261.7	38.6	65.4
Saarland	1.015	56.5	20.4	36.1	20.1
Saxony	4.141	1,206.4	383.6	31.8	92.6
Saxony Anhalt	2.327	1,323.5	309.7	23.4	133.1
Schleswig-Holstein	2.834	493.5	137.7	27.9	48.6
Thuringia	1.638	1,073.7	420.9	39.2	257.0
Germany	**81.042**	**16,388.2**	**6,496.9**	**39.6**	**80.2**

Table A.2 - EAFRD resources spent on axis 2 "improving the environment and countryside" Source: Schröter-Schlaack et al (2013): 28.

Against this backdrop, another major challenge to effective biodiversity conservation policies is a lack of adequate funding. Although the importance of biodiversity conservation as a global policy challenge as well as a national concern is increasingly acknowledged in Germany, public funds attributed to environmental protection, and nature conservation activities in particular, have not significantly increased over the years and accounted for less than 0.3 per cent of total public expenditure in 2002, the last year for which data could be acquired (SRU 2007). Despite advances in implementing instruments that reward conservation at the private level in Germany (e.g., PES to landowners), there are few instruments addressing public actors.

Summing up, the current fiscal system in Germany might lead to an underprovision of the public good biodiversity conservation, since subnational governments do not have incentives to take conservation benefits into account, especially those affecting other jurisdictions beyond their own boundaries.

Saxony aims to increase its forest cover in order to reach the nation-wide average forest cover of 30%. The policy instruments available (forest law, regional plans and agro-environmental measures) do not contribute to reaching this aim. Although the agro-environmental measure for afforestation is the only instrument providing financial incentives, landowners are not motivated to enrol in the scheme. Reasons are very low subsidy payments, partial reimbursement of investment costs and

complicated application procedures (SMUL 2010). Authorities are now looking for ways to improve the scheme in the next programme period.

Moreover, at private level still many environmentally harmful subsidies exist, such as commuting allowances that spur urban sprawl and an orientation towards individual motor traffic (Potter et al 2006, Umweltbundesamt 2005). Property taxes are levied on an outdated assessment basis that provides no incentives for dense development of their premises – to the contrary, it makes developed but yet not built on-land a highly attractive investment. In turn, this leads to a leapfrogging development and an increasing uptake of land for urban development. Although a wide range of solutions were proposed, reforming property taxation is still a task to do (see inter alia Apel et al 1995, Brueckner and Kim 2003, Josten 2000, Löhr 2004, Reidenbach 1999).

ECONOMIC INSTRUMENTS ASSESSED IN THE CASE STUDY AREA

Firstly, we explore from an ex ante-perspective the potential of integrating ecological indicators in intergovernmental fiscal transfers at federal level in Germany; and secondly, we study in depth the conditions required to encourage farmers to enrol in PES for afforestation and thus contribute to the aim to increase forest cover in regions with particularly low shares of forest, such as West Saxony.

Ecological fiscal transfer (EFT) is an instrument that has potential to address public actors by distributing money from higher to lower levels of government based on ecological indicators. So far, only Brazil, Portugal and to a certain extent France have adopted EFT (Ring et al 2011). While EFT is an innovative approach to German federalism, fiscal equalisation as such is not. There is an extensive field of regulation covering the relationship between federal level, states and municipalities. The constitutional rules for the distribution of legislative power and responsibilities among these governmental levels are mirrored by a complex mechanism of distributing public revenues in order to provide governments with the funds necessary to fulfil their responsibilities.

OBJECTIVES AND MAIN RESEARCH QUESTIONS

Ecological fiscal transfers at state level in Germany

Ecological Fiscal Transfers share some characteristics with payments for ecosystem services (PES) as they incentivize decision-makers to change their behaviour in an environmentally friendly way. However, it is important to note, that fiscal transfers are first and foremost a distributive instruments, i.e. aiming at leveling off differences in the available public budgets per capita at the respective governmental levels. Hence, when ecological indicators are introduced without increasing the overall amount of money available to distribute, there will always be winners and losers and thus some states will receive less with EFT than under the status quo. Thus, effectiveness and efficiency of EFT for biodiversity conservation cannot be evaluated in rigorous way. The following research questions are addressed:

- Is there a rational to integrate ecological indicators into the existing fiscal transfer system at state level in Germany?

- What should an indicator for measuring the different levels of conservation activities of the states look like?

- What are the legal options and constraints such an approach would face?

- How would this kind of incentive mechanism interact with other types of regulation concerning nature conservation?

- In defining potential indicators, we build on existing experience with EFT in Brazil and Portugal, and develop a series of protected area-based indicators for integration into the fiscal transfer system.

Agro-environmental measure for afforestation in Saxony

In Saxony, we focus on an improved design of the agro-environmental scheme for afforestation (AEM for afforestation). We investigate conditions under which landowners would be more interested to engage in the AEM for afforestation. Exploring the conditions under which farmers would agree to participate and identifying conditions under which farmers would accept a lower level of subsidies is a valuable input for an improved design of the agro-environmental scheme for afforestation. These conditions include economic issues (i.e. compensation payments, contract length), social and institutional issues (i.e. technical advice, reversibility to agricultural use) and ecological issues (farmer's interest in forest-related ecosystem services, i.e. providing recreational access, timber production, enhancing biodiversity).

METHODOLOGICAL APPROACH AND CHALLENGES

The modelling activities for ecological fiscal transfer (EFT) in cooperation with the University of Leipzig have been completed and a final report has been published. The coarse grain analysis focussed on three major topics: 1) development of ecological indicators that reflect the different conservation activities of German states, 2) options for the integration of such indicators into the existing fiscal transfer scheme from a legal and institutional viewpoint, and 3) the simulation of EFT distribution based on the indicators developed in step 1 and the way of integration derived from the analysis in step 2. The report by Schröter-Schlaack et al (2013) is provided on the project webpage: http://policymix.nina.no).

Saxony aims to increase its forest cover from 28 to 30% to enhance biodiversity and improve ecosystem services such as erosion control, flood control and recreation. The agro-environmental scheme (AEM) for afforestation is the only incentive-based instrument in place to support afforestation measures. However, the AEM is very unattractive among landowners and thus has hardly contributed to enhancing the forest area. We use two methodological approaches to assess

the demand for different contract alternatives and thereby identify the institutional-economic aspects that hamper and/or motivate landowners' to enrol in afforestation schemes: First choice experiments (CE) with farmers, and second qualitative follow-up interviews with a small number of CE respondents.

TRANSFERABILITY AND COMPARABILITY OF CASE STUDY RESULTS AND METHODS

Effectiveness of instrument mixes on outcome variables

In the long-term EFT may encourage a shift in land-use decisions towards protected area designation, as benefits are obtained from the latter.

The ecological indicators introduced to EFT could be important not only in terms of increasing the number of protected areas, but to improve protection, as a high protection status increases the distribution index.

Currently land-owners are not interested in compensation payments for afforestation as offered by an agro-environmental measure (AEM). We find that short-term commitment is preferred to long-term contracts and that technical advice on planting and managing forests is essential for farmers. Both these aspects would enhance participation in the AEM for afforestation. Landowners further prefer small afforestation patches. This reinforces the need for better-designed afforestation schemes (connectivity, plant diversity). These findings are also relevant in the Netherlands and in Brazil (ICDPs).

Conflicts and synergies between functional roles of economic instruments

With respect to EFT, there is a clear synergy between EFT and protected area regulation.

Moreover, EFT may provide resources to the states to co-fund AEM geared at private landowners. Such AEM will most probably have an influence on the performance of the respective states in terms of biodiversity conservation goals and may in turn make states eligible for higher transfers from EFT.

Lastly, a proposal to introduce ecological indicators in Germany may come at the right time. At the federal level, a policy window presently opens up for a restructuring of financial equalisation due to the end of the Solidarity Pact II between the West German and Eastern German Länder. Introduced after the German reunification, the Solidarity Pact provides extra financial resources for infrastructure development in East Germany to catch up with living standards in the West (see Schröter-Schlaack et al 2013, section 4.1.2). These special need supplementary federal grants (about € 10 billion in 2008) are currently phased out until the year 2019 and will stop being paid in 2020. For this reason, politicians of all parties discuss options for redesigning financial equalisation in Germany, including options for considering ecological fiscal transfers.

Conflicts: Fiscal transfers are a distributive instrument aiming at an equalization of per capita tax revenues among states. Introducing ecological indicators in order to create EFT reduces the relative

importance of the now existing indicators. Hence, EFT would be in conflict with providing resources necessary to fulfil other public responsibilities that reside at state level such as education or the provision of traffic infrastructure.

With respect to the AEM for afforestation we have identified the following interactions with other policy instruments:

- There is a synergy between the AEM and forest law/regional development plans: while the forest law encourages an increase in forest cover and the regional development plans identify priority areas for afforestation, these two regulatory instruments are not the main driver for afforestation. The AEM is an important supplement as it provides financial support to landowners for afforestation measures.

- The AEM competes with the overwhelming number of other AEM or funding opportunities available to landowners and thus does not have predominant role.

- There is no conflict between being enrolled in AEM and other environmental measures/funding opportunities for farmers.

- Once farmers have agreed to participate in the AEM for afforestation, they have to keep their forest in perpetuity, as forest law does not allow forests to be cut.

Whether these synergetic and competitive interactions also apply to other countries needs to be appraised.

Impact evaluation and valuation methodologies

EFT in Germany and ICMS-E in Brazil provide ex-ante vs. ex-post evaluation of legitimacy of the policy instrument. In Germany legitimacy regarding the potential way of introducing EFT (compared to the status quo of the transfer system) and in Brazil legitimacy is related to (the actual) distribution of financial resources.

A choice experiment was applied to investigate the conditions under which farmers are willing to afforest on part of their land in order to make recommendations for an improved design of the agro-environmental scheme for afforestation. The same choice experiment was conducted in the Netherlands. While the comparative analysis is still in progress, the findings will give insights into the transferability of CE results, i.e. whether the same conditions raise landowners' motivation to participate in afforestation schemes.

The CE approach adopted in Saxony could be used to calibrate the right scheme design and related institutional design could be adapted in the Mato Grosso ICDP case.

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Portugal (EFT & AEM)

BY RUI SANTOS, PAULA ANTUNES AND PEDRO CLEMENTE

CONTEXT

Biodiversity loss has been extensively addressed as one of the most serious challenges of environmental policy in Portugal, considered a biodiversity rich country, where, according to the last Corine Land Cover version (2006), forests cover about 30% (approximately 26.400 km^2) of the territory. Forest biodiversity in Portugal is mostly associated to human-shaped habitats/landscapes, such as *montados* (Blondel 2006).

In Portugal, policies regarding forest/biodiversity conservation have traditionally relied on regulatory approaches towards the conservation of species and their habitats, such as protected areas regulations, and are influenced by european directives and their goals, such as the Natura 2000 Network, that covers around 20% of the Portuguese territory. Recent policies started to recognize the central role of private and public stakeholders as land managers and proactive actors, and tried to align their interests with conservation goals. Most of the economic instruments implemented are based on public subsidies and focus on compensating local private actors for conservation costs. More recently, in 2007, an ecological criterion was incorporated in intergovernmental fiscal transfers through the Portuguese Local Finances Law, in order to compensate local public actors for land-use restrictions imposed by protected areas (more details in Santos et al 2012a).

CASE STUDY LOCATION AND CONSERVATION CHARACTERISTICS

The case study area is located in the southeast of Portugal, in the Left Margin of Guadiana River, comprising five municipalities - Barrancos, Mértola, Moura, Mourão and Serpa - and is limited by the Guadiana river (west) and the border with Spain (east). The total area of 286.000 ha encompasses multifunctional landscapes, including agricultural properties, urban settlements, national protected areas, and Natura 2000 sites - a Site of Community Interest and a Birds Special Protection Area. This region is a typical Mediterranean landscape, highly vulnerable to drought, presenting an increasing desertification process and poor economic development, mainly due to unemployment, human abandonment and an aging population. This landscape is highly fragmented in small farms, the predominant land uses are agriculture, mainly for olive oil and wine production, and extensive grazing.

The study site has been selected due to the high conservational value of the *montados* ecosystems (Pereira and Pires da Fonseca 2003). As the conservation value of *montados* is highly dependent on the maintenance of the shrub grassland matrix through human management (Joffre et al 1999), this system can be an example of nature conservation and management of Mediterranean ecosystems.

The area is characterized by mosaics of traditional agro-pastoral and extensive oak woods, *montados,* with both cork oak (*Quercus suber*) and holm oak (*Quercus rotundifolia*) forests. *Montado*s are multifunctional systems that, besides forming a diversity of habitats of high conservation value, contribute to climate regulation, water cycle regulation, soil quality, protection against fire and provision of cork and other products. These agro-forest areas are the habitat of species with a high protection status, such as the Iberian lynx (*Lynx pardinus*), the imperial eagle *(Aquila heliaca*) and the black vulture (*Aegypus monachus)* (Santos-Reis and Correia 1999).

CONFLICTS

Currently, *montados* are threatened by agriculture and infrastructure expansion, pine and eucalyptus monoculture and forest fires. Poor agriculture practices are increasing the spread of diseases (e.g. pathogenic fungi), and preventing *montados* natural regeneration threat their sustainability in the long-run. Paradoxically, land abandonment or unmanaged areas also jeopardize *montados* regeneration and maintenance. This critical and paradox link, states that successful *montado* conservation strategies rely on the dynamic equilibrium between human activities and biodiversity protection (Pinto-Correia and Mascarenhas 1999, Proença et al 2009).

Existing command-and-control instruments (e.g. the national network of protected areas, Natura 2000 Network) are still not able to conciliate an effective protection of existing *montado* with the predominant human activities in the region, as they impose land use restrictions or constraints to agricultural and forest management practices, significantly reducing productivity and farmers revenues. This is creating serious competitive disadvantages among landowners, particularly to those inside classified areas.

There is a clear mismatch between those who bear the costs and those who benefit from conservation actions, since the benefits generated flow beyond local, regional and national borders. Conservation costs are unevenly spread, with some public and private actors facing costs related to protected areas or conservation activities (Santos et al 2013).

ECONOMIC INSTRUMENTS ASSESSED IN THE CASE STUDY AREA

Most economic instruments applied to date for biodiversity conservation in the case study area focus on landowners or land users and hence on conservation costs faced by private actors. More recently, the role of public actors in implementing conservation policies at the local level has been recognized, and economic instruments addressing this stakeholder group have been proposed and implemented. Having this in consideration, two particular economic instruments currently used in biodiversity/forest conservation were selected and analysed:

(1) **Agro-environment measures** (AEM)*,* financial incentives designed to encourage farmers to protect the environment on their farmland – consisting on payments made to farmers in return for a service – that of carrying out agro-environmental commitments that involve

more than the application of usual good farming practice and more than legal requirements (specifically directed to private actors) (European Commission 2005).

The analysis of AEM was particularly focused on Integrated Territorial Interventions (ITI), an innovative element of the current Portuguese rural development program (ProDer), funded by the European Union, which uses a site specific approach applied to areas of special conservation interest, such as Natura 2000 sites.

(2) **Ecological Fiscal Transfers** (EFT), which since the 2007 Portuguese Local Finances Law provide an area-weighted allocation criteria to the annual transfers scheme from the national general budget to the municipalities, in order to compensate them for land-use restrictions imposed by protected areas (specifically directed to local public actors) (Santos et al 2012b).

OBJECTIVES AND MAIN RESEARCH QUESTIONS

The fine grain assessment focused on the implementation and environmental outcomes of the Portuguese agro-environment measures/ITI in a *montado* landscape, by assessing its effectiveness, as well as on the identification of opportunities to improve their design, to promote awareness and participation of all relevant stakeholders, both at national and local level. The role of AEM and EFT in the policy mix governing the agro-forest mosaic was also assessed by exploring links and complementarities between regulatory and economic instruments.

The environmental outcomes of the current Portuguese agro-environment program (ProDer) have not yet been consistently analysed, and it was not possible to do so at the coarse grain level due to lack of data (Santos et al 2012a). The fine grain assessment of AEM had two main research questions, What has been the impact of AEM/ITI in the case study area, considering its role in the conservation policy mix?, and How could its effectiveness be improved?

In this fine grain assessment EFT were also analysed, individually and as part of the conservation mix. As EFT are too recent to provide evidence of its impact, the assessment focused on stakeholder's perception of the instrument. The third research question was: what has been the perceived impact of the EFT scheme in the case study area, as part of the conservation policy mix?

It has been acknowledged that a successful biodiversity conservation policy mix should include economic instruments directed to both public and private local stakeholders. Moreover, the selected instruments should be conceived in a way that is mutually reinforcing and that targets decision processes regarding land use zoning and land management practices (Santos et al 2013). Based on this argument, a fourth and final research question was, Should EFT and AEM be linked in a connected approach?

METHODOLOGICAL APPROACH AND CHALLENGES

These research questions were answered using the available data and knowledge on the existing instruments combined with diverse tools and methods, such as surveys to farmers, interviews, systematic conservation planning tools and a choice experiment. An ex-post analysis addressed the implementation and participation levels of AEM/ITI in the case study area, and the perceived legitimacy of EFT by public and private actors. This was complemented by an ex-ante analysis to explore potential improvements in AEM design.

On the ex-post analysis on AEM/ITI the available data and documentation was complemented with a survey, designed to identify farmer's perceptions, motivations and expectations regarding land use change and biodiversity conservation. This tool provided data on the performance of current AEM/ITI and pointed the main drivers for its unsuccessful implementation, particularly of ITI's. Opportunity costs for landowners and how do they relate with received compensations under the existing AEM were also assessed. This survey, along with open interviews conducted to a group of relevant stakeholders provided insights on both private and public actor's perceptions of EFT impact.

The ex-ante analysis of AEM/ITI performance included two methodologies, Marxan with Zones (decision support tool) was applied to four ITI measures, to address targeting issues and to incorporate social-ecological values into conservation planning; and a choice experiment applied to a sample of local farmers, to estimate the acceptable compensation payments of one ITI measure analysed with Marxan with Zones. Both methods were designed to assess how ITIs can or should be (re-)designed in order to reduce adverse social impacts, promote positive social impacts while enhancing ecological effectiveness and policy legitimacy by ensuring a more cost-effective allocation of financial resources.

The methodologies used – literature review, surveys and interviews (ex-post analysis), and Marxan and choice experiment (ex-ante analysis) – are complementary tools and were applied in a combined way, building on each other's goals and results. This methodological approach was adopted in order to improve the consistency of the results, and to guarantee that the main socio-ecological parameters of the region and the dynamic forces acting on the system are effectively included in the assessment.

The main methodological challenge was to obtain data, particularly on the ecological effectiveness of AEM, but also to obtain formal documents, for example, to demonstrate the role and influence of institutions in current agro-environmental measures design. Another challenge was to identify formal rights and responsibilities of the main actors, particularly of public authorities, as for some ecosystem services or biodiversity values it was not clear who's responsible to manage or decide upon those resources.

TRANSFERABILITY AND COMPARABILITY OF CASE STUDY RESULTS AND METHODS

Effectiveness of instrument mixes on outcome variables

Having little or no available information on effective ecological impacts of the instruments assessed, it was not possible to present reliable conclusions on the effectiveness of the current policy mix. Though, the assessment provided evidence that EFT discriminate positively municipalities with high percentages of classified areas (Santos et al 2012b), and that landowners recognize positive ecological impacts of AEM/ITI, such as improvements on biodiversity conservation and lessening climate change through carbon sequestration (Clemente *et al*, manuscript in preparation).

The effectiveness of both instruments is clearly hindered by their own complex configuration, due to intricate design or elaborated implementation procedures. In the case of EFT, the effectiveness of the ecological criteria in LFL is currently undermined by other allocation criteria and their weight within the law (e.g. population). ITIs face some implementation problems as they are competing with less restrictive AEM (e.g. broad and shallow measures), and struggle with penalties and incompatibilities between ITIs and other AEM.

AEM/ITI and EFT share two core problems that reduce its effectiveness, (1) the incentive is not sufficient to compensate classified areas restrictions and management requirements and, (2) there was a lack of involvement and participation of relevant stakeholders in the decision making process. This was particularly harmful to the policy mix, as both private and public actors felt somehow excluded, thus less supportive and aware of the existing instruments (Clemente *et al*, manuscript in preparation).

The lack of communication and information among different government levels and between private and public actors creates additional problems to EFT and AEM/ITI effectiveness. Public authorities have scarce technical and financial capacity to inform and enforce the instruments, and there is an evident lack of coordination with other public and private institutions. Suggestions to improve this policy mix, include involving public and private actors on instrument's design, and new communication strategies for regional/local authorities to disseminate and interact with the relevant stakeholders (Santos et al 2013).

Conflicts and synergies between functional roles of economic instruments

EFTs and ITI were designed to complement the existing policy mix and provide synergies, aiming classified areas quantity and quality, respectively. Nonetheless, these instruments were not designed and implemented in order to promote potential synergies between them (Santos et al 2013).

The most relevant conflict in this policy mix relates to ITI's interactions with other instruments in the case study area, particularly Natura 2000 Network regulation and other existing payments for environmental purposes. The poor involvement of local actors in the design and implementation

process of Natura 2000 sites led to a low perceived legitimacy of the instrument among landowners, thus reducing their inherent bond to biodiversity and affecting their commitment with conservation efforts, which affected adhesion to ITI measures (design specifically for conservation purposes) and their effective implementation (Clemente *et al*, in preparation).

The competition between ITI's and other payments for environmental purposes is also affecting its implementation. Pillar 1 measures from EU Common Agricultural Support, namely the Single Payment Scheme provides, to some landowners, higher revenues per hectare, at a relatively lower cost and with fewer requirements, when compared to ITIs.

There is also a conflict at different level of governance due to poor interaction, but mainly due to an overlap of managing institutions. Depending on the activity, a landowner may have to deal with several institutional bodies and a multiplicity of land use planning tools that have conflicting objectives and methods. This mismatch between institutions and their goals induces confusion among landowners and reduces the credibility of the instruments and the authorities that manage them.

Impact evaluation and valuation methodologies

Decision making processes and policy design should be transparent, participated and supported by reliable information suitable with the conservation goals established for the target area. The use of methodologies and tools, such as surveys with farmers and choice experiment techniques, can be useful to disclosure information that otherwise would not be obtained, to identify key factors affecting the performance of economic instruments or to improve the design of such instruments by providing valuable inputs that might enhance its effectiveness. These methods can also be valuable tools for capturing stakeholders' perceptions on the role of the instruments in the existing policy mix, and to highlight potential redundancies, complementarities or conflicts with other policy instruments (Ring et al 2011).

Using GIS tools and systematic conservation planning tools such as Marxan can be useful to accurately communicate and present results to decision-makers and stakeholders, and to guide and optimize conservation planning by prioritizing fund allocation according to the expected ecological effectiveness on different properties, or if available to all stakeholders, guide landowners in deciding which measures can be more suitable to their properties (Watts *et al*, 2009). The cost-effectiveness of instruments such as AEM/ITI can be enhanced through their specific allocation to sites identified as priority areas for conservation, supporting biodiversity values, habitat connectivity and ecological processes. Then, adjusting already existing protected areas can be a more efficient solution to these multifunctional landscapes, instead of indiscriminately forcing stakeholders to adopt restrictive measures (Pinto *et al*, manuscript in preparation).

Despite the attempt to create a realistic analysis using these methods, there are some caveats that require special attention, namely, setting priorities within the complexity of ecological systems,

which indicators to consider and its distribution over space and time, and how to balance the rights and responsibilities of the several stakeholders (Pinto *et al*, manuscript in preparation).

The outcomes of these methodological approaches can be used in comparative studies, particularly, on social issues (e.g. cross-country comparison study on equity/justice issues), willingness of farmers to accept forestation measures in their lands (e.g. German and the Netherlands choice experiment), or compare zoning frameworks to designate areas for specific purposes (e.g. Mata Atlântica Marxan zones).

Similarities and cross-case comparison

Analysing the case studies included in POLICYMIX project, the Mata Atlântica case study site, in the São Paulo State (Brazil) shows clear similarities with the Portuguese case study. The socio-economic and ecological features are very similar, as well as the main pressures threatening biodiversity/ecosystem services conservation. Forest biodiversity is, in both areas, mostly associated to human-shaped systems, with conservation strategies that focus on regulatory approaches for establishing classified areas in biodiversity hotspots, and on the need to address connectivity of existing fragments through the creation of ecological corridors. In these two areas the trade-off between conservation decisions and land opportunity costs is the central issue restraining the effectiveness of existing instruments.

The analysis of the existing policy mixes in these two case studies shows similar problems and potential improvements. In both case studies the main problems hindering an effective implementation of economic instruments are the lack of information linked to low engagement of relevant stakeholders, and the low incentives provided by the economic instruments at play, as they are not sufficient to compensate for landowners opportunity costs. To improve the cost-effectiveness of these two policy mixes it is essential to align the incentives, both to public and private actors, provided by agricultural and environmental policies towards conservation in protected areas (Santos *et al*, 2013). The use of systematic conservation planning tools such as Marxan can offer significant advance to the spatial implementation of more 'environmental-friendly' agricultural measures into conservation planning in both case studies, thus increasing cost effectiveness.

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Costa Rica (PES)

BY ADRIANA CHÁCON-CASCANTE

CONTEXT

The Costa Rican case study aims at fulfilling some of the research gaps related to effectiveness, cost efficiency and legitimacy of the PES program, given special attention to its interactions with other existing instruments. The case study contemplates several research questions in topics related to opportunity and transaction cost modelling (cost efficiency); path dependency of the development and evolution of the PES program and instrument design (social and political legitimacy); and, ecological effectiveness of the program.

CASE STUDY LOCATION AND CONSERVATION CHARACTERISTICS

The Costa Rican case study is located in Hojancha, Nicoya Peninsula, in the northwestern are of Costa Rica. The region comprises dry and moist forest ecosystems, nonetheless the latter is of special relevance as it is considered one of the most threatened forests in the world. In Central America cover loss of this ecosystem is evident, only 1.7% of its original extent currently remains.

Since the 70's, the Nicoya Peninsula has reversed forest cover loss, mostly through natural regrowth of abandoned pastures. This situation gives the region a particular relevance for its potential value in recovering and conserving dry and moist forest biodiversity and restoring their associated ecosystem services (hydrological, soil erosion control and carbon). In addition, the national analysis of conservation gaps GRUAS II identified a unique phytogeografic unit, whit a very limited extension of 3,528 ha, in the slopes and lowlands of the Nicoya peninsula. The combination of dry and moist ecosystems, and different forest successional stages make this landscape very particular in terms of biodiversity, but also in the structural and physiological diversity of life forms. In terms of ecosystem services, the hydrological services (including water quality/soil erosion control) are very important since this region is prone to droughts.

The Chorotega Biological Corridor (CBC) is one of the regional biological corridors that comprise the greater Mesoamerican Biological Corridor. The CBC is situated in northwest Costa Rica in the Nicoya Peninsula in land that was originally covered by semi-deciduous tropical forest. The dry and moist forests of the Chorotega region are amongst the most threatened in Mesoamerica as well as being amongst the least studied. The biodiversity of the extensive pastures that have replaced these forests have significantly lowered species richness of birds and butterflies than in adjacent silvopastoral and forest systems (Saenz et al 2007). The corridor, which encompasses 153,000 ha, connects the Barra Honda National Park and the Tempisque Conservation Area.

CONFLICTS

Since the program launching, Costa Rica`s conservation efforts at the national level has increasingly relaid in the PES program. It became the main instrument to target private landowners (Porras et al 2014). Although other instruments are simultaneously implemented, i.e. national system of Protected Areas (PAs), the importance of the PES program has escalated up to the point that it represents the main (if not solely) banner of the country`s REDD+ proposal.

Under this scenario, one of the main challenges is to align PES with the overall conservation policy (Porras et al, 2014). Conservation efforts at the national level are shifting from quantity, as done in the beginning of the establishment of the PA system, to quality. This means that efforts are shifting toward areas with proven conservation values. In the case of PA for example, this new paradigm implies that new areas are not to be created unless conservation gaps, social feasibility and ecosystem service provision are taken into account. In the specific case of the PES program, this new model calls for a better targeting of contracts.

According to Porras et al (2014) the PES programme has established two concrete environmental objectives: (i) protect existing forests and (ii) regenerate degraded areas and secondary forests. The first objective calls for eliminating conservation gaps in about 14 per cent of the country, increasing protection of existing forests in private lands to reach a target of 256,000 hectares by 2030, and promoting connectivity between forests through biological corridors to facilitate the movements of flora and fauna. In the case of secondary forests, the program´s efforts are focused on agroforestry system to regenerate at least 8,500 ha of degraded lands, and, to support 20,000 ha of secondary forest growth.

To achieve these goals, the program must (i) have a better understanding of how it interacts with other instruments (policy mix); (ii) to balance the two simultaneous goals of conserving while ensuring social legitimacy; (iii) to gauge its real ecological impact in terms of ecosystem services provision (quality and quantity) and biodiversity protection, and beyond general indicators of forest cover and avoided deforestation; (iv) and, as mentioned before, a better targeting.

ECONOMIC INSTRUMENTS ASSESSED IN THE CASE STUDY AREA

Four instruments are assessed in the analysis: the PES program, protected areas, forest certification and direct regulations. As a potential new instrument, REDD+ is to be analysed in the light of its possible interactions with the other policies. Besides this multicity of instruments, the analysis will focus on the PES program. Although this instrument that has been widely analysed, there are still gaps to be filled in issues related on the program’s ecological effectiveness, cost efficiency and social impacts.

In our fine grain case study, environmental effectiveness and cost efficiency of the PES is assessed in different manners. The analysis always considers, either explicitly or implicitly, the co-existence of this mechanism with Forest Law, certification schemes and protected areas.

OBJECTIVES AND MAIN RESEARCH QUESTIONS

In Costa Rica, the case study included analysis on five main topics (i) instrument effectiveness, (ii) instrument cost and benefits, (iii) equity and legitimacy, (iv) institutional opportunities and, (v) instrument interactions.

METHODOLOGICAL APPROACH AND CHALLENGES

The main contribution of the project to the existent literature of the PES effectiveness is the use of biodiversity and ES provision indicators to measure the program's impact. Up until now, researchers have analysed the program's success based on forest cover, as a surrogate for ES provision and biodiversity protection. The project's new approach will require a great multidisciplinary effort and the use of different tools (economic and ecologic modelling, geographic information systems among others).

Within the methodological innovations introduced by the analysis are: (i) the use of opportunity cost mapping as a management tool; (ii) the evaluation of optimal conservation policy mixes using Marxan with Zones; (iii) the introduction of scale in the analysis of PES effectiveness on biodiversity conservation, carbon, and hydrological services; and (iv) the usage of mixed methods impact evaluation for the analysis of PES.

Important challenges were faces in most topics. For instance, in regards to the program's effectiveness, detailed information of species and biodiversity is required. However, this information is not only scarce but also presents important analytical challenges when available; i.e. compatibilities issues due to differences in methods, scales and location of existing data sets. For the cost efficiency analysis, challenges center on methodological aspects of cost (opportunity and transaction) estimation. To overcome these limitations, the project team is composed of an interdisciplinary team (i.e. economists, geographers, ecologists, and sociologist). Each member contributes in their own area of expertise in the data generation and gathering processes, in the methodological definition, analysis of results and their policy implications.

TRANSFERABILITY AND COMPARABILITY OF CASE STUDY RESULTS AND METHODS

Economic instrument costs and benefits

From the cost opportunity analysis we demonstrate the large difference in opportunity costs of conservation implied by two extreme management hypotheses: full law enforcement and none enforcement of forest law. We discuss the implications of these alternative assumptions for reserve site selection modelling using tools such as Marxan with Zones. We discuss the pros and cons of using such maps to spatially target PES and/or set payment levels.

We also analysed transaction and compliance cost relative to the payment level of PSA for the two contract modalities of 'forest protection' and 'reforestation'. Results show that reforestation

contracts have on average transaction and compliance costs of 91,8% in total. This suggests that PES payments for reforestation are quite well calibrated as compensation for the additional costs of participation. In terms of financial incentives 'PES for reforestation' is similar to a forestry subsidy, with little additional payment for any provision of ecosystem services. Expected plantation timber sales are meant to cover opportunity costs of alternative land-uses. The transaction and compliance costs of forest protection contracts were on average of 24,2% of the PSA payment. In this case payments are (partial) compensation for opportunity costs of alternative land-uses and therefore, compensate landowners for cover at least part of the ecosystems provided. Differences in transaction and compliance costs between forest conservation and reforestation incentives suggest that it is useful to distinguish deforestation and reforestation incentives in the public private benefits approach we used to frame the analysis of transaction costs.

Economic instrument equity and legitimacy

We conducted an evaluation of socio-economic impact of two of the most extensively used PES contract modalities in Nicoya Peninsula. Results show no socio-economic impact of those PES modalities on socio economic indicators, which goes in line with previous findings. We claim for a better social targeting based on farm wealth would perform better in terms of poverty reduction as it would increase the likelihood of less well-endowed farmers to enrol in the programme.

Institutional opportunities and constraints for economic instruments

Analysis of institutional opportunities and constraints of the PES program was based on a qualitatively impact analysis based on Ostrom framework. Results show that in Nicoya, Nandayure and particularly in Hojancha, participation of the population played an important role in their resilience to crisis situations. Public participation in decision-making allows integrating cultural diversity and the rights and duties distinct social sectors in environmental management. It is also a means to increase the environmental awareness of the population, generating legitimacy and transparency in environmental decision. Hojancha is known for establishing integrated networks around the environment which has encouraged the private sector to get involved in solving environmental problems.

Conflicts and synergies between functional roles of economic instruments

Analysis of instrument interaction makes evident that Costa Rica's biodiversity conservations and ecosystem services (ES) provision instruments interact in many ways. Some of these interactions are regarded as complementary while other are self-defeating. From our paper analysis the interaction between PES and protected areas, it was concluded that both instruments are perfect substitutes. This because their effectiveness levels, measured as avoided deforestation, decrease when both instruments are placed together. Contrary to this, analysis of the interaction between PES and forest law (ban on forest land use change) shows how a ban on forest conversion, along with incentives can be interpreted as synergistic with PES, rather than redundant or conflicting.

São Paulo - Mata Atlântica, Brazil (PES)

BY DANIEL CAIXETA DE ANDRADE, ADEMAR ROMEIRO RIBEIRO

CONTEXT

The Atlantic Forest, the most biodiverse forest in the world, has had its area reduced to around 10% of its original cover, a critical resilience point according to many forest experts, and still has been threatened in many points. The main objective of the study is precisely to contribute to create a structure of economic incentives, complementary to the existing Forest Code, as to make it viable a forest recovery according to a map of forest fragments re-connection. The focus of the conservation strategies is on private areas since they are under direct control of private owners who suffers from opportunity costs.

The State of São Paulo has the most important Atlantic remnants in Brazil. Most of them are concentrated on the coastal mountains and valleys. These geographical peculiarities are the main reason why they have been preserved, but they still are threatened in some parts by predatory exploitation of forest products and cattle breeding. The project's underlying hypothesis is that policing and the Law is not enough for the protection of the forest remnants as well as for forest recovery. It is necessary also specific policies aimed at providing economic alternatives for local populations.

Other important challenge for environmental policy in the state of São Paulo is to ensure the continued provision of some crucial ecosystem services to support the population's wellbeing. Special attention should be directed to the provision of water-related services, whose supply is seriously threatened by the Atlantic Forest degradation.

CASE STUDY LOCATION AND CONSERVATION CHARACTERISTICS

Our case study was focused on two regions. The first one was the Cantareira Mantiqueira Corridor Region, which lies fully within the Atlantic Forest biome. This region is defined by the Brazilian Government as highly biological important and a priority area for environmental conservation (Ordinance MMA n° 9, 01/23/2007). It is appointed by Biota-FAPESP project researchers in the study "Guidelines for Restoration and Conservation of Biodiversity in the State of São Paulo, Brazil" as a priority area for ecological corridors that can connect two important Atlantic forest remaining areas (Cantareira and Mantiqueira Hills) (Rodrigues et al 2008).

This region is located in the Atlantic Plateau and the elevation ranges from 700 to 1,700 m, and the relief is dominated by small round hills (Ponçano et al 1981). The mean monthly temperature varies from 16°C to 23°C. The annual precipitation is about 1,500 mm with seasonal variation, April to August being the coldest and drier period. The vegetation is a "Dense Low Mountain Rain Forest" (700-1100 m) and "Dense High Mountain Rain Forest" (>1100 m; Oliveira-Filho and Fontes 2000).

Despite the Cantareira Mantiqueira Corridor region biological importance, it is possible to define water provision as the most richness ecosystem service for this area. Located fifty kilometers from the city of São Paulo (23º12' South e 46º 21' East) this region comprehends the Cantareira Water Provision System (simply Cantareira System). This human made water supply system is responsible for daily water provision to more than nine million people that live in the Metropolitan Region of São Paulo. Cantareira System water catchment is one of the biggest in the world. It has an area of 234 thousand hectares and provides 31 thousands litres of water per second every day. A recent managerial report indicates that Cantareira System is getting down in water provision and the problem will become worst after 2020.

The region is an important area of remnants of the Atlantic Forest. This biome has only 8% of its original forest cover spread out in a myriad of fragments. Despite the existence of protected areas, the majority of fragments are located in private properties. The predominant farming in the area has been dairy cattle farm and eucalyptus. The region is considered a high priority for the conservation and recovery of fragments and increasing connectivity between fragments has been a strategy advocated to increase and maintain biodiversity.

Since the Cantareira System's construction in 1973, the region surrounding the reservoirs and their forming watersheds were being transformed under the influence of different variables. Originally held by traditional family farms, now much of the pressure comes from the new-rural: urban inhabitants seeking recreational refuge in its picturesque landscapes which results in an excessive fragmentation of land.

Besides focusing on a local-level analysis (Cantareira Mantiqueira Corridor Region), this case study also comprised a state-level analysis in São Paulo, which is the most industrialized of Brazil, with a GDP of more than US$550 billion, and more than 40 million inhabitants living in 248 thousand km^2 (IBGE, 2010). Its location at the transition between the tropical and subtropical region, combined with a diverse topography, have created habitats to a vast biodiversity with many endemic species (Joly et al., 2010). Both biomes found in the State, Atlantic Forest and *Cerrado* (a type of savanna), are recognized as world's biodiversity hotspots (Myers et al. 2000).

Economic development has put pressure on natural systems, transforming the landscape in extensive rural areas with many small fragments of forest remnants that account for 14% of original area of Atlantic Forest (Nalon et al 2008) and 10% of *Cerrado*. This has led to a large proportion of the vast biodiversity being threatened to extinction (Ribeiro et al., 2009). Furthermore, 75% of the remnant vegetation is located on private properties (Rodrigues and Bononi 2008), highlighting the important role of this group in the conservation planning in São Paulo.

However, in spite of the degradation, the remnants still contain significant samples of its original flora that hosts a diverse fauna, including jaguar and pumas, as well as many other endangered species (Rodrigues et al., 2008). The deforestation dynamics in the state is now stabilized, and showing signals of recovery in line with the forest transition theory (Barreto et al 2013, Farinaci

Batistella 2012, Mather 1992), but there is still the need for a more intensive and qualified restoration effort.

CONFLICTS

The rural space is one of the places where we can see more incisive evidence of the conflict between environmental protection and economic activity. That is because the preservation of forest remnants often requires the sacrifice of farming activities, generating an opportunity cost for the populations that directly depend on the cultivation of their lands. Admittedly, this is the main reason why the Brazilian environmental legislation on forest reserves is often neglected by farmers. On the other hand, the increasing conversion of land for agricultural purposes has been causing losses that are often irreparable in terms of ecosystem services and biodiversity, especially in ecologically relevant regions, as in the case of the Cantareira Mantiqueira Corridor region. This region provides water to one of the most important catchment systems in Brazil. However, the urban pressure is threatening the provision of this service. One of the measures to minimize deadlocks caused by the need to guarantee the water supply in the metropolitan region of São Paulo is to enable the protection of forest remnants in the Cantareira Mantiqueira Corridor as a means to increase the provision water supply.

Regarding the São Paulo State, direct regulation has been the most important type of policy for biodiversity conservation. This has resulted in conflicts with the rural sector about compliance costs and has led to limited effect on nature conservation. The main command-and-control (C&C) instrument for forest conservation is the Forest Code, which was newly amended in 2012. It requires that all private properties set aside parts of the property for conservation, called the Forest Reserve.

In order to reduce the economic impact of the Forest Reserve on landowners some flexible mechanisms are being discussed. One of the options is the compensation of Forest Reserve requirements in another property, as a form of tradable development rights (TDR). The landowners who have deforested more than allowed by law can compensate their deficit in another farm which has more natural vegetation than required.

ECONOMIC INSTRUMENTS ASSESSED IN THE CASE STUDY AREA

The conflicts described above pose important challenges for the preservation of the Atlantic Forest remnants and the compliance with the Brazilian environmental legislation. In order to cope with these challenges, we have analysed two potential instruments that can be implemented in the two regions considered:

(1) Payment for Environmental Services (PES): the underlying logic of PES is that actors who incur efforts to ensure provision of ecosystem services must be monetarily rewarded for beneficiaries of them. The idea of using PES has been suggested and discussed with enthusiasm as a complementary economic policy instrument to command and control policies. Also, when it comes to the necessity of preserving the

Atlantic Forest remnants, PES schemes have been identified as desirable in order to achieve this goal, especially when taken into account the successful case of a PES scheme in the city of Extrema;

Tradable Development Rights (TDR): the "compensation of Forest Reserve" option for compliance with the Brazilian Forest Code allows the landowner which has less Forest Reserve than required by law to compensate its deficit in another farm which has more forest than required. This kind of market-based mechanism is known as Tradable Development Rights (TDR). It could play an important role in this new phase of the biodiversity conservation in São Paulo and Brazil and complement the policy mix by increasing its efficiency. The role of the TDR in the Forest Code is to reduce the compliance costs of the Forest Reserve on private properties and also to remunerate landowners who have natural vegetation on their farm above the Forest Reserve minimum requirement.

OBJECTIVES AND MAIN RESEARCH QUESTIONS

The fine grain study is aimed at assessing the potential implementation of PES and TDR in the Cantareira Mantiqueira Corridor and São Paulo state, respectively. The main research questions were as follow:

(1) Is it possible to scale up pilot PES experiences such as Extrema's case for the whole area of Cantareira Mantiqueira Corridor? If yes, what would be the necessary changes to make it work properly?

(2) Is a PES scheme a suitable and cost-effective instrument for the region? Is a PES scheme a good instrument capable to meet the needs in terms of enhancing water-related ecosystem services?

(3) How would a PES scheme for Cantareira Mantiqueira Corridor interact with preexisting instruments (regulatory mainly)? How would a productive and effective policy mix for the region look like?

(4) Does the region's population have willingness to accept a proposal for PES as a good way to balance their economic, social and environmental needs? Is a PES scheme capable to deliver fairness and legitimacy?

(5) To what extent are compliance costs reduced with TDR, compared with compliance without TDR?

(6) What are the ecological results of an allocation of Forest Reserves based solely on the minimisation of opportunity costs?

(7) Could the addition of an ecological criterion increase the cost-effectiveness of the instrument?

METHODOLOGICAL APPROACH AND CHALLENGES

To answer the research questions we have used a variety of methodologies, such as field trips aimed at collecting data about production costs and revenues for the four most important agricultural activities in the Cantareira Mantiqueira Corridor; factorial analysis and cluster analysis in order to build a typology for agricultural production units; application of a multicriteria tool (MACBETH process) which included a decision conference; literature review and institutional analysis; interviews with key stakeholders and landowners. The state-level analysis comprised the use of conservation planning techniques, such as the software Marxan with Zones in order to simulate different scopes for the forest reserve market, and evaluated their cost-effectiveness.

Data field collection was conducted using the guidelines of Brazilian Water Resources National Policy (Law 9.433/1997). Data was collected using interviews with land owners supported by semi-structured questionnaire (Triviños 1987, Richardson 2010). Investigation was conducted seeking the understanding of agricultural production characteristics including its costs and revenues in the Cantareira Mantiqueira Corridor.

For the development of the typology of agricultural production units, we used data from the Census Survey of Agricultural Production Units of the State of São Paulo (LUPA), held in 2007/08 by the Ministry of Agriculture and Supply of the State of São Paulo (SAA), through the Institute of Agricultural Economics (IEA) and the Integral Technical Assistance Coordination (CATI) (Torres et al 2009). The treatment and analysis of the APU data were carried out in a secret room in the IEA, without the registration information to ensure the non-identification of farmers and agricultural production units.

Regarding the spatial state-level analysis, we used Marxan with Zones software (Watts et al. 2009; Ball et al., 2009) to obtain an approximation of cost-effective allocations of the Forest Reserves using three different restrictions of the market. We used for scenario allocation Marxan with Zones v2.1 and the spatially explicitly analysis were performed using ArcGis (ArcView v9.2), Quantum GIS v1.7.3 and GRASS v6.4.2.

During the study we have faced some methodological challenges, such as the access to data about cost and revenues for the farmers in the Cantareira Mantiqueira Corridor; the difficulty of bringing together the key stakeholders for the decision conference implementation; and difficulties caused by the ongoing revision of the Forest Code.

The assessment of opportunity costs for conservation in the State scale was a methodological challenge for TDR study because we have many different economic activities and land use associated, but we did not have them spatially explicit. So we used the Bare Land Value as a proxy of the land profitability. The database was also not spatially explicit, but we overcame this by building a model that makes the secondary data of bare land value spatially explicit using the combination of suitability for agriculture, distance to infrastructure (roads, urban areas), rivers and elevation model. Also, as we did not want to use valuation of the benefits in monetary terms and decided it was better

to perform a cost-effectiveness analysis than cost-benefits. So we kept the final result as a ratio between the cost ($) and the benefits in terms of hectares of forest recovered in priority areas.

Transferability and comparability of case study results and methods

Effectiveness of instrument mixes on outcome variables

Our study in São Paulo State confirmed the important role that TDR can play in the policy mix for conservation. The ex-ante analysis performed showed a good cost-effectiveness of TDR instrument and a very high potential to both reduce the compliance costs and improve the ecological effectiveness of the Forest Reserve compliance. The use of a State scale was due to the methodological challenge to address the impact of an economic instrument that involves trade at this wide scale. To overcome the difficulty to get data of biodiversity in this scale we used the map of Priority Areas for Biodiversity Conservation produced by BIOTA-FAPESP as an indicator of biodiversity gain. The spatial explicit evaluation proved to be crucial in the assessment of this economic instrument whose potential efficiency derives from the spatial heterogeneities of the territory. Marxan with Zones, the software used, was useful to find solutions for allocating Forest Reserves at minimal costs, which represents the behaviour we expect of a market and, to provide multiple near optimal solutions to meet conservation objectives, as the markets never work at the optimal level.

At the regional level we developed a sample design that considered water catchments with different landscape and socioeconomic context and composition. For the Cantareira Mantiqueira Corridor Region cattle raising (milk and meat) and eucalyptus plantation (timber, firewood or charcoal) drives the higher proportion of agricultural based activities (39.33% and 12.05%, respectively). By using high resolution images from Sensor Spot (2.5 meters resolution) and the Feature Analyst extension for ArcGIS 10 software, we identified all riparian areas defined as protected areas by Brazilian Forest Code. A private opportunity cost of each agricultural activity was obtained from the calculation of land use change between agriculture activities and native forest in these protected riparian areas. Results show that the private opportunity costs in the Cantareira Mantiqueira Region vary from US$ 117.07 to US$ 449.80 $ha^{-1}.year^{-1}$ which represents a range of 384.22% between the lowest and highest private opportunity cost value. The most cost-effective strategy for an extensive forest restoration in this region is to differentiated payments to reflect the private opportunity cost for each agricultural activity individually. PES along the lines of the Costa Rican scheme are standardized and face difficulties in achieving such differentiation. Auctions and TDR have the potential for better targeting of low opportunity cost lands.

The Cantareira Mantiqueira Corridor region and the broad case of forest recovery in São Paulo State are very interesting one with policies currently in the process of evaluation and implementation. In effect, the Cantareira Mantiqueira Corridor Region probably presents a unique case within the whole state of São Paulo for a classic PES scheme: (i) on one side a high priced ecosystem service to be provided by forest recovery at a low opportunity cost, fresh water for the macro-metropolitan region of São Paulo and Campinas and, (ii) a huge market for it, where previous studies already revealed a willingness to pay up to four dollars per month during ten years, which is significant. A successful

policy there could easily be implemented in other regions, such as the Paraíba´s Valley, an important industrial region between Rio de Janeiro and São Paulo states.

Conflicts and synergies between functional roles of economic instruments

In order to assess the interactions among the instruments analysed we used a qualitative approach and results from available studies, trying to point out obvious complementarities/ synergies/ overlaps, etc. based on instrument design issues. It is worth mentioning that we attempted to consider only the direct interactions. All of the analysed instruments interact indirectly, more or less intensively, as they are all policy instruments for conservation. For the proposed instruments (PES and TDR) we assessed potential interactions based on their expected roles and objectives. In a nutshell, a preliminary analysis pointed out that the regulatory instruments interact positively with each other. Emphasis was given to the Forest Code (main Brazilian regulatory instrument) which has been extensively complemented by more recent command-and-control instruments such as the Environmental Crimes Law. Moreover, the Forest Code has a potential complementary interaction with PES and TDR. The two proposed instruments, PES and TDR, could be overlapped in the same area. The interaction could reinforce the role of these instruments; since both are aimed at bringing incentives for conservation of natural areas. But their roles are not redundant as it may seem at first. TDR is more focused on achieving protection of forest biome remnants, whereas PES is more focused on remunerating the provision of a specific ecosystem service.

Impact evaluation and valuation methodologies

Given the ecological importance of Cantareira Mantiqueira Corridor Region, it is necessary to promote actions to diminish the environmental negative impacts mainly in the area where are located the main headwater of rivers that compose the region. A group of stakeholders that have been developing actions in the area met together in the beginning of 2012 to discuss which are the objectives to be achieved aiming to solve the several problems in the region and formed the working group (WG) for the Revitalization of the Cantareira Region, which is composed of NGOs, universities and research government institutes, municipalities, state agencies, PCJ watershed technical committee representatives, among others. The WG agreed that they had not a shared understanding about the meaning of the revitalization of Cantareira region and consequently could not identify which should be the objectives to achieve to revitalize the region. Consequently, it would be difficult to assess which could be the policy instruments most useful to help them solving their socio environmental problems. It was suggested to the WG that they could build a shared understanding about the meaning of the revitalization of the Cantareira region applying the social component of the MACBETH process, which is composed the following phases: (a) analysis of the decision context and design of the intervention process; (b) structuring the problem; (c) building the evaluation model; and (d) sensitivity and robustness analyses and elaboration of recommendations. In our case study only the phases (a), (b) and partially phase (c) were applied since the objective of the intervention was to help the WG to build a shared understanding regarding the revitalization of Cantareira region.

The following activities were done during the process of structuring: the WG worked together with the help of a facilitator during two decision conferencing (DC). During the DC the WG participants expressed their main concerns regarding the problems in the Cantareira region and identified a set of objectives to solve the problems following the value-thinking approach, i.e., the criteria were structured to distinguish between means and ends objectives. The WG identified seven mean objectives which are: present to society the importance of the contribution areas for water production; increasing environmental mobilization in the region; development and implementation of management plans of protected areas; encouraging environmental-friendly agricultural practices; increase rural extension as a way to spread environmental-friendly agricultural practices; conserve forest remnants and biodiversity; reforest areas around the reservoirs between quota filling and SABESP property boundary.

We also performed an institutional analysis aimed at identifying the main factors that enabled the Extrema's case to be considered a successful one. We found that the Extrema's initiative, appears as the evolution of different environmental policies made by the municipality, allied to several factors that led to the introduction of the PES. Analyzing the success of the program takes into account the political institutional framework of Extrema. Despite the similarity with other cities in the region, the process of industrialization in Extrema and the historical rural exodus, coupled with political stability and increased government revenues, has emboldened the initiative. Furthermore, the proximity of policymakers with contractors is extremely important for the results of program. The city government taking on the lead role in driving the program and seeking only external additional supporters differs from the way that other programs have been designed.

Similarities and cross-case comparison

The Atlantic Forest case presents similar challenges, in terms of opportunity costs, to most of the biodiversity conservation and/or recovery cases where the target area has being used and occupied. In these cases the effectiveness of any policy will depend on a more or less voluntary participation of the local agents. Voluntary participation as command and control requirements are either insufficient to assure the minimum the ecologists claim as necessary, or not enforceable as they should be. Actually, it can be said that, as a general rule, command and control policies are absolutely necessary to the establishment of sustainable scales for ecosystems management but are inefficient when it comes to the resources allocation which would lead to them.

In the Atlantic Forest case, as we have seen, a command and control requirement – Forest Code has defined a supposedly sustainable scale for forest conservation and/or recovery, but the institutional and social-economic reality has pointed out the need of complementary economic instruments – PES, TDR, as to induce the economic agents to comply with the law. However, achieving cost-effective results depends on a fine tuning that takes into account the characteristics of the institutional and socio-economic structure in play.

For doing so two methodological approaches were followed: the first one, a farmers' typology (factor analysis and cluster analysis), was thought to produce the relevant information for policy making

resulting from the social and economic heterogeneity of the main stakeholders; the second one, multi-criteria analysis (Conference Decision), was thought as a very effective tool to better understand the stakeholders' demands and views as it is designed to help the stakeholders themselves to do so.

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Mato Grosso, Brazil (EFT & AEM)

BY PETER MAY

CONTEXT

Biodiversity loss through widespread and massive deforestation in Amazonian tropical forests is one of the most serious challenges of environmental policy in Brazil, considered a mega diverse country. Forest remnants still cover about 82% (approximately 4 million km^2) of the Amazon biome. However, forest biodiversity in the Brazilian Amazon, and particularly in the state of Mato Grosso and other areas along the so-called "Arc of Deforestation", is increasingly associated with human-transformed landscapes.

In Brazil, policies regarding forest/biodiversity conservation have traditionally relied on regulatory approaches towards the conservation of species and their habitats, such as protected area creation, land use and infrastructure licensing and command-and-control (C&C) instruments to restrict deforestation. Policies based on the Brazilian Forest Code (1965) recognize the central role of private stakeholders as land managers in forested areas outside the protected area system, but were historically unsuccessful in aligning their interests with conservation goals. The Amazon is a frontier context where survival and speculation are too often the major drivers behind land use decisions. Economic instruments associated with more rigorous efforts to implement the Forest Code initially sought to chastise those municipalities that had exceeded deforestation reduction targets, cutting off credit access and threatening sources of public financing. On the other hand, governments in some states compensated local governments through an ecological fiscal transfer for lands devoted to protection.

CASE STUDY LOCATION AND CONSERVATION CHARACTERISTICS

The case study area is located in the northwest corner of Mato Grosso, bordering the Juruena River to the east and the states of Rondônia on the west and Amazonas to the north – a region the size of Panama comprising seven municipalities, of which three were the object of a fine grain POLICYMIX analysis: Cotriguaçu, Juruena and Juína. The total area of 3.2 million ha in these three municipalities encompasses a mosaic of ranches, agrarian reform projects, timber operations, frontier towns, federal and state protected areas and indigenous lands.

The NW MT region is one of the few remaining areas of significant forest cover in the Amazon biome of Mato Grosso, with around 80% forest cover in 2012. Forest ecosystems in other regions of the state have succumbed to the nation's most aggressive agribusiness complex concentrated on soybeans, cotton and cattle. In the Northwest region (NW MT), extensive grazing on planted pasture is the predominant agricultural land use, even on small farms, where raising heifers for the beef

chain and dairy cows represent important market strategies. Agroextractivists and Indians in the region manage forests for Brazil nut, rubber and palm heart, supplying niche and institutional markets.

We selected the study site due to the high conservational value of the remaining forests in NW MT, the object of a series of national and international projects seeking to conciliate frontier occupation with biodiversity conservation since the early 1990s (Prodeagro, PPG-7/SPRN, Proambiente, UNDP/GEF frontier forests, Petrobras and Peugeot Carbon sink projects...). Approaches tested here serve as models for nature conservation and management of Amazon ecosystems.

NW MT lies fully within the Amazon biome of Mato Grosso, where patches of savanna and transitional (ecotone) vegetation also occur. Lowland humid tropical forest vegetation predominates, similar in structure to that found in Costa Rica and Brazil's Atlantic Forest, with vertical strata of herbaceous plants, bushes, small and large trees in the upper canopy. Besides their high biodiversity and carbon stocks, such forests provide hydrologic stability to local agroecosystems. They are also important for regional climatic regulation, due to high rates of evapotranspiration and infiltration. NW MT and the Juruena River basin have recently become a stage for numerous hydroelectric power generation ventures.

CONFLICTS

Agriculture and infrastructure expansion, spontaneous settlement and forest fires threaten current land use mosaics in NW MT. The prevailing extensive rangefed cattle activities are vulnerable to pasture degradation and pests, while perennial crop production (coffee, cocoa, palm heart) has neither the quality nor supply chains necessary to access remunerative markets. Despite rolling topography in much of the region, continuous soybean cultivation has begun to supplant pastures in parts of NW MT. Poor grassland management practices and the absence of natural predators in deforested open pastures increase the spread of the pasture spittlebug (*Homoptera: Cercopidae*), a scourge of the cattle industry in the Amazon. Paradoxically, proximity to forests may promote biological pest control, a critical link, where the conservation of these ecosystems in buffer areas provides habitat for these predators while generating valuable services to the surrounding countryside (Del Arco et al 2013).

Existing command-and-control instruments (e.g., the national protected areas network; Forest Code provisions requiring 80% of private lands be dedicated to forest conservation) have not secured the necessary legitimacy among regional land users to conciliate an effective protection with the maintenance of human activities. They impose either excessively rigid land use restrictions or remove lands from productive use altogether, leading to demands for compensation or flexibility. The divisive debate over the new national forest code of 2012, whose weakening is still fiercely contested represents one public expression of this conflict.

ECONOMIC INSTRUMENTS ASSESSED IN THE CASE STUDY AREA

Most economic instruments applied to date that affect biodiversity conservation in the case study area focus on public land use, including land reform, protected and indigenous areas. Economic instruments addressing private landowners and stemming from taking advantage of flexibilities present in the new forest code have been proposed as part of a state REDD+ initiative. With this in mind, two particular economic instruments currently used in biodiversity/forest conservation were selected and analysed:

(3) **Agro-environment measures** (AEM) – consisting of agroforestry extension and forest management incentives designed to encourage land reform beneficiaries and other smallholders to protect the environment on their farmland. The analysis of AEM focused on a sequence of Integrated Conservation and Development Projects (ICDPs) and the relationship between colonist participation and forest retention on their lots and at a landscape scale, as compared with the regional deforestation trajectory.

(4) **Ecological Fiscal Transfers** (EFT), which since 2002 provide an area-weighted allocation of "Ecological Value Added Tax" (ICMS-E) revenues to municipalities in order to compensate them for land-use restrictions imposed by protected areas (specifically directed to local public actors).

OBJECTIVES AND MAIN RESEARCH QUESTIONS

The fine grain assessment focused primarily on the social and environmental outcomes in the Brazilian Amazon of the agro-environment measures (ICDPs) and ICMS-E (EFT) in the NW MT policyscape, as well as on the identification of opportunities to improve their locally perceived legitimacy and equitable implementation. The study involved a participatory assessment of ICDP's effectiveness, and of their consistency with the exigencies of the new forest code. The research addressed the importance of financial and technical support and its continuity to individual and collective conservation and income generation efforts over the medium term.

Several municipalities in NW MT had become significant beneficiaries of the ICMS-E due to protected areas and indigenous lands lying within their borders. We assessed the extent to which its allocations had led to additional protected area creation, and whether local governments had budgeted these additional resources to reflect and reinforce the benefits obtained from such conservation.

We also sought to assess the functional roles of AEM and EFT in the policy mix governing the agro-forest mosaic by exploring links and complementarities between these two existing instruments, as well as appraising the effectiveness of additional mechanisms contemplated for implementation in the region. The latter included transferable development rights (TDR) over forest reserves in excess of forest code strictures, and the stimulation of forest reserve retention by ranchers derived from their effectiveness in biological pest control.

METHODOLOGICAL APPROACH AND CHALLENGES

We combined information from a variety of existing datasets with additional interviews, field measurements and group discussions to answer these main research questions. Prior colonist surveys, remote sensing data at different scales and interviews with relevant public actors in the case study area were complemented with application of a systematic conservation planning tool (Marxan) to identify TDR effectiveness, and with a biological control sampling experiment relating forest proximity to pest prevalence. We conducted an ex-post analysis relating participation levels and land use responses of ICDPs in three settlements in an equal number of municipalities, as well as an ex-ante analysis of conservation cost effectiveness of TDR between properties in one municipality (Cotriguaçú).

The methodologies used – literature review, surveys, interviews and focus group discussion and satellite imagery analysis – are complementary tools permitting a combined analysis, building on each other's results to guarantee that the main socio-ecological parameters of the region and the dynamic forces acting on the system are effectively included in the assessment. The NW MT study site, over 1,000 km from the state capital of Mato Grosso over unpaved highways for a good part of this stretch, demanded substantial resources from a relatively small project budget. Complementary funding obtained from Brazilian sources permitted more field research than could otherwise be possible in such a setting, but logistical and communication problems with collaborators and subjects prevented this research from being as thorough as would have been desirable.

The main methodological challenge was to obtain data regarding changes in forest coverage at the individual lot or property level, at which scale we hypothesized greater conservation effectiveness of participation. Participants were compared with "non-participants" in the same settlements, but this comparison was to some extent artificial since Instead, we inferred these results from site visits. Another more significant challenge to ex ante appraisal was to characterize the feasibility of implementing instruments based on the new forest code, in an institutional setting that remains in flux, creating uncertainties about rights and responsibilities, and incidence of costs.

TRANSFERABILITY AND COMPARABILITY OF CASE STUDY RESULTS AND METHODS

Effectiveness of instrument mixes on outcome variables

With regard to agro-environmental measures adopted in pilot projects assessed in NW MT, it is clear that no one instrument adopted can be effective in securing conservation outcomes without the juxtaposition with other instruments evaluated at the coarse grain level. These included a combination of law enforcement (forest code, environmental crimes, forest product transport, etc.), with credit, extension and technical assistance, and access to remunerative market channels (Vivan et al 2013). Effectiveness is also a function of managerial capacity. Local government officers lack orientation regarding public policies available to them, as well as training in the application of incentives and tools available for conservation compatible with local development goals.

Policy effectiveness in a mix requires the capacity to coordinate these policies at the local level. Such coordination is generally poor in NW MT, at the forest frontier. Rather, though managers agree that implementation of a policy mix is very important to achieve conservation goals, in practice they face serious difficulties in doing so. Such difficulties include: lack of information, bureaucratic complexity and a general lack of coordination between government entities at different tiers in the hierarchy and even more so between line agencies. Suggestions to improve the effectiveness of the mix include holding regular meetings where local managers can reconcile priority agendas and instruments. Above all, political will is crucial.

Conflicts between functional roles of economic instruments

Although there is no serious internal conflict at the fine grain level between conservation policies we reviewed, conflicts arise between these and policies of other sectors (reflecting the eternal dichotomy of development vs. conservationism). Serious conflicts exist between instruments heavily promoted by government and the cattle industry to expand the rangefed cattle herd in the Amazon with those designated for conserving and restoring forests. Continuity of financial and technical support to countervailing agro-environmental measures is also crucial and rarely observed in practice, due to shifting priorities and oscillation among political groups in power each seeking to impose its signature on the policy conjuncture.

There is also a conflict regarding the implementation of environmental policies at different levels of governance. The example of the ICMS-E is clear in this sense – lack of knowledge prevalent regarding how municipalities receive resources, for example, reflects this. Local government officials were unable to discriminate between those resources received due to conservation status and those received due to business as usual. The policy, which reflects a supposed intention to stimulate greater efforts toward conservation, contains no earmarking and resources are instead used for general purposes with greater local socioeconomic priority (e.g. road maintenance), which may instead stimulate greater deforestation. There is a serious lack of communication, information and interaction between entities and managers at different levels of governance (May et al 2013).

Sequencing and implementation

Intermittent and non-institutionalized federal governmental funds, which often suffer from abrupt termination, created an aversion by farmers to ICDP initiatives that arose in sequence. Different organizations and agencies (both governmental and non-profit) compete over scarce resources in a struggle to leave their mark on the sustainable development/conservation scenario. There is little synergy between organizations, which often perceive the funding base as a limited good, fomenting competition.

Solutions are available: funding agencies must create conditional rules including recognition and operational interfaces with pre-existing initiatives already operating. New projects and instruments should demonstrate clearly, through consultation with other projects in operation how and why they will not conflict, overlap or counteract other projects, and how, when and how much they will

complement or create synergies in the field. Finally and more important, funding agencies should be adaptive, evolving collective tools to recognize the context and different actors involved before approving funds.

In light of our analysis of the ICMS-E, it is clear that the initial allocation benefits have little impact on protected area designation or management. A sequence of EFT strengthening would provide for inclusion of quality-based incentives to motivate progressively greater commitment to protection and management. Such progression could also reward those municipal governments which take the initiative to dedicate resources from the ICMS-E to support indigenous territorial protection, streambank restoration in line with the forest code and agro-environment measures. However, the ICMS-E clearly is insufficient on its own to finance biodiversity conservation.

An interesting result of the ICMS-E allocation in part of the study area in Brazil refers to sub-allocation of part of the proceeds as project finance to indigenous communities whose lands were the principal sources of the additional funds. However, the proportionate share so allocated (2.5% of the total) does not do justice to the substantial importance of indigenous protection of remaining forests in the study region. The establishment of a more direct link between the source and destination of such allocations is impossible absent earmarking or conditionality in EFT expenditure. Currently, such determination requires annually renewed municipal budget provisions to maintain such sub-allocation.

The main lesson is that it is not easy to adopt a mix of different instruments at the local level. Managers lack capacity or opportunities to exchange information, a crucial aspect of policy implementation (Vatn 2005). The local context may make it more feasible to adapt the mix to reflect distinct actors and receptiveness in different types of property (e.g., indigenous, protected areas, private ownership, land reform settlements, etc.). Monitoring of these instruments and management of information on impacts and their relative effectiveness on the ground is essential so that public managers can make a better choice of instruments to include in the mix.

Transferability of impact evaluation and valuation methodologies

First, considering the biophysical indicators and their spatial scale, and our analytical approaches to track land use changes, case studies may deserve a more sensitive metrics approach at the fine grain (property vs. landscape level). Agroforestry Systems (AFS) adopted on one hectare per farm is invisible from the remote sensing analysis we adopted, though from an economic perspective it had substantial impact on labour use and financial viability of more sustainable practices. The impacts on reorganizing workforce and land use logics may also be imperceptible from a short-term perspective, because they take time and a complex rearrangement of political, economic, ecologic and social issues. On this perspective, sequential imagery at a micro level may be more useful to map transitions, along with time-linked sampling frames to incorporate farm level details for calibrating imagery interpretation with socioeconomic variables.

Second, considering the desirable analysis of temporal scale of impacts, an AFS will take three-five years to reach full economic maturity, and positive impacts in halting deforestation rates would occur only after six or more years at farm level if combined with conducive sectoral public policies (not the situation in most of the Amazon). Potential impacts at a landscape scale will also strongly depend on the functioning of complementary instruments (environmental law and its enforcement, alternative productive chains, technical assistance, local governance of resources and collective enforcement of common rules). Project and government time horizons are usually shorter or asynchronous with these temporal scales.

Finally, rather simple research and monitoring methodologies can offer the systemic view necessary to assess baselines and impacts at farm level in order to check and refine satellite imagery analysis. Protocols can be adapted from Carbon and Diversity measurements in agroecosystems (Vivan 2010) or in rural forests (Michon et al 2013), along with social sciences derived social and economic interview schedules (both structured and semi-structured). Valuation exercises adopted by ethnobotanists and related statistical approaches (Höft et al 1997) may be useful as well. They can be a source for adapting protocols to assess values for regeneration of useful native trees, pollination and pest control, water quality, wildlife sighting and assessing habitat overall functional surrogate indicators (diversity indexes, biomass, horizontal and vertical structure). These approaches used for forest frontiers may permit assessments and valuation of ecosystem services in rural forest or other man-managed anthropogenic forests. Examples are the Dehesas and Montado cork oak forests in Portugal (Santos et al 2012) and Spain, the mosaic landscapes of SE Poland (Baran-Zglobicka and Zglobicki 2011) of the chestnut forests of Corsica (Michon 2011), the Faxinais in southern Brazil (Moro and Lima, 2012), and even the open pine forest with combined grazing in Nordic countries (Oksanen and Riseth 2005).

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