

concept paper

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Governing biodiversity and ecosystem services through market-based instruments?

THEORY AND PRACTICE FOR DECISION-MAKERS

On 19 June 2015, the INVALUABLE European research project presents its main results and recommendations. This last newsletter (N°6, June 2015) is a concept paper which serves as a basis for discussions to be held.

EDITORIAL

Whether in the context of the post-2015 development agenda, the Sustainable Development Goals (SDGs), or the UNFCCC climate conference taking place in Paris at the end of this year, the conservation and sustainable use of biodiversity and ecosystem services remains essential for human well-being, while ecosystem-based options are also seen to offer part of the solution. Development, poverty alleviation, climate mitigation and adaptation, together with biodiversity preservation are thus interrelated policy strategies which should be pooled together and mainstreamed in all economic sectors.

In this regard, by modifying behaviours, allocating scarce resources optimally, and leveraging private funding, market-based instruments (MBIs) are often alleged to potentially better integrate biodiversity and ecosystem services (B&ES) into society.

Nevertheless, for this to happen, appropriate institutional arrangements need to be designed, promoted and implemented; supportive regulations, legal frameworks and policies need to put in place; researchers, decision-makers, practitioners and civil society need to be informed, sensitised but also actively involved.

The INVALUABLE project aims at responding to such societal challenges by engaging with diverse stakeholders. On 19 June in Paris, it publicly presents its main results

and policy-relevant messages and wants to confront these with diverse actors concerned with the conservation of B&ES.

Funded by the ERA-Net BiodivERsA as part of the 2011 joint call for research proposals, the INVALUABLE project, coordinated by the Institute for Sustainable Development and International Relations (IDDRI) in Paris, started in January 2012. It gathers together 9 European institutions and around 40 researchers.

In order to feed useful debates on the potential of MBIs to help better manage B&ES, the project especially focuses on the analysis of payment schemes for ecosystem services (PES) and biodiversity offsets (BO). In particular, the project :

- clarifies the nature and meaning of the heterogeneous group of MBIs;
- informs stakeholders, including decision-makers, about the relevance (or irrelevance) of using MBIs, with associated strengths and weaknesses;
- provides an analysis of the emergence of MBIs in societal discourses in relation with their theoretical foundations;

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- researches the impacts of their implementation on agents' motivations, institutional arrangements, environmental efficiency, social equity, legitimacy, reinforcement of environmental public policies;
- investigates the use of scientific information (e.g. economic valuations) for decision-making, especially through existing Science-Policy Interface bodies;
- studies the role of legal and institutional frameworks in improving the use of scientific information and other types of knowledge for MBIs.

As the reader will see in subsequent pages, overall the INVALUABLE project found that, pushed by environmental economists, the MBIs concept emerged in the biodiversity sector during the second half of the 2000s within an advocacy coalition of big international NGOs, think tanks, environmental international institutions and the private sector. In developing countries and transition economies, the concept is however seldom used and is rather part of a broader green growth agenda. At the implementation level, various institutional arrangements of PES and BO, often grouped under the unique label of MBIs, are actually far from displaying market characteristics. Rather than markets for environmental services, these are either specific contracts, simple payments, or hybrid structures. In this context, some of these so-called innovative financial mechanisms actually adopt the market language in order to be more acceptable in a context of decreasing States' influence. Against this backdrop, scientists, policy-makers

and practitioners should avoid the term MBIs and rather adopt the term 'economic incentives', which encompasses a broader variety of institutional options (not only markets) and allows to think about diverse, multi-layered institutional architectures which are better adapted to local specificities.

Indeed, at the empirical level, case studies of PES and BO undertaken during the project (in Belgium, Germany, France, Indonesia, Cambodia, Guatemala, Costa Rica, Mexico, Brazil, Madagascar) show that institutional design varies largely across regions and contexts. Many actors are involved in PES and BO, including NGOs and intermediary institutions (e.g. parastatal agencies, watershed stakeholders' forums, etc.). The latter's role, promoting or hindering procedural equity, is shown to be essential to explain success and failure of many of the projects. In this regard, beyond evidencing successful environmental outcomes in Mexico, Brazil or Germany, as well as greater involvement in Mexico, some weaknesses were identified. On the one hand, additionality was found to be limited as most PES schemes, for instance, would not enroll farmers with the most harmful degrading activities. Secondly, pre-existing pro-social and pro-environ-

ment motivations should be seriously taken into account when designing those schemes. If not, motivations could be adversely modified and sustainability could be highly jeopardized.

In order to usefully relay some of this generated knowledge to policy-makers, the INVALUABLE project aimed at reviewing Science-Policy Interfaces (SPI) in the field of biodiversity policies. Compared with knowledge exchange exercises for climate change, we found that SPI practices for biodiversity were limited, especially at the local level. Further, our research on conservation triage in Australia and New Zealand uncovered that such methods may falsely reduce uncertainty and lead to overconfidence in wrong decisions. One of the decision support system (DSS) tools to facilitate SPI, QUICKScan, was then evaluated during the project. A Spatial DSS, QUICKScan was shown to increase knowledge, learning and shared understanding in participatory decision-making processes, and thus could be of great interest to enhance MBIs' effectiveness. Finally, a legal analysis of PES case studies carried out in INVALUABLE's WP2 showed that the binary distinction between 'public' and 'private' PES is not appropriate. Policy-makers and practitioners should rather greatly focus on the scheme normative framework, e.g. the presence of monitoring and enforcement procedures and knowledge integration. In the latter case, the strong role of regulation is further to be stressed, especially in establishing arenas for dialogue and public participation within MBIs' design processes.

So as to engage with various stakeholders, such INVALUABLE results and recommendations were widely disseminated during the second half of the project. At the academic level, two special sessions were organized at both European and International conferences for the Society for Ecological Economics in Lille, France, in 2013, and Reykjavik, Iceland, in 2014. At the policy-making and international negotiations levels, a side event was organised at the twelfth Meeting of the Conference of the Parties to the Convention on Biological Diversity in October 2014 in the Republic of Korea. Finally, at the practitioners' level, INVALUABLE results on financing biodiversity conservation were presented at the IUCN World Parks' Congress in Australia.

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“ Institutional design in PES and BO varies largely across regions and contexts. ”

“ INVALUABLE informs stakeholders about the relevance of using MBIs, with associated strengths and weaknesses. ”



Beyond confusions: characterising conservation instruments and their relation with markets

With its first work package (WP1), the INVALUABLE project aims at elaborating a comprehensive theoretical framework in order to characterise market-based instruments for the management of biodiversity and ecosystem services, with a focus on institutions, discourses, epistemic communities and social networks.

WHY SHOULD WE CLARIFY WHAT MARKET-BASED INSTRUMENTS FOR BIODIVERSITY AND ECOSYSTEM SERVICES MEAN?

While the use of market-based instruments (MBIs) for the management of biodiversity and ecosystem services (B&ES) is currently booming, the definition and underpinning theory of these tools are matters yet to be settled. This gap obscures useful debates and jeopardizes efficiency when designing and implementing policies. It is therefore necessary to advance in the definition, theory and consistent classification of these instruments if one wants to analyse their respective advantages and risks.

This clarification is also necessary because the emergence of MBIs has influenced national conservation policies and the role of the State in environmental governance, and has consequences for the international regime of biodiversity conservation, particularly in relation to the attribution of responsibilities among public and private spheres.

A comprehensive theory of MBIs, we contend, has to incorporate insights from different disciplines, such as economics, anthropology and economic sociology. Similarly, historical and stakeholder analyses are necessary to locate these tools in their socio-political framework, which is essential for assessing their scope of applicability and functioning. In this regard, building on cases in Brazil, Costa Rica, France, Madagascar and Cambodia, and on examples of mitigation banking in Europe and the US, the INVALUABLE project examined different institutional arrangements promoted under the name of MBIs. This allowed, first, to develop a typology of these instruments and, second, to identify and discuss gaps between discourses and theory. To complement this, the historical analysis of the emergence of MBIs was done simultaneously at the global and national levels, building on the same case studies.

HOW AND WHY HAVE THESE MECHANISMS EMERGED?

The term of MBIs appeared in the 1970s and was applied to US environmental policy during the 1980's (Boisvert, Méral *et al.*, 2013; Méral, 2015; Hrabanski, 2015). The assumption they relied upon was that policies would be more effective if price signals were sent to stakeholders to induce changes in individual behavior. Compared to administrative regulation or "command-and-control" (this term also emerged at this time with a very negative connotation), MBIs appeared as innovative and promising instruments. In the field of biodiversity, the MBIs concept arose during the second half of the 2000s following the political implementation of the concept of ecosystem services and payments for ecosystem services (PES). Environmental economists played an active role in transferring economic analysis (based on economic rationality, internalisation of externalities, propriety rights, and efficiency of market approaches, etc.) from pollution management to biodiversity issue. Economic arguments have then been used by conservationists and environmental institutions in order to find new solutions for the management of biodiversity. Besides, an advocacy coalition between some economists from scientific arena, economists and financial experts from big international NGOs (BINGOs), think tanks, environmental international institutions (OECD, IUCN, UNEP, etc.) and private sector appeared in the mid-2000's (Hrabanski, 2015), as it is reflected in recent exchange platforms like The Economics of Ecosystems and Biodiversity (TEEB) and the Business and Biodiversity Offset Program (BBOP) that actively contributed to promote and diffuse MBIs for B&ES.

In developing countries, like Cambodia or Madagascar, PES and biodiversity offsets (BO) are promoted and implemented by BINGOs or through common initiatives between these BINGOs and international firms like Rio Tinto or Sheritt in Madagascar (Bidaud, Hrabanski *et al.*, 2015), often as part of a green growth agenda. In these countries, PES and BO schemes are voluntary and experimental, and are not framed by a national law. Hence, most national experts and staff of environmental administration do not know about the term MBIs and consider PES and BO schemes as a part of the portfolio of these international stakeholders (BINGOs and global companies). The situation in other emerging countries, like Brazil or Costa Rica, is different. In these two countries, national or federal PES programs have existed for a long time. Debates about REDD+ are for instance crucial in Brazil (Aubertin, 2015; Filoche, forthcoming). Nonetheless, the term MBIs does not seem to be used explicitly in these countries either.

WHAT ARE MBIS FOR B&ES AND DO THEY DESERVE THEIR NAME?

In the literature, there is a great heterogeneity of instruments referred to as MBIs and the only common feature they seem to share is that they aim at changing behavior through a price signal. To analyze this heterogeneity and diversity of institutional arrangements, INVALUABLE developed a typology of MBI based on the economic characteristics of each instrument. This typology identified six types of MBIs: direct markets, tradable permits, auctions, Coasean-type agreements, regulatory price changes and voluntary price signals (Pirard, 2012; Pirard and Lapeyre, 2014). Thereafter we found that the majority of instruments labeled as MBIs actually have little to do with the market. These indeed do not follow the logic of a market as the price is not determined by the confrontation of supply and demand. In fact, the emergence of the term MBIs may be instead considered as a new way to group other types of instruments that in

A VARIETY OF BO AND PES

While all of these are labelled under the concept term MBIs, there is actually a great variety of biodiversity banks, which feature various economic characteristics and differentiated relations to markets. A typology based on three criteria was defined to better analyse these: (i) nature of the banks (status and objectives), (ii) statement content in banking implementation (creation and management of a biodiversity bank), and (iii) method of valuation of biodiversity (environmental or economic). Five key categories that cover the spectrum of biodiversity banks may then be identified:

1) private non-commercial banks (private single-user banks in which the private promoter or operator is also the client), 2) private commercial banks (managed by a private entrepreneur whose biodiversity credits are available for sale on the market, e.g. wetland mitigation banks in the US), 3) hybrid commercial banks (set up by agreement between private and public entities, e.g. BioBanking in New South Wales, Australia), 4) public commercial banks (administered by public entities to offset impacts caused by either public or private development

project, e.g. biodiversity offset supply in France) and 5) public non-commercial banks (generate biodiversity units solely for use by various public agencies, e.g. Land pools in Germany) (Froger, Ménard *et al.*, 2014). In each case, the characteristics of transactions are specific and lead to differentiated institutional arrangements, which might not relate to any market.

In a similar way, we observed a great variety of PES mechanisms. We for instance found, under the name of PES, instruments such as social transfers, compensation systems, disguised subsidies, etc. As such, PES are not implemented in an "institutional vacuum". Analysis of PSE therefore requires greater consideration of the role of institutions and social and political context. PES programs can take very different forms in different countries. PES can be used to legitimize political support for forestry sector like in Costa Rica, to integrate the ES framework in a national law, like in the Brazilian Forest Code, or to obtain sustainable financing for protected areas managed by conservation NGOs, like in Madagascar and Cambodia.

fact do not have a price dimension. This is for instance the case of pre-existing instruments which, recently relabeled as MBIs, just reflect new perceptions and representations of them, and adopt the market language to be more acceptable in a context of free trade and globalization.

WHEN ARE THEY APPROPRIATE POLICY TOOLS FOR IMPROVING BIODIVERSITY CONSERVATION?

Insights from institutional economics can be used to distinguish 3 features of transactions that define different structures of governance: specificity, uncertainty and frequency. The appropriateness of governance structures would then depend on the combination of these features. Markets tend to be effective when assets hold a low degree of specificity, when uncertainty related to the transaction is low and when exchanges are frequent (Lapeyre and Pirard, 2013; Muradian and Gomez-Baggethun, 2013). US mitigation banks, BioBanking in Australia or the carbon market can be considered as examples of this type of governance structures. At the opposite, when the situation is characterised by high asset specificity, high uncertainty and rare transactions, structures of governance based on centralized authority (state or firm regulation) tend to be more effective. In between most governance structures are actually neither market-based nor hierarchical, but have elements of both (hybrid) (Lapeyre *et al.*, 2014).

The governance of ES is characteristically multi-layered. Multi-level governance entails a complex architecture involving a multiplicity of actors and many interrelations between the 'local' and the 'global.' The main issue for policy makers is thus not to select one specific instrument in a toolbox but to organize institutional arrangements between stakeholders at different levels to constitute a relevant policy mix. More specifically they need to ensure the legitimacy of decisions. The case studies indicated that PES design is neither just a contract between providers and users nor a market but rather a complex process sensitive to the economic and institutional context, including for example power relations or conflicts between stakeholders (Chervier, Peresse *et al.*, submitted). Analysing this context before selecting a PES design is a major step to improve acceptability and relevance of a PES scheme.

For all these reasons, we suggest adopting the term "economic incentives" to characterise measures intended to change behavior through economic signals. The use of the term "economic incentives" (that can be in cash or in-kind, collective or individual, etc.), we contend, is relevant because it spans a broad spectrum of possibilities and because it does not define a priori a specific system of governance. Economic incentives are not tools leading to a specific management of ES but are part of integrated policies combining economic and non-economic (legislation, communication, awareness, participation, etc.) measures. Practitioners and decision-makers should therefore be careful, when designing MBI schemes, to take into consideration this diversity of options and combinations.

“The majority of instruments labeled as MBIs actually have little to do with the market.”

THE DIVERSITY OF GOVERNANCE ARRANGEMENTS OF PES SCHEMES IN CAMBODIA

In order to illustrate this diversity of governance scheme, we build on the three variables defined by Muradian *et al.* (2010) for the classification of PES schemes and apply them to three contrasting schemes in Cambodia. Variables are: the directness of transfer or “the extent to which individual providers receive direct payments from the ultimate beneficiaries of the environmental service”; the level of commodification of the environmental service or “the extent and clarity with which compensation received by the environmental

service providers has been defined as a tradable commodity”; and the importance of the monetary payment or “the relative role of the transfer in steering the desired land use among providers of environmental services”. The use of these variables for analysis allows us to illustrate the great diversity of PES schemes in Cambodia (see Figures 1 and 2). In practice, Cambodian schemes are hybrid structures, involving individual and collective approaches, with composite actors involving state, private and NGO elements.

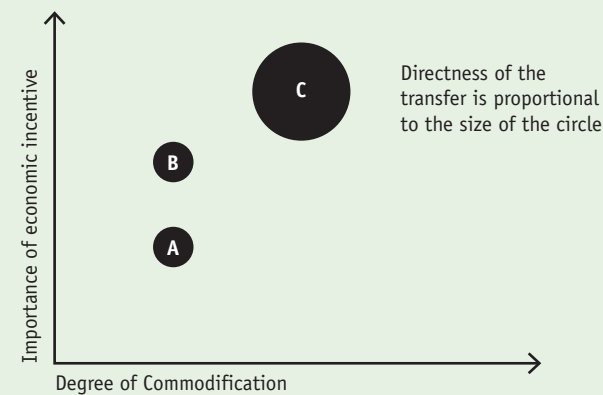
FIGURE 1. EXTRACT FROM MILNE AND CHERVIER (2013)

Scheme	Directness of transfer	Level of commodification of ES	Importance of the economic incentive
A Community conservation agreements	The buyer (NGO) transfers funds through commune committees for agricultural support and local patrolling.	Commodification is low as disbursement of the payment depends on compliance with land-use plans or non-logging/non-hunting rules.	Most forms of payment are in-kind and collective. The program also focuses on clarification of rights and building of local institutions.
B Biodiversity friendly “ibis rice” certification	There are a number of intermediaries between the ultimate buyers (hotels, restaurants and urban consumers) and the community service providers (farmer association).	The disbursement of the payment depends on compliance with land-use plans or non-logging and non-hunting rules. The premium is fixed and not linked to the level of environmental service provided.	Payments are individual and monetary, delivered through a premium on the paddy price. Besides, the program also focuses on the clarification of rights and building of local institutions.
C Bird nest direct payment	The ultimate buyer (NGO) gives direct payments to individual service providers.	Bird nest protection is measured in the number of protection days, which is converted into monetary terms based on average daily wages in the area.	Payments are monetary and individual. Monetary payment is the only form of intervention. The level of payment corresponds to local daily rates for labour.

FIGURE 2. THREE CAMBODIA'S PES Schemes

Three Cambodia's PES schemes in terms of importance of the economic incentive, degree of commodification and directness of the transfer.

Adapted from Muradian et al (2010)



Source: Muradian, R., Corbera, E., Pascual, U., Kosoy, N., May, P. H. (2010). “Reconciling theory and practice: An alternative conceptual framework for understanding payments for environmental services”. *Ecological economics*, 69(6): 1202-1208.

Implementing market-based conservation instruments on the ground: achievements and challenges

In a second step, the INVALUABLE project sought to assess impacts from some MBIs. In particular, it explored advantages and risks from biodiversity offsets and payments for ecosystem services, drawing comparative lessons across several case studies.

The overarching objective of work package 2 (WP2) was to evaluate the environmental effectiveness, cost-effectiveness and equity of payments for environmental services (PES) and biodiversity offsets (BO) through case study research in Asia, Latin America and Europe. Effectiveness and equity, alongside cost-effectiveness, are critical analytical lenses for understanding the environmental and social outcomes of incentive-based conservation. Effectiveness refers to how well PES and BO perform against their environmental objectives, i.e. the extent to which the PES and BO land management strategies have translated into an increased provision of ecosystem services and biodiversity. This entails evaluating also how additional such performance compares to what would have happened without the provided incentives, as well as to interrogate the likely permanence of such outcomes over time. Equity, in turn, refers to how well these conservation instruments feature in terms of legitimacy and fairness, i.e. the extent to which the instruments involve all relevant stakeholders while empowering them in decision-making processes, and how the correspondent benefits from participation are fairly used or shared by participants.



The methods employed in case studies range from strict impact effectiveness assessments based on treated *versus* control units and econometric analysis, to largely qualitative analysis of institutions, governance and equity based on literature review, interviews and participant observation. Such diversity of approaches can be explained by three principal factors. First, the different design features and implementation contexts of the case studies selected did not allow for a set of common research questions to be thoroughly explored, given the expertise of INVALUABLE researchers and local partners in case study countries. Second, each case study relied on very different budgets for the research process and this constrained empirical efforts and depth. And third, the data obtained or available in each case differed considerably in amount and quality, which also compromised certain level of analytical enquiry. In what follows, we do not provide an exhaustive review of the results, since these can be found in the correspondent cited references, but highlight key findings and draw comparisons across cases when relevant. The main characteristics of WP2 case studies, the research questions and the methods employed are found in Figure 3 below.

INSTITUTIONAL INTERSECTIONS AND PROCEDURAL EQUITY

As highlighted in WP1 results, PES and BO are new institutions that when ‘parachuted’ into rural contexts interact with existing complex socio-ecological systems. These systems, local or regional, are already made up of multi-layered and dynamic institutions and governance systems that jointly determine how natural resources are managed, by whom and for whose benefit, and they embed

specific socio-political processes and cultural dynamics which also determine the environmental characteristics of such systems. For PES and BO to be environmentally and socially successful then, the new institutional rules need to “fit” with or be adapted to these existing dynamics and both new and already existing actors will have to coordinate and cooperate.

As shown in Figure 3, institutional design varies largely across case studies. The European cases include one case of a more sophisticated, market-based, offsetting scheme in Germany and two cases of agri-environment measures that resemble public state subsidies for conservation in managed agricultural landscapes. Case studies in developing countries also differ, including: public-driven programmes of payments for watershed and biodiversity services (Mexico), developed at either national or regional scales; public incentives for the adoption of more sustainable farming and forestry practices (Costa Rica and Guatemala); and four projects of conditional payments for biodiversity conservation (Cambodia), watershed services (Indonesia) or carbon mitigation (Brazil and Mexico), which are implemented at sub-regional and local levels and combine both public and private market finance.

WP2 research has aimed to shed some light on the social interactions unfolding in incentive-based conservation. For example, the adoption of agri-environmental measures by all kind of farmers (small and large-scale) in the Walloon region, Belgium, effectively increases when a hybrid combination of non-governmental and government actors cooperate to persuade farmers about the advantages of pursuing environmentally sound measures (Dedeurwaerdere *et al.*, submitted). Seemingly, the increasing participation of farmers in one of the studied PES schemes in Mexico can be partly explained by the fact that the NGO in charge of the project has been adaptive to local resource management contexts and effective in delivering payments. The organisation’s legitimacy as a PES broker has thus increased over time across the state of Chiapas and beyond (Hendrickson and Corbera, 2015). In these case studies, technical intermediaries play a critical role in connecting different stakeholders as complementary enablers of rural development strategies.

ENVIRONMENTAL EFFECTIVENESS

Quantitative studies by Costedoat *et al.* (2015a) in Mexico and Chervier and colleagues in Cambodia (forthcoming) demonstrate that PES can have a positive impact on forest conservation. For example, the former demonstrate that payments for biodiversity conservation in the state of Chiapas can contribute to additional reduced deforestation of approximately 10%, i.e. for each 100 hectares of forests’ payments,

the latter contribute to protect 10 hectares that would have been otherwise deforested by agricultural development or cattle raising enterprises. In Cambodia, deforestation has also substantially diminished in the conservation easement lands compared to other neighbouring, although such reduction has been more significant in remotely-located easements than in those closer to in-built infrastructure and cities. In Germany’s biodiversity offsetting scheme, Mazza and Schiller (2014) show that specific environmental restoration is underway in several sites but that the permanence of such positive impacts over time cannot be assured given the lack of strong government monitoring.

Besides PES and BO environmental performance, critics argue that these instruments rarely offer anything to support rural development, other than a limited cash transfer. The PES schemes analysed in Guatemala, Costa Rica and Brazil, however, have been designed to overcome such situation and they promote activities in line with ongoing development efforts. Guatemala’s PINFOR program promotes local reforestation efforts geared at establishing future commercial plantations and covers its full set-up costs, provided that such plantations thrive in good quality and are made productive (Le Coq and Sandoval, 2015). Costa Rica’s program aims to promote a transition to organic agriculture and sustainable cattle production. Nevertheless, the fact that payments are made *ex-post* and that they do not fully cover the costs of adopted actions have significantly decreased the additionality of the scheme (Lamour *et al.*, 2015). The Brazilian project, on the contrary, which combines *ex-ante* payment with an individually-targeted investment plan for each participant farmer, has led to broad participation and is already translating into positive environmental outcomes (Simonet *et al.*, 2015).

Based on the evidence provided by our case studies, we also identified two main weaknesses regarding the likelihood that PES and BO meet ambitious environmental goals. On the one hand, most cases are limited in their capacity to enroll parcels with high opportunity costs, and are thus partially unable to reverse the most harmful degrading activities (Russi *et al.*, 2014). Schemes very often target lands with low to middle opportunity costs or the activities to be adopted only represent a small addition to the resource management strategies already underway. The case studies in Germany, Belgium, Costa Rica and Guatemala show that payment level and payment sustainability over time is key to determine enrolment rates. This in turn poses a difficult political question, i.e. how long are we willing to sustain payments for environmental conservation? This question takes us to the second observation, which concerns the impact of PES and BO on participants’ intrinsic motivations. Lapeyre *et al.* (2015) and Chervier (submitted), for example, show that intrinsic motivations can play a more important role than economic incentives when enrolling farmers in the scheme and that the danger of changing pro-conservation behaviour into a utilitarian conservation ethos—no pay, no conservation—is real and

currently happening. Fitting the design of PES schemes to factors that increase satisfaction—such as autonomy, fostering personal development and social relatedness—can be a way—yet to be explored—for minimizing such threat (Ezzine-de-Blas *et al.*, submitted).

DISTRIBUTIVE EQUITY

In Cambodia, Guatemala and Mexico, where tenure regimes are ultimately collective, benefit sharing becomes critical to understand social outcomes. Hendrickson and Corbera (2015) show that the way the scheme has been designed allows informal right holders in a common property regime to participate in the project, allocating a share of their families’ managed lands into the program. The authors highlight that as a result of such involvement, these informal right holders have become more empowered in natural resource management and decision-making at community level, now actively partnering with land titled farmers. Costedoat and colleagues (2015b) report a similar finding in a community receiving biodiversity conserva-

tion payments in Chiapas, which allow both formal and informal landholders to benefit from payments. The latter have then used their participation to stake further claims on their managed, but yet not owned cultivated lands, and they feel now more entitled to benefit from environmental services (Costedoat *et al.*, 2015b).

FUTURE RESEARCH

Future research efforts need to better understand spillovers, the effects of treated populations’ heterogeneity in policy impacts, and how PES and BO work in policy mixes. Answering these questions, as part of the broader impact assessment overarching interrogation of what works, what does not, where and why, will need building continuous solid evidence through new research partnerships. These will require a greater collaboration between researchers, conservation managers and donors in order to support long-term partnerships and implement impact evaluation protocols in early stages of policy design (Baylis *et al.*, 2015).

“ PES can have a positive impact on forest conservation.”



FIGURE 3. MAIN CHARACTERISTICS OF WP2 CASE STUDIES

Case study (Country)	Research questions		Methods		Scheme characteristics (objective, scale of implementation, payments)		Involved actors
ECO-ACCOUNTS PAYMENTS SCHEME (GERMANY)	Has the eco-accounts scheme succeeded in guaranteeing farmers' participation and operational transparency? Are the implemented activities additional and permanent in the long term?	What are the advantages and risks compared to previous mitigation strategies ("license to trash" <i>versus</i> increased conservation)?	Combination of semi-structured (24) and structured interviews (21) to capture costs and benefits of the scheme; review of administrative and technical procedures.		Acquisition of ecological points issued from ecosystem restoration, to restore on-site ecosystem degradation.	Baden-Württemberg region. Payments are in form of investments in compensation measures such as the restoration of grasslands, rivers and the reintroduction of fauna.	Project developers (municipality or private stakeholders) – Compensation agents (municipality) – Technical advisors (private stakeholders)
AGRI-ENVIRONMENT MEASURES (GERMANY)	What are the key design features of this measure? Is the scheme additional? What drives farmers to participate in the scheme?		Semi-structured interviews with representatives from the environmental and government sectors (14); structured interviews for participating (17) and non-participating (7) farmers.		Conservation of species-rich grassland. Baden-Württemberg region. Cash payment with a cap of €40,000 per year and farm unit.		European Union (50% funding) – Ministry for Rural Area and Consumer Protection from Baden-Württemberg (50% funding, and management costs) – Farmers.
AGRI-ENVIRONMENT MEASURES (BELGIUM)	Are multi-stakeholder cooperation and social learning in collaborative networks of state and non-state actors critical in determining participation in the scheme and its effectiveness?		Structured interviews with participating farmers (34).		Increase of ecological quality through the adoption of one from 13 AEM, ranging from light (farm hedges) to deep measures (extensive cattle and grasslands of high biological value)		Ministry for Rural Area and Consumer Protection from Baden-Württemberg – Environmental management organization – Peer-to-peer farmer organizations – Farmers
PAYMENTS FOR HYDROLOGICAL SERVICES (INDONESIA)	How do multi-stakeholder intermediary agencies and internal governance rules impact PES effectiveness?	How do intrinsic and economic motivations operate to enroll participants of the PES scheme?	Structured interviews with participating farmers (270)		Protection of forests to enhance hydrological services (water quantity and quality). Watershed level.	Reforestation and conservation payments of 125 to 350 USD/ha/yr.	Water private company – Private stakeholders (water users) – Provincial government – Local NGOs – Farmers.
CONSERVATION AGREEMENTS FOR FOREST PROTECTION (CAMBODIA)	How effective are conservation agreements in guaranteeing forest conservation?	Has the scheme changed participants' motivations to conserve the forests?	Covariate matching at grid scale; Household interviews in treated and control villages (205).		Conservation agreements to halt deforestation in the Cardamom mountains. Sub-regional level.	Community cash and in-kind payments equivalent to 1,700 to 8,200 USD/ha/yr.	Farmers – International NGOs – Commune council – PES local institutions composed by groups of farmers.
PES/REDD+ PROJECT (MEXICO)	What factors explain farmers' willingness to participate in the project?		Semi-structured interviews with participants, non-participants and former participants in four project communities (114).		Reforestation payments to local communities in order to sell forest carbon credits. Regional level (states of Chiapas and Oaxaca).	Cash total payments vary depending on the type of agroforestry system implemented and the number of hectares enrolled.	Local landholders – Community assembly – Private carbon developers – International universities.
PAYMENTS FOR HYDROLOGICAL SERVICES (MEXICO)	Which are the most relevant and locally perceived benefits and costs of participating in the scheme?		Focus groups and semi-structured interviews with participants in two villages (72).		Forest protection in hydrological sensitive areas: Interdiction to deforest, hunt, raise cattle and active forest protection.	National program. Analysis of two peri-urban communities enrolled in the program. Cash payments. 29 to 84 USD/ha/yr.	State forest administrations – Private technical intermediaries – Community assembly – Landholders.
PAYMENTS FOR BIODIVERSITY CONSERVATION (CHIAPAS)	What is the environmental effectiveness of the PES program? What role do intermediaries play in program implementation and its cost-effectiveness?	How do current PES contract characteristics compare with participants' preferences? How has the PES intersected with resource management institutions, particularly tenure, and which ecological and social consequences have resulted?	Impact evaluation through spatial matching; Choice experiment; Semi-structured interviews with technical intermediaries (21), focus groups (2) and semi-structured interviews with community members (30).		Forest protection in biodiversity hotspots. National program. Impact evaluation conducted at sub-regional level in the state of Chiapas. Cash payments. ~40 USD/ha/yr.		State forest administrations – Private technical intermediaries – Community assembly – Landholders.
PAYMENTS FOR REFORESTATION (GUATEMALA)	Impact of the national reforestation program (PINFOR) on land-use trajectories of rural associations.		Structured interviews and participatory mapping with the management board of associations (20).		Providing kick-off investments for commercial plantations in rural private and community land. National program. ~225 USD/year and per project for 6 years.		National Institute for Forests (INAB) – Private and Community landowners.
AGRI-ENVIRONMENTAL PAYMENTS FOR SUSTAINABLE CATTLE MANAGEMENT (COSTA RICA)	Adoption of agricultural organic practices.		Econometric and spatial analysis of household questionnaires and farm maps (62).		Supporting transition to organic agriculture, agroforestry and cattle production. National program. Case study focuses on cattle organic investments. Average of 985 USD per adopted technology.		Cattle ranchers – Technical intermediaries – Ministry of Agriculture and Cattle.
PES/REDD+ PROJECT (BRAZIL) ¹	REDD+ environmental effectiveness.		Before-after-control-intervention in eight rural villages involving structured questionnaires (181).		Forest protection through investments in organic and no fire agriculture, agroforestry and cattle production. Local project (municipality of Altamira). <530 USD/year for 10 years.		Family small holders – National NGO.

¹ Case study in collaboration with CIFOR REDD+ Global Comparative Study.

Engaging with policy makers on market-based instruments: decision support tool, knowledge and the law

In a third step, the INVALUABLE project built on existing Science-Policy Interface (SPI), decision support system (DSS) tools, and legal analysis to formulate relevant options to better integrate scientific results and policy in the field of MBIs for B&ES.

Although research on biodiversity, ecosystem services and economic valuations, more specifically, has proliferated, this information rarely informs conservation policies in practice. One major challenge in this context is the scientific uncertainty that may hamper effective conservation efforts. Likewise, to ensure the legitimacy of economic approaches, the knowledge and values of stakeholders, especially at local implementation levels, need to be considered. Departing from these persisting ‘implementation gap’ and ‘integration’ challenge, the aim of work package 3 (WP3) was to illuminate and elaborate on institutional or organizational, technical as well as legal approaches to enhance the science-policy interface (SPI) in the development of MBIs.

POLICY-ORIENTED SPI DESIGN AND PRACTICE

Against this background, a first sub-working package wanted to gain a more systematic analytical understanding about the practical working of supposedly innovative SPI formats. When doing this it was, however, addressing the ‘political’ dimension of knowledge use, misuse or rejection. It paid heed to the fact that the unstructured nature of the problem of biodiversity decline requires more participatory, policy-oriented and context-sensitive SPI.

Because experiences with and critical academic considerations of MBIs in practice were hard to find, a major part of our initial work was dedicated to reviewing academic work and scanning practical experiences to gain a more comprehensive understanding of science-policy interfaces. When screening the landscape of SPI practices in the field of biodiversity policies, it became clear that limited empirical and aca-

ademic experience existed especially for locally rooted and more policy- and practice-oriented formats.

In comparison, a fairly elaborate repertoire of integrative knowledge brokerage (KB) practices has flourished in the climate change policy field. However, our research on climate services in Germany (Climate Service Center), the UK (ClimateXChange; UK Climate Impact Programme), and Switzerland (ProClim), suggests that this decision orientation in KB is often ‘tinsel and glitter’ rather than true responsiveness to political realms. Linear knowledge transfer from science to policy still prevails. Surprisingly, even exceptionally innovative cases, like the United Kingdom Climate Impact Programme (UKCIP), risk being canned by clients if they induce undesired shifts in the distribution of power in science and policy. Hence, re-designing SPI in bottom-up oriented ways remains a major challenge and may incite heavy resistance in science and policy.

Among the few cases where economic approaches to biodiversity conservation actually already inform policies, is the controversial Project Prioritization Protocol (PPP) model for prioritizing investment in threatened species. It is based on the concept of conservation triage, which means that only a set of threatened species is actively managed and financed, while other species are left to fend for themselves. The experiences of national and state conservation departments in Australia (New South Wales, OEH) and New Zealand suggest that involving different stakeholders in decision-making processes is important to acknowledge the societal values associated with threatened species. However, an unresolved concern persists because translating science into numbers may obscure the high uncertainty in ecological systems and thereby create false certainty in decisions.

Finally, the INVALUABLE project reflects on the global knowledge ‘politics’ in environmental NGO campaigns. The work scrutinizes the role and practices that transnational actors, like WWF, play in promoting Euro-American scientific knowledge claims about biodiversity, while undermining local and alternative ways of ‘knowing and valuing nature’.

EXPLORING KNOWLEDGE INTEGRATION FOR ECONOMIC APPROACHES

The challenges and opportunities associated with biodiversity science-policy interfaces and issues relating to knowledge integration were the focus of a two-day expert workshop held in March 2014 in Freiburg, Germany. The two-day event brought together 17 experts in the fields of SPIs, knowledge integration (KI), and economic valu-

FIGURE 4. QUICKSCAN VISUALS



ations and instruments for biodiversity conservation and ecosystem services management. Apart from more academic considerations, the workshop was a valuable occasion to exchange in field experience with specific practical tools, methodologies and approaches for KI and SPIs. After two days of exchange on topics of shared interest, major insights of the workshop were, that, for biodiversity and ecosystem services management:

- it is important to account for the complexity of socio-ecological systems;
- it is important to consider carefully which stakeholders and political target groups to include in decision-making processes;
- it is important to keep track of the quality of KI tools (like maps) because of the political role these can have in decision support;
- it is important to avoid narrow view on ecosystem services and valuation.

SOCIAL EVALUATION OF THE USEFULNESS OF THE QUICKSCAN TOOL TO SUPPORT SPATIAL DECISION MAKING

Environmental challenges require contemporary policy to be responsive, innovative and forward-looking. Different tools meant to support policy-making processes are available and might be of value in building market-based approaches to conservation. For instance, computer-based tools, known as Decision Support Systems (DSS), are information systems developed with the objective to support decision makers in the identification and search of solutions to complex management problems. Yet, it appears that most DSS are rarely used. While there are many reasons for this, missing user involvement during tool development appears to be the main cause as users end up

with tools which they perceive as too complex and time consuming, i.e. a “black box”.

As a response, QUICKScan tool is a Spatial Decision Support System meant to support participatory decision-making processes. The tool was developed in collaboration with the potential users with the aim to address current policy-maker needs; stakeholder involvement during tool design and development also helped to keep key aspects at focus. For instance, in contrast to other comparable softwares, QUICKScan is conceived as a “white box” as users can follow the logic behind the outcomes produced quite easily. This improves transparency of the process and reduces the uncertainty of the outputs. Transparency is strengthened also by the possibility to trace the steps made to reach a certain outcome at a later time when for instance new information becomes available, or a need emerges to verify the reasoning followed (Verweij *et al.*, 2012). This is also beneficial in terms of improved legitimacy when a policy decision needs to be presented and justified to stakeholder groups since possible uncertainties can be addressed. Its use in the planning of MBIs development—especially spatially-explicit schemes like habitat banking—could thus be of great interest to enhance their effectiveness in the field. The aim of our study was to evaluate how the QUICKScan software performs on “soft aspects” and more specifically on knowledge integration, learning and shared understanding when used during a participatory process.

During two workshops, participants were asked to complete a pre-test questionnaire before using the QUICKScan software tool, and to complete a post-test questionnaire when the session ended. In addition to this we interviewed a few participants from the second workshop by telephone to explore some aspects that emerged from the post-test

“Translating science into numbers may obscure the high uncertainty in ecological systems.”



questionnaires. The results collected suggest that the QUICKScan software performs well on the variables of interest (Rodela *et al.*, 2015). Participants have evaluated with high scores aspects around knowledge, learning and shared understanding, which can be linked back to the opportunity participants have to take an active role and contribute with own knowledge and expertise throughout the mapping process. The QUICKScan tool allows fast processing of data and prompt display of look-up maps and other visualizations which are immediately available for discussion (Figure 4 above). This greatly benefits the discussion as gaps and mistakes in the line of reasoning can be identified promptly and the process refined. Making explicit the logic of the steps taken benefits the process and allows for a sense of ownership of the outcomes achieved (e.g., maps) because participants can see the way in which their knowledge was integrated in the final outcomes. The visualizations produced by the QUICKScan help the discussion and allow to un-lock issues of interest. However, results also suggests that prior knowledge of GIS helps the participants in better understanding the outputs QUICKScan produces such as maps, diagrams, tables (Rodela *et al.*, 2015).

THE ROLE OF REGULATION IN THE DEVELOPMENT OF MARKET-BASED INSTRUMENTS FOR BIODIVERSITY AND ASSOCIATED KNOWLEDGE INTEGRATION

The INVALUABLE project also focused on the role of regulation in the design and implementation of market-based instruments for biodiversity, especially payments for ecosystem services (PES) and mitigation banking schemes. The study was two-folded. First INVALUABLE addressed PES and the role of regulation to ensure their effectiveness. Building on case studies carried out within WP1 and WP2, we considered PES in four countries: Indonesia, Costa Rica, France, and Belgium. For each case study, we analysed the nature of regulation in the concerned PES, its intensity, and the main elements of its content as compared with success factors of PES, as described in literature and in WP2. Whereas public regulation refers to unilateral norms enacted by public authority, we also considered private regulation, i.e. any voluntary norm negotiated and adopted by private and public partners to a PES, such as in private contracts. We thus investigated the extent to which the intervention of the public authority in the design and implementation of PES contributes to their success. Two main results emerged. First, the legal analysis suggests that the binary distinction between 'public' and 'private' PES is not relevant from a legal point of view. A gradient model of public intervention seems more accurate, as

it covers the full range of PES, from mostly private PES like in the Vittel case to fully public-driven PES like the agro-environmental environmental scheme in Belgium, based on regional subsidies. However, position along this public-private spectrum does not seem to determine the effectiveness, efficacy or efficiency of PES. The intensity and quality of the scheme's normative and institutional framework appears more important, irrespective of whether it was public or private. The more sophisticated the regulation the better the results in the field across all important success factors, among which knowledge integration and the presence of monitoring and enforcement procedures. These results contradict the dominant belief that market-based approaches to environmental protection are associated with less regulation as compared to classical command-and-control approaches.

Second, INVALUABLE focused on the role of regulation for feeding relevant scientific and non-scientific knowledge and values into the decision-making process. We analysed the four cases mentioned before and two federal habitat banking schemes in the US (Wetland Mitigation Banking and Conservation Banking) from a legal point of view. On

the one hand, our research unraveled the role that conservation planning processes and environmental and sustainability impact assessments can play for providing scientific evidence for informing different schemes. On the other hand, legal procedures and institutions ensuring public participation and dialogue between stakeholders were identified as success factors during the establishment and implementation phases of the MBIs, as shown in the cases of Vittel

and agro-environmental measures. This fostered not only the attractiveness and the environmental performance of the scheme but also its legitimacy.

“ Legal procedures ensuring dialogue between stakeholders are success factors for implementing MBIs. ”



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Policy makers should not select one specific instrument in a toolbox but rather a relevant policy mix of various institutional arrangements.

THE INVALUABLE PROJECT

The overall objective of the INVALUABLE project is to clarify the potential of market-based instruments (MBIs) to better integrate biodiversity & ecosystem services (B&ES) into society, based on appropriate institutional arrangements for relevant public policies and an improved utilization of economic valuation approaches. To do so, three main interconnected issues are analysed through an interdisciplinary research framework. First, the project aims at elaborating a comprehensive theoretical framework in order to define and characterize MBIs for the management of B&ES, and conduct an analysis of the notion of market-based approaches to B&ES with a focus on institutions, discourses, epistemic communities and social networks (work package 1). Second, project researchers seek to assess impacts from some of these MBIs; in particular, they investigate advantages and risks from biodiversity offsets (BO) and payments for ecosystem services (PES), drawing comparative lessons across several case studies in France (BO), Germany and Belgium (BO and agro-environmental schemes), but also Indonesia, Cambodia, Brazil, Ecuador, Mexico, Guatemala and Costa Rica (all PES) (work package 2). Finally, the project builds on existing Science Policy Interface (SPI) and decision support system (DSS) tools, as well as legal analysis so as to formulate relevant options to better integrate scientific results and policy in the field of MBIs for B&ES (work package 3).

The INVALUABLE Project is a network of 9 european partners, coordinated by IDDRI : CIRAD (Centre de coopération International en Recherche Agronomique pour le Développement, France), IRD (Institut de recherche pour le développement, France), Radboud University in Nijmegen (Netherlands), IFP (Institute of Forest and Environmental Policy, Germany), Université Catholique de Louvain (Belgium), ICTA at the Autonomous University of Barcelona (Institut de Ciència i Tecnologia Ambientals, Spain), IEEP (Institute for European Environmental Policy, UK), Wageningen University (Netherlands), and IDDRI (Institut du développement durable et des relations internationales).

The INVALUABLE Project, via IDDRI, is a member of the Conservation Finance Alliance (CFA).