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Tackling fragmentation of climate and biodiversity regimes complexes: the role ecosystem services and payment for environmental services

Abordando la fragmentación de los complejos de regímenes de clima y biodiversidad: el papel de los servicios de los ecosistemas y el pago por los servicios ambientales

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Abstract
In the realm of global governance, fragmentation is a recognized and recurrent feature and the multiple causalities underlying global governance issues along with their often cross-sectoral and cross-scale dynamics constitute major driving forces for fragmented governance. The article aims to identify the interactions between the elements of two regime complexes: climate and biodiversity. We argue that despite the different structuration and history of climate and biodiversity regime complexes, the notion of Ecosystem services, in developing specific policy instruments such as payments for environmental services, contributes to the synergy of these two complexes regimes. Indeed, ES concept has been an "integrative" and "bridging" concept that facilitated the creation of linkages between climate and biodiversity regimes complexes. First, the international diffusion of the ecosystem services concept has been possible though bringing organizations involved in both regimes complexes. Second, the market based instruments for ecosystem services and biodiversity, especially payment for environmental services has been the operational setting that enables to create at national and/or local scales the operational synergies between both issues and regimes. Payment for environmental services can achieve jointly biodiversity conservation and some mitigation and adaptation objectives.

Keys words: Governance, Environmental, Climate regimes, Biodiversity regimes, Ecosystem services.

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Resumen
En el ámbito de la gobernanza global, la fragmentación es una característica reconocida y recurrente. Las múltiples causalidades subyacentes en los desafíos de la gobernanza global, así como las dinámicas inter-sectoriales e inter-escalas, constituyen las mayores fuerzas impulsoras de esta gobernanza fragmentada. Este artículo tiene como objetivo identificar las interacciones entre los elementos de dos complejos de régimen: el complejo de régimen climático y el de biodiversidad. A pesar de las diferencias de procesos de estructuración e dinámicas históricas de los complejos de régimen climático y de biodiversidad, la noción de servicios eco-sistémicos y el desarrollo de instrumentos de tipo pago por servicios ambientales, han contribuido para crear sinergias entre estos dos regímenes. El concepto de servicios eco sistémicos ha sido un concepto "integrador" y "de enlace", que ha facilitado la creación de vínculos entre los regímenes climáticos y de biodiversidad. Primero, la difusión internacional del concepto de servicio eco-sistémico ha sido posible reuniendo organizaciones que participaban de los dos regímenes. Segundo, los instrumentos de mercado para servicios eco-sistémicos y biodiversidad, en particular los pagos por servicios ambientales, han constituido el dispositivo operacional que permitió crear a nivel nacional y/o local, sinergias operativas entre los dos desafíos y regímenes. El pago por servicios ambientales permite juntar/reunir objetivos de conservación de la biodiversidad y de mitigación e adaptación al cambio climático.

Palabras clave: Gobernanza, Servicios ambientales, Regímen de clima, Regímen de biodiversidad, Servicios ecosistémicos.

Introduction

In the realm of global governance, environmental issues are fragmented in several regimes such as climate, biodiversity, water and desertification. The idea of an international regime, defined in broad terms as "norms, rules, and procedures agreed to in order to regulate an issue-area" (Haas 1980), has led to numerous studies on international governance with respect to three general questions: the emergence of regimes, their effectiveness, and the transformation of their forms of governance (Hasenclever, Mayer et al. 1997). The question of interdependence between agreements and institutions has occupied studies from early on: E. Hass points out that "Nowadays, governments recognize complex cause-and-effect linkages between issues they once considered as distinct" and reignites the idea of "complex interdependence" to highlight the complex and tangled mass of questions that States and international organizations seek to manage at the international level (Haas 1980). More recently, Orsini, Morin, & Young defined a regime complex "as a network of three or more international regimes that relate to a common subject matter; exhibit overlapping membership; and generate substantive, normative, or operative interactions recognized as potentially problematic whether or not they are managed effectively" (Orsini, Morin et al. 2013).

As environmental issues are complex and interlinked, fragmentation of regime complex that are addressing these issues may hinder effective management and solution to address them, creating overlap, tension, leading to an inefficiency of regulation proposed (Biermann, Pattberg et al. 2009; Van Asselt 2011; Zelli and van Asselt 2013). Whereas climate change (CC) and biodiversity are part of environmental issues, some antagonism is prone to appear.

Hence, this article aims to identify the interactions between the elements of two regime complexes: climate and biodiversity [1] In the realm of global governance, fragmentation is a recognized and recurrent feature (Biermann, Pattberg et al. 2009), and the multiple causalities underlying global governance issues along with their often cross-sectoral and cross-scale dynamics constitute major driving forces for fragmented governance. However, the concept of regime complex (Keohane and Victor 2010) allows us to look beyond this apparent fragmentation and take into account the different elements at the global level and at the local level which contributes to the cooperation between regime complex. We argue that despite the different structuration and history of climate and biodiversity regime complexes, the notion of ecosystem services (ES), in developing specific policy instruments such as payments for environmental services (PES), contributes to the synergy of these two complexes regimes.

In the first part, thanks to the concept of regime complex and its relevance to understand global environmental governance, we examine the emergence and dynamic of these two regime complexes, climate and biodiversity. In the second part, we discuss the interaction modalities between regime complexes through the genesis of ecosystem services concept, his promoters and the market based instruments which are developed to foster provision of ES.

Part1: Emergence and structuration of the climate and biodiversity regime complexes

The concept of regime complex in global environmental governance and methods

The multiplication of agreements, regimes, and institutions as well as the interventions of an increasing number of different actors (state and non-state actors, transna-

1 Most of the theoretical part of this article was presented and discussed during the 8th Pan – European Conference on International Relations, in 2013. Hrabanski, M; Pesche, D., Fragmentation, circulation, and regime complexes : the network of experts and organizations at the interface between climate and biodiversity, 8th Pan – European Conference on International Relations, One International Relations or Many? Multiple Worlds, Multiple Crises, 18-21 septembre 2013, Warsaw (Poland).

tional actors…) in global governance lead certain studies to a more comprehensive understanding of the complicated dynamics of interdependence, fragmentation and coherence of regime complex. At this point, fragmentation is fully recognized as a recurrent feature of global environmental governance (Biermann, Pattberg et al. 2009). According to the authors, analyzing the fragmentation is a way to develop a research agenda on global governance architectures rooted in the earlier works on interlocking institutions, and more recent works on the interplay or overlap between international institutions or regimes (Biermann, Pattberg et al. 2009).

The multiple causalities underlying global governance issues, often cross-sectoral and cross-scales in nature are major factors behind the forces driving this fragmentation of governance involving the interactions between various networks, institutions, values, and norms. Biermann and his colleagues set out to differentiate three types of fragmentation: synergic, cooperative, and conflictive (Biermann, Pattberg et al. 2009).

To characterize the CC and biodiversity regime complexes, we first carried out a review of scientific literature and documents including legal texts (conventions...) and document related to international organizations, governments and non-governmental organizations (NGOs) participation and positioning within the CC and biodiversity regime. This information was processed to analyze the dynamics of complex regime using as a framework the proposal of Young (1998) who showed (on the Artic accords) that overall process of regime formation can be address considering three (development) stages: agenda formation, negotiation, and operationalization. This information was also used to capture the degree of fragmentation of the regimes. For that purpose, we characterized the three components of the regime complex: i) the agreement component, that we grasp through the number of international conventions related to the issue, ii) the science component that we characterize through an analysis of the science policy interface of the regime (Hrabanski and Pesche 2016; Vadrot 2016), which capture the scientific community structuration that feed the decision process in the regime, and iii) the operational component, we capture through the number and nature of specific protocol to operationalize the agreements (conventions). In a third phase, analyzing document and actors' networks involved in both regimes, we derived the interactions among them. This analysis was supported with some interviews of actors involved in both regimes and some ethnographic survey, especially within the recent Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES[2]) meetings.

2 The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) is an independent intergovernmental body, established by member States in 2012. It provides policymakers with objective scientific assessments about the state of knowledge regarding the planet's biodiversity, ecosystems and the benefits they provide to people, as well as the tools and methods to protect and sustainably use these vital natural assets.

Additionally, we analyzed the ES concepts genesis and diffusion, based on literature review and complementary interviews of actors involved in ES diffusion process at international level. Furthermore, we review evidence of implementation of payment of environmental services schemes to grasp their capacity in achieving jointly climate and biodiversity goals, and thus participating in this way to bring closer these two regimes.

The unified and linear climate regime complex

It has become trite to point out that global warming or climate change is a worldwide problem, and the climate regime complex is fairly unified as compared to the more recent regimes of biodiversity. Additionally, dynamic of climate regime appears to be linear and follow the three stages of regime development proposed by Young (Young 1998): agenda formation, negotiation and operationalization.

Andresen and Agrawala (2002), contend that the agenda formation period of the climate regime extends from the late 1950s to the start of intergovernmental negotiations in early 1991. In this first stage, the creation of the IPCC (1988) is an achievement, and it makes up one of the three essential elements of the climate regime complex (Paterson 1993; Dahan Damedico and Guillemot 2006; Encinas de Munagorri 2009). The second or "negotiation stage" begins in 1991 with the adoption of the Climate Convention and continues (UNFCCC) until the adoption of the Kyoto Protocol in December 1997. The UNFCCC along with the subsequent Conferences of the Parties (COP) constitute the base of world governance for the climate. In the convention framework adopted in 1992, the goal of a reduction of greenhouse gases is established and will lead to commitments to actual numbers. The third stage of "operationalization" is achieved beginning in 1997 with the adoption of the Kyoto Protocol. The protocol attempts to secure the commitments made in the UNFCCC by putting in place the mechanisms known as Flexibility Mechanisms[3] (Schneider 1998; Tietenberg 2003; Goers, Wagner et al. 2010). After Kyoto, and following the failure of the conference in Copenhagen, that was meant to reorganize terms for a second agreement, the Paris agreement, in 2015. The

3 Rather than set up a system of taxes, the Kyoto Protocol put in place economic incentives in the form of two types of mechanisms which are different but unified by the creation of a carbon unit as the means of exchange: carbon emissions trading by the States, and two project-based mechanisms, the clean development mechanism (CDM), and Joint Implementation (JI). Supported by the US, this scheme was first considered with extreme prudence by the Europeans before becoming its principal defenders after the turn of the century. In the end, the Unvoiited States did not ratify the Kyoto Protocol when the Senate legislature determined that it hurt US competitiveness against emerging countries that would not have the constraint of limiting their emissions under the Kyoto framework.

agreement is based on a bottom up, voluntary process of commitment of countries (in form of "Intended Nationally Determined Contributions, INDC), and a regulation based on cooperation principles (Caron and Treyer 2015; Okereke and Coventry 2016)

Although the climate regime complex may interact with other regime complexes (commerce, biodiversity), it remains nevertheless a regime complex that is unified around a single convention, and structured around three essential elements : a single convention (UNFCCC), a single science policy interface (IPCC) and some operational elements (Kyoto protocol then Paris Agreement). Consequently, climate regime complex is less fragmented than the biodiversity regime complex.

The fragmented biodiversity regime complex

Few works attempt to understand the biodiversity regime complex as a whole since the complex is scattered among several sub-groups, all of which address specific dimensions of biodiversity while still being conducted to deal with the same themes (Le Prestre 2004; Velázquez Gomar 2013; Gomar, Stringer et al. 2014; Le Prestre and Compagnon 2016). In addition, the creation of the biodiversity regime complex has not followed a linear evolution, leaving little relevance to Young's theory on the construction of regimes (Young, 1998). Above all, several International Conventions on different biodiversity topics were ratified before the famous Convention of biological diversity (1992), that is why the biodiversity regime complex is characterized by its fragmentation.

Historically, well-known scientists begin to draw attention in the late 1970s to a mounting concern over the extinction of species(Carson 2002). But it is the middle of the 1980s before the "biodiversity crisis" (Takacs 1996) that it becomes a focus for the media, leaders, and the general public opinion through the emergence and diffusion of the neologism, "biodiversity" (as a contraction of biology and diversity).

In 1992, although the Convention on Biological Diversity (CBD) could be considered as offering an encompassing framework for biodiversity questions, it is primarily concerned with regulatory questions of access to genetic resources, especially through the 2000 complementary agreement on biosecurity (the Carthage Protocol, and later the Nagoya Protocol of 2010). Thus the questions of genetic resource management take precedence over the questions of natural habitat and species conservation (Boisvert and Vivien 2010). Today, there are more than 150 multilateral environmental agreements (MEAs) related to biodiversity, some regional and some global, some issue-related, others general. Some of the most important

ones, from a conservation perspective, are the Convention on the Conservation of Migratory Species of Wild Animals (CMS), the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the Convention on Wetlands of International Importance (Ramsar Convention), the Convention concerning the protection of the World Cultural and Natural Heritage (WHC), the International Treaty on Plant Genetic Resources for Food and Agriculture (IT-PGRFA) and finally the Convention on Biological Diversity (CBD), a group of MEAs often referred to as the "biodiversity cluster". Of course, the biodiversity complex extends across scales, with its vertical interactions with the more or less integrated national biodiversity policies, as much as horizontal interplay between MEAs (Anderson 2006; Gomar, Stringer et al. 2014; Gomar 2016). Given the growing importance of transnational governance initiatives, in particular public/private partnerships in sustainable forestry, wildlife conservation, it is important to include non-state actors. Their role is much broader and farther reaching than being mere observers in the conferences of parties and other international negotiations, although their participation in these forums is far from anecdotic (Orsini and Compagnon 2011; Orsini 2014). Lots of NGOs, for are some strong supporter of many MEAs at an early stage, including the CBD, and plays a role in monitoring their implementation (Hrabanski, Bidaud et al. 2013).

The climate and biodiversity regimes complexes: two different histories and structuration

The structuration and histories of climate and biodiversity regimes complexes are really different. The first one is unified around a single convention (UNFCCC)° and structured around three main elements : a convention, a science policy interface and some agreements. On the contrary, biodiversity complex regime is fragmented between several conventions and several protocols. Even though the UNFCCC and the CBD are both signed in 1992, the climate regime complex simply acquires an implementation instrument from the decisions of the COP of the UNFCCC. In the biodiversity regime complex, two protocols come later with the signature in 2000 of the Cartagena Protocol on Biosafety to the Convention on Biological Diversity, then the 2010 Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity, but these protocols only covered a specific dimension of biodiversity questions.

Concerning science policy interface, in the climate complex regime, the IPCC was established in 1988, and has produced general and special reports on global

warming. It will inspire subsequent creations the Millennium ecosystem assessment (MA) between 2001 and 2005. The MA is an important step in the process of the unification of multilateral agreements dealing with biodiversity that finally succeeds in 2012 with the creation of the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) based on the model of the IPCC.

Despite some the interconnection between climate change and biodiversity regarding actors involvement (e.g. United Nation Environmental Program - UNEP) and a specific initiative, REDD+ that comes from the climate regime complex but integrates biodiversity concern[4] , these two issues remained mainly address separately within /through two regime complexes with very different history and structure (table 1).

Table 1. Characteristics of climate and biodiversity complex regime

Component of the complex regime	Climate complex regime	Biodiversity complex regime
Agreement component (Convention)	A unique convention: CNUCCC (1992)	Multiple conventions: CDB (1992), Ramsar, (1971) CITES (1973), CMS (1979)
Science component (Science policy interface)	IPCC (1988)	IPBES (2012)
Operationalization component (protocol)	Successive : Kyoto protocol (1997); Paris agreement (2015)	Fragmented: Nagoya Protocol (2010), Cartagena Protocol (2000)

Source: authors based on bibliographical review.

4 REDD+ is an initiative to Reduce Emissions from Deforestation and forest Degradation, and foster conservation, sustainable management of forests, and enhancement of forest carbon stocks. Negotiation on REDD+ were launched in the framework of UNFCCC during Conference of the Parties to the United Nations Framework Convention on Climate Change held in 2005 (COP-11) but although international negotiation did not come up with international agreement, many multilateral and bilateral funds and programs has been created and implemented such as Forest Carbon Partnership Facility (FCPF) of the World Bank, or the UN-REDD programme (Corbera and Schoeder 2011 (Corbera, E. and H. Schroeder (2011). "Governing and implementing REDD+." Environmental Science & Policy 14(2): 89-99.)

Part 2: Ecosystem services concept in favor of the synergy of the climate and biodiversity regime complexes

While climate and biodiversity complexes followed different paths, we argue that the notion of ecosystem services (ES), in developing specific policy instruments such as payments for environmental services, contributes to the synergy of these two complexes regimes. More precisely, three drivers, derived from the genesis of ES concept, contribute to the synergy of the two complex regimes studied. First, the global framing of this concept participates to bring closer biodiversity and climate change issues. Secondly, some actors who diffused the ES concept are involved in the two complex regimes and act as international brokers in transferring norms between these two complex regime (Dolowitz and Marsh 1996) . Thirdly, the tendency to address ES through ES valuation and operationalize it through market mechanisms, especially payment for environmental services (PES) creates some synergy between both complex regimes, because PES can achieve jointly biodiversity conservation and some mitigation and adaptation objectives.

Ecosystem services concept, a global concept beyond biodiversity

Since the 1992 Rio summit, global environmental changes have become a growing preoccupation and global scientific assessments have become more and more frequent. These assessments, like the Millennium ecosystem assessment (2001-2005), can be regarded as a formal effort to assemble selected knowledge in order to make them publicly available in a form useful for decision making (Mitchell, Clark, Cash, & Dickson, 2006). In this way, at the end of the 1990's, the MA sponsors shared the conviction that highlighting the idea that ecosystems produce services was a strong argument for changing decision makers' thinking with regard to the growing environmental degradation which by then was receiving increasing attention from the media. They argued that to improve human well-being, four categories of ecosystem services: the supporting services (e.g. nutrient cycling, soil formation), provisioning services (e.g. food, timber, fuel), regulating services (e.g. climate, flood regulation), and cultural services (e.g. recreation) must be taken into account.

The evolution of the science-policy interface on the issue of ES seems to follow the same trend as with climate change. Often presented as the biodiversity equivalent of the IPPC initiatives and the Stern report, the MA (2005) and IPBES (2012) have contributed to steer policy on conservation and sustainable management of

biodiversity towards various means of economic regulation (Vadrot 2014; Hrabanski and Pesche 2016; Vadrot 2016). In this way, the notion of ES as a simple indicator that can be easily incorporated into public policy, practical provisions, corporate strategies (Godard and Hommel 2005; Boudia and Pestre 2016; Hrabanski 2017) and international institutions[5], but more broadly, the ES concept seems to offer a broader frame to address environmental issues. In other words, if the international community in charge of the biodiversity agenda wants a means of measurement, as climate change issues are presented from the standpoint of tons CO2, ES concept proposes a global framing for all environmental issues, including climate change considered as a regulating services.

In this way, the ES concept enables to go beyond the fragmentation of the international arenas on environmental issues. More precisely, ES had become a boundary concept (Kull, de Sartre et al. 2015) and is a key concept in biodiversity regime complex (including CC) and has been diffused in the climate regime complex, thanks to several types of organizations.

Organizations implicated in the two regimes

In the view of the MA's promoters, the involvement of international conventions and intergovernmental organizations should, by extension, help to raise governments' awareness and influence policy on environmental complex regimes. After 2005 and the publication of the MA reports, UNEP, the CBD and other UN agencies were important channels for the MA promoters' work of spreading the concept of ES.

Michonski and Levi show that it is possible to identify 7 large categories of entities that are mobilized in the climate regime complex: 1. institutions focused on the environment, 2. informal leader forums, 3. sectoral institutions, 4. institutions focused on energy, 5. (non-banking) development institutions, 6. Multilateral and development banks 7. Other institutions such as the WTO (Michonski and Levi 2010).

Taking inspiration from this classification, we identify the types of entities that are present in both biodiversity and climate regime complexes. In both regimes, we identify environmental institutions, such as the UNEP, development institutions such as FAO and WFP, multilateral development banks, such as

5 See also the growing concern on indicators and measuring biodiversity (for instance United Kingdom parliament, http://www.parliament.uk/documents/post/postpn312.pdf, ; the private sector and NGO's : http://www.businessandbiodiversity.org/what_is_measuring.html, ; see also the 3rd chapter of the TEEB on the use of indicators.

World Bank, and other institutions like the WTO. However, the two complexes do not involve the same informal leader forums, or sectoral institutions. More over energy institutions are not involved in biodiversity regime complex as they are in climate one.

Nevertheless, there are other actors and organizations participating in both complexes. The work of Yamin and Depledge also identifies countries or groups of countries, and NGOs (noting the large families: environmental NGOs, business and industry associations, local authorities, indigenous associations, NGOs tied to research)(Yamin and Depledge 2004).

Combining this work produces a typology of the organizations present in both the climate regime complex and the biodiversity complex based on the following categories:

1. Institutions specialized on the environment such as the UNEP
2. Non-banking development institutions (FAO, WFP)
3. Multilateral development banks (World Bank, BID…)
4. Other institutions such as the WTO
5. Countries and groups of countries such as G77, G20…
6. NGOs (environmental NGOs, NGOs tied to research, business NGOs, indigenous associations, and NGOs tied to local authorities
7. Research organisms (universities, research centers)

Found at the interface between the two regimes, these 7 types of organizations participate in the circulation of the norms and public policy models between regimes, especially market based instruments such as payment for environmental services.

Payment for environmental services: a policy instrument in favor of the synergy of climate and biodiversity

Among the MA's most significant contributions were to propose an analytical framework incorporating ES, now embedded in the literature and public policy, and to draw the international community's attention to the monetary value of ecosystems. The main event illustrating this trend is the emergence of The Economics of Ecosystems and Biodiversity (TEEB) initiative in 2008. Building on the conclusions of the MA, Pavan Sukhdev proposes to continue to raise the alarm about the global loss of ES by valuing them in monetary terms. The first step (TEEB, 2008)

was to assess the state of knowledge on the monetary value of ecosystems, show how some policies run counter to sustainable management of ES and list the economic instruments best able to help conserve them. This gradual incorporation of the ES concept in international arenas and national policies has also been facilitated by the tendency to put ES together with valuation of ES and the introduction of market mechanisms, especially payment for environmental services.

Payment for environmental services is an instrument whose primary purpose is to channel multiple stakeholders' efforts into financing and implementing an ecosystem protection scheme. While initially proposed and emphasized as a transaction between ES providers and users (Wunder 2005), the power of coordination and collective learning is emphasized by many authors and shows how PES can make users and suppliers of environmental services aware of the importance of optimal management of the natural resources they depend on (Muradian, 2013). In that way, PES helps to enhance various stakeholders' adaptability by building their capacity for socio-environmental action and innovation (van de Sand, 2012). In addition, their environmental objectives relate to services that either directly promote climate change mitigation through the carbon sequestration and reduction of greenhouse gases emissions, or have an indirect impact in that they improve the adaptability of ecological and human systems (Ezzine-de-Blas, Hrabanski et al. 2016) . It is also clear that they contribute to foster CC adaptability (Wertz-Kanounnikoff, Locatelli et al. 2011; van de Sand 2012) as they contribute to hydrological regulation, multifunctionality of agriculture, and thus enhance the resilience of socioecosystems. At global level, Strassburg et al (2010) showed a strong association between carbon stocks and species richness, suggesting that many areas of high value for biodiversity could be protected by carbon-based conservation system. Considering data from 85 countries, Busch et al 2011 showed that reduction in deforestation incentivized by a REDD+ mechanism has the potential to greatly reduce the extinction rate of forest species, and concluded that elements of REDD+ that are most effective for climate change mitigation also offer the greatest benefits for biodiversity. At country level, Locatelli et al (2013), based on a thorough spatial evaluation of ES provision in Costa Rica, evidenced that areas under PES program are providing both biodiversity and carbon sequestration, concluding at synergy results between biodiversity and CC related objectives. Furthermore, PES design and implementation is prone to create dialogue between national institutions oriented toward conservation and CC oriented community. Indeed in most of the existing PES in Latin America (Costa Rica, Mexico, Ecuador, Brazil,…), PES building process has been the results of interaction between forest conservation interests groups and institutions (often driven by biodiversity concern), wood planting interests groups

and institutions more concern by climate change issues, and/or actors concerned by water conservation issues (Ezzine de Blas, Le Coq et al. 2017). Hence multiservice and multiple objective nature of PES makes them a binding tools between climate change and biodiversity conservation strategies.

However, while some authors highlight the synergies between CC and biodiversity which can be achieved through PES (Wendland, Honzák et al. 2010; Busch 2013), the integration of CC and biodiversity complex regimes through the operationalization of PES instruments is facing some limits. First, dominant PES schemes in operation are still mono ES specific and respond to specific objective. As shown in a recent meta-analysis of PES schemes worldwide, PES are distributed in three dominating clusters, that differs in term of objective and promoting actors: "agri-environmental public PES", "NGO-led biodiversity PES", and "private commercial carbon PES" (Ezzine-de-Blas, Wunder et al. 2016). A recent review of Latin American PES schemes also shows that operational bundled PES are still a minority compared with water or carbon PES (Raes, Loft et al. 2016). Therefore, it's worth to notice that specific CC mitigation oriented mechanisms may have negative impacts on biodiversity (Strassburg et al, 2010). As spatial distribution of carbon sequestration and biodiversity services is uneven as in the case of Costa Rica, if CC mitigation instruments are applied strictly from a carbon maximization viewpoint, it may not protect the forests that provide the greatest benefits in terms of biodiversity (Locatelli et al, 2013). An often-cited example for trade-offs between carbon sequestration and biodiversity is the establishment of fast-growing tree species, such as eucalyptus, which might not only replace more biodiversity-rich habitat but could also have implications for the water table, thus increasing the sensitivity of the system to drought (Van de Sand, 2012). Secondly, while being a promissory way to synergic operationalization of CC and biodiversity conservation agendas, bundled PES are prone to experience tensions among objectives during their implementation. For example, while the iconic Costa Rican PES program do integrate the promotion of four environmental services (biodiversity, climate change, water and scenic beauty), tensions appears in the implementation regarding the modality of action of PES as the results diverging views and interests of stakeholders involved in its governance, especially between actors oriented toward biodiversity conservation goals and thus promoting conservation and ecological restauration of forest , and actors interested in wood production and supportive mitigation climate change goals (Le Coq, Froger et al. 2015).

Conclusion

As facing complex and interlinked environmental issues may be jeopardized by the fragmented nature of environmental regime, synergies between regime complexes is a key issue. As part of environmental regimes, CC and biodiversity issues have been followed different dynamics and exhibit contrasted fragmentation level. Hence, in contrast with climate regime complex, biodiversity regime complex followed a nonlinear dynamics and is more fragmented. Whereas climate regime had integrated some biodiversity concerns (e.g. though REDD+), synergies between both regimes derived from initiatives related to biodiversity regimes following the creation, promotion and diffusion of ES concept. Indeed, ES concept has been an integrative and bridging concept that facilitated the creation of linkages between climate and biodiversity regimes complexes. Indeed, ES concept and derived frameworks integrated CC issue (as regulation services) within biodiversity concerns. The diffusion of the ES concept has been possible though bringing organizations involved in both regimes complexes such as international organization and NGOs. Finally, the market based instruments for ES and biodiversity has been the operational setting that enables to create at national and/or local scales the operational synergies between both issues and regimes. Indeed, whether mono-services specific PES are blooming, multiservice and bundled PES are instruments to deal with both CC and biodiversity issues.

However, even if synergies between climate and biodiversity regimes are facilitated by PES at international, national and even local level, some limitations still difficult to transcend, such as the trade-off between ES (especially between climate regulation services and biodiversity objectives among PES), and the tensions that it creates in the operationalization of PES. Furthermore, the growing interest for biodiversity offsets shows the analogy between climate market-based instruments such as REDD and the Clean Development Mechanism (CDM) and biodiversity compensation. In this way, biodiversity offsetting is a promise to replace nature destroyed and lost in one place with nature somewhere else (Hrabanski 2015; Lapeyre, Froger et al. 2015). As with schemes for reducing emissions from deforestation and forest degradation (REDD), biodiversity offsetting is a way to "pretend you can trade places". Yet in the scientific community, economists, geographers and ecologists, are insisting that there are risks and limits to the monetary evaluation of biodiversity and the reduction of damage evaluations to compensation based solely on the market mechanisms. On the other side, expectation from carbon market has been disappointing. These limitations and criticisms of market based instruments may reduce their capacity to link both regimes. Indeed, some hesitation on the international scene can be seen. In a FAO report(FAO 2011) in which biodiversity and carbon compensation was thoroughly addressed, the

techniques and strategies proposed are varied and not limited to monetary or market valuations. Furthermore, non-market mechanisms such as collective action and regulation are gaining back interests in international and local debates. The emergence of these new trends, that could either contribute to create new synergies or push toward more fragmentation, constitutes new challenges regarding interrelations within environmental regimes complex.

Bibliography

Anderson, E. R. 2006. "Wetlands mitigation banking: Putting your wetlands to work for you and the environment." Forest Landowner 65(2): 17-18.

Andresen, S. and S. Agrawala 2002. "Leaders, pushers and laggards in the making of the climate regime." Global Environmental Change 12: 41-51.

Biermann, F., P. Pattberg, et al. 2009. "The Fragmentation of Global Governance Architectures: a Framework Analysis." Global Environmental Politics 9(4): 14-40.

Biermann, F., P. Pattberg, et al. 2009. "The Fragmentation of Global Governance Architectures: A Framework for Analysis." Global Environmental Politics 9(4): 14-40.

Boisvert, V. and F.-D. Vivien 2010. «Gestion et appropriation de la nature entre le nord et le sud.Trente ans de politiques internaiotnales relatives à la biodiversité.» *Revue Tiers Monde* 2(202): 15-32.

Boudia, S. and D. Pestre 2016. «Mises en économie de l'environnement et hégémonie politique.» Ecologie & politique(1): 13-18.

Busch, J. 2013. "Supplementing REDD+ with biodiversity payments: the paradox of paying for multiple ecosystem services." Land Economics 89(4): 655-675.

Caron, P. and S. Treyer 2015. «L'agriculture climato-intelligente et les arènes de la négociation internationale sur le changement climatique.»

Carson, R. (2002). Silent spring, Houghton Mifflin Harcourt.

Corbera, E. and H. Schroeder 2011. "Governing and implementing REDD+." Environmental Science & Policy 14(2): 89-99.

Dahan Damedico, A. and H. Guillemot 2006. «Changement climatique: dynamiques scientifiques, expertise, enjeux politiques.» Revue de sociologie du travail 48(3): 412-432.

Dolowitz, D. and D. Marsh 1996. "Who learns from whom: A review of the Policy Transfer Literature." Political Studies 44 (3).

Encinas de Munagorri, R. 2009. L'organisation de l'expertise sur le changement climatique. Numéro spécial de Droit et société, Expertise et gouvernance du changement climatique Paris, LGDJ. 51.

Ezzine-de-Blas, D., M. Hrabanski, et al. 2016. Payment for environmental services in climate change policies. Climate Change and Agriculture Worldwide. E. e. In: TORQUEBIAU, Springer: 277-288.

Ezzine-de-Blas, D., S. Wunder, et al. 2016. "Global Patterns in the Implementation of Payments for Environmental Services." PLoS ONE 11(3): e0149847.

Ezzine de Blas, D., J. Le Coq, et al. 2017. Pagos por servicios ambientales en america latina : gobernanza, impactos y perspectivas. . Mexico, Mexico, Universidad Iberoamericana Ciudad Mexico.

FAO (2011). Payment for ecosystem services and food security. Rome, FAO.

Godard, O. and T. Hommel 2005. «Les multinationales, un enjeu stratégique pour l'environnement et le développement durable ?» Revue internationale et stratégique 4(60): 101-112.

Goers, S. R., A. F. Wagner, et al. 2010. "New and old market-based instruments for climate change policy." Environmental Economics and Policy Studies 12(1): 1-30.

Gomar, J. O. V. 2016. "Environmental policy integration among multilateral environmental agreements: the case of biodiversity." International Environmental Agreements: Politics, Law and Economics 16(4): 525-541.

Gomar, J. O. V., L. C. Stringer, et al. 2014. "Regime complexes and national policy coherence: Experiences in the biodiversity cluster." Global governance 20(1): 119-145.

Haas, E. B. 1980. "Why Collaborate?: Issue-Linkage and International Regimes." World Politics 32(3): 357-405.

Hasenclever, A., P. Mayer, et al. 1997. Theories of International Regimes. Cambridge, Cambridge University Press.

Hrabanski, M. 2015. "The biodiversity offsets as market-based instruments in global governance: Origins, success and controversies." Ecosystem services 15: 143-151.

Hrabanski, M. 2017. "Private sector involvement in the Millennium Ecosystem Assessment: Using a UN platform to promote market-based instruments for ecosystem services " Environmental Policy and Governance.

Hrabanski, M., C. Bidaud, et al. 2013. "Environmental NGOs, policy entrepreneurs of market-based instruments for ecosystem services? A comparison of Costa Rica, Madagascar and France." Forest Policy and Economics 37: 124-132.

Hrabanski, M. and D. Pesche 2016. The Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES): Meeting the challenge of biodiversity conservation and governance, Routledge.

Keohane, R. O. and D. G. Victor 2010. "The Regime Complex for Climate Change" Discussion Paper http://belfercenter.ksg.harvard.edu/publication/19880/regime_complex_for_climate_change.html, 10-33.

Kull, C. A., X. A. de Sartre, et al. 2015. "The political ecology of ecosystem services." Geoforum 61: 122-134.

Lapeyre, R., G. Froger, et al. 2015. "Biodiversity offsets as market-based instruments for ecosystem services? From discourses to practices." Ecosystem services 15: 125-133.

Le Coq, J.-F., G. Froger, et al. 2015. "Understanding the governance of the Payment for Environmental Services Programme in Costa Rica: A policy process perspective." Ecosystem Services 16: 253-265.

Le Prestre, P. and D. Compagnon 2016. 2 IPBES and governance of the international biodiversity regime complex. The Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES): Meeting the challenge of biodiversity conservation and governance. M. Hrabanski and D. Pesche, Routledge.

Le Prestre, P. G. 2004. Governing Global Biodiversity. Hampshire, Ashgate Publisking Compagny.

Locatelli, B., Imbach, P., & Wunder, S. 2014. Synergies and trade-offs between ecosystem services in Costa Rica. *Environmental Conservation*, *41*(1), 27-36.

Michonski, K. and M. Levi 2010. The Regime Complex for Global Climate Change. Council of Foreign Relations. New York: pp. 27.

Okereke, C. and P. Coventry 2016. "Climate justice and the international regime: before, during, and after Paris." Wiley Interdisciplinary Reviews: Climate Change 7(6): 834-851.

Orsini, A. (2014). «Les lobbies environnementaux: intérêts d'une approche pluraliste.»

Orsini, A. and D. Compagnon 2011. «Lobbying industriel et accords multilatéraux d'environnement. Illustration pa rle changement climatique e tla biosécurité.» Revue français de science politique 61(2): 231-248.

Orsini, A., J.-F. Morin, et al. 2013. "Regime Complexes: A Buzz, a Boom, or a Boost for Global Governance?" Global Governance: A Review of Multilateralism and International Organizations 19(1): 27-39.

Paterson, M. 1993. "The Politics of Climate Change after UNCED." Environmental Politics 2(4): 174-190.

Raes, L., L. Loft, et al. 2016. "Towards market- or command-based governance? The evolution of payments for environmental service schemes in Andean and Mesoamerican countries." Ecosystem Services 18: 20-32.

Schneider, S. H. 1998. "The climate for greenhouse policy in the U.S. and the incorporation of uncertainties into integrated assessments." Energy and Environment 9(4): 425-440.

Strassburg, B. B., Kelly, A. , Balmford, A. , Davies, R. G., Gibbs, H. K., Lovett, A., Miles, L., Orme, C. D., Price, J. , Turner, R. K. and Rodrigues, A. S. 2010. Global congruence of carbon storage and biodiversity in terrestrial ecosystems.

Conservation Letters, 3: 98-105. doi:10.1111/j.1755-263X.2009.00092.xTakacs, D. (1996). The Idea of Biodiversity: Philosophies of Paradise. Baltimore, The Johns Hopkins University Press.

Tietenberg, T. (2003). "The tradable-permits approach to protecting the commons: Lessons for climate change." Oxford Review of Economic Policy 19(3): 400-419.

Vadrot, A. B. 2014. The politics of knowledge and global biodiversity, Routledge.

Vadrot, A. B. 2016. The birth of a science-policy interface for biodiversity. The history of IPBES. The Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES): Meeting the challenge of biodiversity conservation and governance. M. Hrabanski and D. Pesche, Routledge.

Van Asselt, H. 2011. "Managing the fragmentation of international environmental law: forests at the intersection of the climate and biodiversity regimes." NYUJ Int'l L. & Pol. 44: 1205.

Van de Sand, I. 2012. "Payments for ecosystem services in the context of adaptation to climate change." Ecology and society 17(1).

Velázquez Gomar, J. O. 2013. Co-evolution of regime complexes and national policy coherence: the case of the cluster of biodiversity-related conventions and national implementation systems in Latin America and the Caribbean, University of Leeds.

Wendland, K. J., M. Honzák, et al. 2010. "Targeting and implementing payments for ecosystem services: Opportunities for bundling biodiversity conservation with carbon and water services in Madagascar." Ecological economics 69(11): 2093-2107.

Wertz-Kanounnikoff, S., B. Locatelli, et al. 2011. "Ecosystem-based adaptation to climate change: What scope for payments for environmental services?" Climate and Development 3(2): 143-158.

Wunder, S. 2005. Payment for Environmental Services: Some Nuts and Bolts. Bogor, CIFOR.

Yamin, F. and J. Depledge 2004. The international climate change regime: a guide to rules, institutions and procedures, Cambridge University Press.

Young, O. R. 1998. Creating Regimes Arctic Accords and International Governance. Ithaca, NY, Cornell University Press.

Zelli, F. and H. van Asselt 2013. "Introduction: The Institutional Fragmentation of Global Environmental Governance: Causes, Consequences, and Responses." Global environmental politics 13(3): 1-13.