

Um≠kl;;§Draft Paper: not to be circulated nor quoted without author's authorization

Bioprospecting, REDD and PES: innovative market-based instruments in an economy of promises

Jean Foyer (ISCC, CNRS), Aurore Viard-Crétat (Centre Alexandre Koyré, EHESS), Valérie Boisvert (IGD, UNIL)

Abstract

This paper starts from the premise that at the Rio+20 Summit, history has repeated itself and that the same expectations raised by bioprospecting 20 years ago are now attached to the market-based instruments associated with conservation policies (Payments for environmental services, REDD mechanisms, biodiversity offsets,...). The promise that market mechanisms are best suited to reach biodiversity conservation goals has been renewed. Building on Polanyian definition of fictitious commodities and on the idea of the 'economy of promises' (developed by P.B. Joly in relation to biotechnologies and nanotechnologies), we argue that beyond their ideological foundations, market mechanisms require complex institutional arrangements that are often irrelevant and ineffective in reaching their environmental objectives. These various market-based or market-like arrangements rely on the reasserted promise of a synergy between market and conservation rather than on actual market mechanisms. They are supposedly meant as conservation tools. However, they rather foster the development of a market for consulting and economic expertise in conservation issues, the growth and perpetuation of which depend on the renewal of this promise, in the form of changing institutional arrangements and mechanisms.

The starting assumption of this article is that the way market-based instruments have been mobilised as environmental conservation tools at Rio+20 continues the bioprospecting promotion pattern adopted 20 years before. The promise has been renewed that market mechanisms would be more capable of achieving environmental protection goals. This assumption leads us to propose an analysis of key innovative mechanisms that have been promoted in turn in the environmental field at the international level over the past two decades, which emerge from the concept of economy of promises.

This concept was first proposed by STS (Science and Technology Studies) scholar Pierre-Benoit Joly. He used it to put forth a general model of techno-scientific innovation at work over the last forty years in fields like biotechnology, nanotechnology, computer science and, more recently, synthetic biology. According to Joly, with contemporary societies increasingly engaged with their future, technological innovation is now based on promises involving the different forms that this future may take. The

promise would then be one of the mainsprings for developing technological innovation, in the sense that the latter implies the formulation of solutions to redefine and improve the future. For example, biotechnology development cannot be explained independently of the promise of a solution to world hunger through GMOs, or a medical revolution via gene therapy. Similarly, nanotechnology promise, with its quantum computers and nano-robots, is based on spectacular applications and promises of radical transformation—in the positive sense—of our societies. Pierre-Benoit Joly notes that while the imaginary substrate—in this case, belief in technological progress—and the formulation (or rhetoric) of the promise, are essential elements of the latter, one must be mindful of its other dimensions. “Promises are not just a matter of discourses and representations. They also involve practices of exploration and experimentation; they are related to investment, and to mobilization, circulation, and accumulation of resources.” In this way, Joly offers several characteristics of this economy of promises. Generally speaking, the promise is **first based on an imaginary, and linked to a problem**, often a very general one, that must be addressed. The promise must also be **credible**, and one of its most direct effects is **to create an irreversibility**, or to establish itself as an “obligatory passage point” in the words of STS (Akrich, Callon and Latour, 2006). A further significant effect is **the generation of counter-promises**, that is, radical opposition to the proposed future models, often in reaction to the excesses of the promise itself (Joly, 2010). The economy of promises should not then be understood as a conscious undertaking by stakeholders seeking to manipulate and impose their agenda (although the instrumental dimension is real), but rather, as a complex of imaginaries, discourses and practices producing more or less unpredictable effects.

The main idea advocated in this paper is that political innovation concerning the environment (Lascoumes and Le Galès, 2004) reproduces the pattern of technological innovation, in the sense that it takes on the form of promises based on a common imaginary according to which environmental problems can be solved through market mechanisms. This promise plays on the market imaginary, based on the belief that the market is the most efficient system of resource allocation (Tordjman and Boisvert, 2012) and the vision of a future not only of possible conciliation but rather of synergy between market development and environmental protection. For bioprospecting, PES and REDD, the challenge is to develop markets and property rights that allow for the attribution of economic value to natural entities or phenomena (biodiversity, carbon storage, *etc.*), in order to encourage protective practices. This promise of market-based environmental solutions is regularly reformulated through the promotion of new mechanisms in different arenas. These devices are always presented as policy innovations offering new solutions, even though beyond their differences, and this is what we wish to elucidate here, they operate according to very similar patterns. Our major analytical concern, based on the framework of the economy of promises, is to study the emergence of innovative policy tools, while highlighting the continuities not only in the underlying beliefs, but also in the rhetoric, resources mobilized, effects produced, and dynamics of implementation.

It could be objected to this analytical framework that the promise at stake in our demonstration is none other than the central myth of economics, especially of finance, that of market efficiency (Giraud, 2001). Indeed, any market creation is based on the expectation of income generation and wealth accumulation in the future. Given unsettled preferences and the uncertainty about price setting and evolution in real-

life markets pointed out by Keynes (1936), there is a fundamentally speculative element in economy. Yet our purpose here is not to engage in an epistemological debate over market representations and their performativity in economics. Our focus is not as much on the —economic — essence of the promise as on its effects. Our theoretical proposal addresses existing market or market-like institutional arrangements about the environment, the promised efficiency of which implies the achievement of environmental as well as economic goals. Our contention is that environmental markets engineering raises specific issues that do not come under the generic notion of implementation gap and are more complex than a mere difference between pro-market narratives and the actual performance of market-based instruments.

We therefore suggest adapting the “economy of promise” regime to the analysis of international environmental policies. Our purpose is not only to account for the changes undergone by environmental policies, but also to participate in the theoretical refining of the conceptual proposal associated with the economy of promises. Accordingly, our analysis builds on the framework developed in STS but also relies on political sociology concepts developed to deal with political instruments (Lascoumes and Le Galès, 2004), and on institutional economics for the issue of market construction (Polanyi, 1944, Postel and Sobel, 2010). These various theoretical strands share a constructivist vision of their respective objects (science, public policies, markets...) and we combine their contributions to analyze the social career of the mechanisms under study from their imaginary foundations, to their implementation through the narratives they give rise to and the various effects they produce. Building on the economy of promise we account for the life cycle of hybrids of science, policy and market — bioprospecting contracts, REDD and PES mechanisms —and trace the networks and spaces through and along which they expand.

For each device analyzed, we will thus question and investigate:

- The particular **rhetoric** of the promise, by describing the mechanism’s rationale, the associated claims, and the construction of their legitimacy and credibility (who does the promising and how);
- The **performativity** of the promise, *i.e.*, its expected institutional effects (how it is made), its capacity for generating irreversibility, but also its unwanted collateral effects, in particular the generation of a counter-promise denouncing this promise, whereas paradoxically validating it.
- The **implementation** of the promise, *i.e.* of the market model — and associated attributes and objectives — initially promoted. We will especially show the discrepancy between the promise and its actual implementation, by emphasizing that the arrangements to which the promise leads are often much more complex and less market like than expected and wished for.

I. The rhetoric of promises: new market-based devices to save the environment

A. Successive promises of market solutions

Beyond the concise description of each mechanism in its ideal form, the purpose of this subsection is to show how bioprospecting, REDD and PES can be read as variations on a common theme: the general

promise of environmental preservation through market development. While they differ in many respects (timing, purpose, subject, implementation), these devices can be analyzed as the renewal and extension of that same general promise.

In 1992, market-based devices appeared at the heart of the Convention on Biological Diversity that would supposedly renew biodiversity conservation practices: bioprospecting contracts. While bioprospecting is an ancient practice, its reformulation in the framework of the CBD as a conservation and sustainable development mechanism is a central political innovation, breaking with traditional conservation devices such as protected areas. The principle is simple: in exchange for access to genetic resources held by local rural communities in the South, industries from the North would pay a fee, provide non-monetary benefits and pay back a part of their royalties to the local communities in case they would develop patented innovation based on these resources. These income flows would in turn fund nature conservation and local development. The exchange between resource providers and users would be organized through bioprospecting contracts, negotiated directly between firms and local communities. The promise of bioprospecting represents a fundamental discursive innovation, since it rendered the economic exploitation of biodiversity and its conservation—that were formerly seen as antagonistic— compatible and desirable.

Initiated under the UN climate convention, REDD concept aims to value forest ecosystems for their carbon stock. The idea is in line with the Kyoto Protocol framework and debates, according to which the industrialized countries, as part of reducing their greenhouse emissions between 2008 and 2012, could purchase carbon credits on the open market from projects reducing GHG emissions in developing countries, as a way of offsetting their emissions surplus. The “Reduction of Emissions Due to Deforestation”¹ concept proposed in 2005 to expand the carbon trading mechanism from its previous base of local projects to country-wide level, in the hope that this would reduce the risk of domestic deforestation leakage (Coalition for Rainforest Nations, 2005). While afterwards some stakeholders rejected the financing model of the carbon market (notably Brazil and some NGOs such as Friends of the Earth) for technical, political and ethical reasons, the economic crisis argument kept this option as the only possible long-term eventuality. In addition, non-UNFCCC carbon markets constituted a second payment option for projects currently being prepared on the ground, if financing via the climate convention did not ultimately emerge. The post-Kyoto stalemate and the crystallization of multiple interests around the REDD concept made it scatter gradually off the UN framework to become protean in its re-appropriation by diverse stakeholders at different levels. Thus, on the voluntary market, local projects with various technical, social and environmental safeguards can be advertised as REDD, whereas the UNFCCC REDD process is expected to lead ultimately to national programs.

Irrespective of these variations, the central concept remains the same: project leaders, or states that help maintain or increase carbon stocks in the forests of the South can eventually claim carbon credits with a market value, depending on the amount of “not emitted” carbon tons.

¹ Initially proposed to fight deforestation, the concept was expanded during negotiations to include other forest-related activities, because of the diverse interests of countries with large areas of forest. The program then became “REDD+.”

Payments for environmental services (PES) are often associated with ecosystem services, whereas the two notions have appeared in different contexts. The terms « nature's services », « ecosystem services » and « environmental services » have emerged in ecology in the 1970s (Ehrlich and Mooney, 1983; Mooney and Ehrlich, 1997) and have been in widespread use since the late 1980s (Gómez-Baggethun *et al.*, 2010; Méral, 2012) in conjunction with the development of ecological economics. The notion of ecosystem services was first associated with functional ecology and intended as a telling metaphor: while ecosystems were presented as 'natural capital', to stress their importance for the humankind, the flows of goods, values and various amenities provided by this 'capital' were referred to as 'services', by analogy with the income flows generated by capital.

The term PES was introduced during the 2000s, and has been popularized especially by Stefano Pagiola (Pagiola *et al.*, 2002), an economist in the World Bank's Environment Department and Sven Wunder, Principal economist with the Center for International Forestry Research (CIFOR) in relation to forest and agricultural policies. The rise of environmental concerns in agriculture throughout the 1990s, the growing interest for agricultural landscapes and agrobiodiversity in environmental conservation arenas, and the need to re-legitimize farming subsidies in a neoliberal context had paved the way for such instruments. Accordingly, the *State of Food and Agriculture 2007* highlights that modern agriculture has been successful in providing the ecosystem services for which markets exist (crops, various food products), but at a high cost to other ecosystem services that are necessary to sustain human life. Farmers are therefore presented as the 'largest group of environmental managers on Earth' and it is suggested that they should be induced to increase their provision of environmental services through appropriate schemes of payments (FAO, 2007:7). According to Wunder's canonical definition (2005:9), "A PES is: a voluntary transaction (1) where a well-defined ES (or a land use likely to secure that service (2) is being bought by a (minimum one) ES buyer (3) from a (minimum one) ES provider (4) if and only if the ES provider secures ES provision (conditionality) (5)."

The promise associated with PES is that of a renewed contract between the society as a whole and the farmers, a reconciliation of agriculture with environmental protection (and incidentally of farming subsidies with neoliberalism). According to FAO (2007), paying farmers for the environmental services they provide is "akin to viewing environmental protection as a business transaction". Such perspective has gained momentum as the final report of the *Millennium ecosystem assessment* was released, in 2005.

Bioprospecting, REDD and PES correspond to an extension of market logic to environmental entities that were not previously subject to a commercial relationship. They are thus based on the central idea that the market internalization of different socio-environmental objects can solve a whole range of problems.

B. A legitimate promise: The solution to all your problems

This subsection aims to show how bioprospecting agreements, REDD and PES are legitimized by contrast to pre-existing forms of regulation, and in response to a series of general problems to which they supposedly respond in an innovative and holistic way.

Bioprospecting's legitimacy was constructed as a concrete response to the erosion of biodiversity, as it became a global environmental issue following the identification by conservation biologists of the sixth great mass extinction (Wilson, 1988, 1992). Bioprospecting was also legitimized by the different kinds of goals, both economic and social, that it could reach. It represented, first of all, an opportunity to develop genetic resources in the context of the first biotechnology applications placed on the market. Genetic resources were effectively presented as the raw material of biotechnology, which promised to revolutionize numerous fundamental industries. As many authors have pointed out (Aubertin and Vivien, 1997, Hayden, 2003), there was obvious crossover and connection between biotechnology development and the emergence of a discourse on the valuation-conservation of biodiversity; the two promises are related in many respects. Finally, due to the recognition of traditional knowledge and "fair and equitable benefit-sharing" provisions, the promise of bioprospecting appeared to hold socio-cultural legitimacy because it supposedly allowed for the implementation of development mechanisms that benefited local communities, at a time when indigenous mobilizations in the Americas were reminding 500 years of domination and unfair trade.

By combining environmental goals for biodiversity conservation, economic goals for biotechnology development, and social goals for local development, bioprospecting was presented as a means to concretely and optimally implement sustainable development, a principle which it immediately took on with fresh legitimacy.

The idea of REDD emerged and appeared as an innovative and pragmatic solution against the backcloth of the disappointment of the international policies on forests and global warming. Following the failure to sign a convention on forests in Rio in 1992, an international cooperation regime on forestry seemed to arise from the mid-1990s (Humphreys, 2001); but significant conflicts of interest reduced these efforts to the simple continuation of negotiations whose only official result was a non-binding agreement (Asadi, 2008) of relatively limited effectiveness. Meanwhile, the results of the Kyoto Protocol were also coming out as inadequate to address climate change. Avoided deforestation had been rejected from these negotiations in 2001, particularly under pressure by environmental NGOs denouncing a way out for the industrial emissions of the North. Given the urgency and also the increasing difficulty of achieving commitment to ambitious and binding goals beyond 2012, the inclusion at all costs of combating deforestation into the fight against climate change has been established as the pragmatic solution a few years later.

Besides multilateral negotiations, significant investment is made for forest protection, particularly through development assistance. However, such funding is most often destined to support the first years of projects to initiate changes in practices. This timeframe can undermine the sustainability of conservation and improved management projects. A financial mechanism based on the sale of carbon credits has thus been encouraged as a way of providing longer-term funding (Hamel, 2013).

The emerging consensus around the REDD mechanism at the national level therefore gives new life to the deforestation emergency. Different forest-related agendas (of environmental NGOs, development NGOs, indigenous peoples' organizations, governmental and intergovernmental institutions, etc.) converge and crystallize around a win-win discourse. Due to the UN search for integration of a

multiplicity of sometimes conflicting viewpoints and interests, the concept of REDD becomes a kind of promise of an “all inclusive” sustainable development mechanism: compensation for avoided carbon emissions would not only fight climate change, but would also, almost automatically, preserve a long-term suite of forest ecosystem services, including biodiversity, providing income for local and indigenous populations, and more generally financing the economic development of the countries concerned.

Similarly, payments for ecosystem services are considered both as an innovative funding mechanism for ecologically sound agricultural practices and an option to rekindle under-financed biodiversity conservation policies. By the beginning of the 2000s, it became obvious that the green gold rush expected in association with bioprospecting development would not occur and that biodiversity valorization strategies should not rely on genetic resources alone but also on other environmental assets. Serious doubts were arising as to the possibility of achieving within a decade the 2010 biodiversity target *i.e.* a significant reduction of the rate of biodiversity loss at the global, regional and national level. The concept of ecosystem services and associated payment schemes opened up new and potentially unending prospects of market development, (since new ecological functions and new cultural values in relation to nature may emerge, leading to new ecosystem services.) Some organizations (*i.e.* WRI), began to reflect on the possibility of stacking payments for ecosystem services and some economists dared to dream of projects that would generate several ecosystem services in the same time, favouring biodiversity conservation while limiting greenhouse gas emissions for instance, and receive payments from several programmes.

C. The credibility of the promise: epistemic arguments, metrics, success stories, and best practices

Regarding the other essential element of rhetoric—credibility—the formulation of epistemic advocacy (Hayden, 2003), namely, promotional discourse by a community of scientific experts who share the same world vision and policy objectives (Haas, 1993) is essential. In this advocacy, beyond its promoters’ academic prestige, common methods of promise consolidation include the mobilization of statistics, the provision of typical examples, and best practices.

In the case of bioprospecting, ever since the Washington Conference of 1986 (Wilson, 1988), leading conservationists and some economists have promoted a discourse that associates biodiversity with genetic resources on the basis of potential pharmaceutical development (Farnsworth, 1988; Plotkin, 1988), which leads to an injunction to economically develop these resources (Randall, 1988). The economic value of biodiversity was actually put on the political agenda at this conference, six years before Rio 92, by an epistemic community on conservation biology, explicitly seeking to mobilize financial and institutional resources to support their scientific and political objectives (Takacs 1996; Foyer, 2010). Figures on the alarming rate of biodiversity loss, especially in tropical areas, but also on the use of natural compounds in modern pharmacopoeia (between 25 and 40%), were provided, that have been quoted over and over during the following years. Tentative estimates of the total biodiversity value were given. These discourses were systematized in articles and scientific literature (Reid *et al.*

1993) that presented bioprospecting as a device of the future. The pace and scope of the promise were further increased by some widely circulated success-stories, for instance that of Eli Lilly, which in the 1970s developed the anti-tumor agents vincristine and vinblastine from the rosy periwinkle, and the highly profitable anticancer drugs Taxol (derived from Pacific yew) and Taxotere from an isolated molecule from the European yew, which since the early 1990s have brought millions of dollars to Bristol-Myers-Squibb, Rhône Poulenc and Sanofi-Aventis (ten Kate and Laird, 1999). Nevertheless, it is the 1991 bioprospecting agreement between the pharmaceutical company Merck and the National Institute of Biodiversity (INBio) in Costa Rica that was most regularly used as a model of best practices with regard to bioprospecting practical implementation.

To explain how credibility was built around the concept of REDD, the notion of “epistemic configuration”² (Pesche, Méral, Hrabanski and Bonnin, 2011) seems more appropriate than epistemic community: it is effectively the cooperation among heterogeneous groups and stakeholders that allowed for a scientific-political co-construction of knowledge and discourse to counter the arguments that had initially excluded deforestation from climate change.

While the concept of “Reducing Emissions from Deforestation” appeared in the 2005 climate negotiations, the rehabilitation of deforestation as a carbon market eligible activity started before.

In 2002, the World Bank launched the BioCarbon Fund, intended to “explore projects with a component of avoided deforestation” (Noble, 2003), which had just been excluded from the Kyoto Protocol. This fund is playing the role of broker and certifier of carbon credits purchasable by governments and businesses in the North. The rhetoric of “exploration,” which was also repeated for the voluntary markets (Hamilton, Bayon, Turner and Higgins, 2007), tends to hide the political reasons for excluding deforestation from the Kyoto Protocol, and to suggest that the latter is due to technicalities, that might be overcome in the future. In this context, a partnership around the BioCarbon Fund developed a methodology in 2004 for monitoring carbon in the Malagasy forests (Pedroni, 2008). This initiative, which was subsequently renamed “REDD,” was advertised as a forest carbon success story by its promoters; other success stories include the Noel Kempff Climate Action Project in Bolivia, launched in 1997, and the later partnership between Google and the Surui in Brazil initiated in 2007. In each project, the component of scientific and technical innovation was crucial, particularly for the deployment of advanced satellite tools to attest to the accuracy of carbon measurements. The announcement by VCS, generally recognized to be a demanding certifying organization, of its first validated REDD methodology in 2010, and of its first REDD credits allocation in 2011 also helped build its credibility.

A proposal analogous to REDD, that of “compensated reduction,” had been made in 2003 on the sidelines of the Milan climate conference between a coalition of Brazilian and US NGOs (Santilli, Moutinho, Nepstad, Curran and Nobre, 2003). The NGO Environmental Defense Fund had a longstanding commitment to promoting “cap and trade” as a solution to environmental problems, a tool it had already promoted to the Bush administration for the 1990 Clean Air Act, and later to the Clinton administration for the Kyoto Protocol (Fialka, 2011). Beyond the work of disseminating their concept in international political and scientific arenas, they effectively lobbied the Brazilian government (Moutinho,

² These authors define it as “the act of a work of brokers, mediators or entrepreneurs who bring together very different groups and networks with a view to influencing political processes” (p. 5).

2011), which has always been hostile to international negotiations on forests, in the name of State sovereignty, the right to development of the South, and the historical responsibility of industrialized countries for climate change. While remaining opposed to financing through market development, Brazil began³ to consider climate negotiations on forestry as an opportunity to assert itself as a major political, scientific and technical player (Carvalho, 2012), and therefore accepted to reopen debate on including deforestation in the UNFCCC.

Certain high-profile personalities and publications also contributed to promoting forest offsets: the so-called “Stern report” (Stern, 2006), which became a reference and advanced the idea (later called into question) that fighting deforestation was an inexpensive way to curb climate change. The 2007 IPCC estimate that 20% of global emissions were due to deforestation was reified and used as a basis for mobilization, despite the significant margin of error and subsequent changes in the respective shares of emissions of the various sectors.

A heterogeneous group of stakeholders with very different interests and knowledge sets—remote sensing specialists, anthropologists, ecologists and economists, affiliates of national or international institutions, private consulting offices, think tanks, NGOs or research centers—united behind a common vision of the importance of enlisting forests in carbon markets, built up the credibility of REDD using technical and policy advocacy, and the promotion of data, methodologies and best practices.

There had been several tentative assessments of Nature’s services prior to the *Millennium ecosystem assessment* but most of them had met with harsh reception. The notion of giving a monetary value to ecosystem services and hence to the biosphere had been considered as totally misplaced and as a dangerous step towards a commodification of nature. It was especially the case of the famous *Nature* article by Costanza *et al.* in 1997 that had raised considerable criticism. On the contrary, the *Millennium ecosystem assessment* (MA), called for by the United Nations Secretary-General Kofi Annan and launched in 2000, witnessed a great success. It was above all welcomed as a major procedural success, because of the number, diversity and renown of the scientists and research institutions involved, but also because of the governance structure, the peer-review of technical reports, the broad consultation and validation processes that all displayed managerial professionalism. Established under the auspices of the UN, this global appraisal of the world’s ecosystems and the services they supply was considered as an exercise in pragmatism, providing a scientific basis for conservation actions and policies, while prior assessments had been perceived as tinged with neoliberal ideology or at least a pro-market bias. In asserting the economic value of ES, the MA played a decisive role in making the promise associated with PES credible.

The MA contributed to impose ES concept as a new hegemonic framework to account for the relations between societies and their environment.

Many different bodies and organisations enrolled in the MA and in mainstreaming ES and PES in conservation policies. Accordingly, a broad range of stakeholders, from public research institutions, environmental NGOs (WWF, The Nature Conservancy, IUCN), UN Agencies and Programmes, various

³ The change in power distribution among the different ministries involved in climate negotiations, Lula’s election in 2003, the slowdown of Brazilian deforestation rate, NGO lobbying and a changing international context were all factors contributing to Brazil’s change of position.

think tanks, environmental policy brokers, funding agencies, through transnational corporations and corporate interests (*e.g.* the World Business Council for Sustainable Development) support the ES agenda and the associated promise.

II. Promise performativity: Irreversibility, transformation and counter-promises

Promise performativity comprises all the more or less direct and sought after effects engendered by the formulation, promotion and institutionalization of the promise. The promise, with its accompanying expectations, tends to reconfigure the stakeholders interplay, and the institutions, representations and practices of the different communities in which it is formulated.

A. Institutional entrenchment and irreversibility: How the promise became an “obligatory passage point”

Because of their successful inclusion in the political agendas, bioprospecting, REDD and PES have spread gradually through institutions. The first period of this institutionalization contributed quite clearly to building credibility as described in Part I-C, since international institutions incontestably brought forth a pledge of seriousness. Once accepted by national and international institutions, the promise gained clearly in credibility, becoming difficult to contest, and imposing itself as an “obligatory passage point”, with at times surprisingly irreversible effects. In heralding these tools, international institutions contributed to their entrenchment and evolution, and were in turn modified by the promise.

This dynamic is particularly obvious in the case of bioprospecting, whose institutional recognition within the CBD framework helped in conveying credibility to a practice that still had a long way to go to prove its worth. The fact that bioprospecting contracts were central to the CBD as a biodiversity conservation mechanism had a lasting influence on the negotiations on biodiversity over the past 20 years, especially in the context of the COPs (Conferences of Parties). The latter have notably focused on the contentious issues of Access to genetic resources and Benefit Sharing (commonly known by their acronym ABS), which are directly linked to the bioprospecting mechanism (Orsini, 2010). These negotiations have eventually led to the Nagoya Protocol, which was signed in 2010. Similarly, in many countries, the adoption of legal norms to frame the ABS issue emerged as an important topic (Filoche, 2012). This intense institutional, diplomatic, and legal activity around ABS and bioprospecting contrasts with what we will see below: the low level of actual development of bioprospecting activities and their disappointing results, both for biodiversity conservation and biotechnology development. Devoting an international protocol to regulating bioprospecting activities, in spite of their limited development and scope, may appear disproportionate. The persistent institutional significance of bioprospecting is probably best explained by other factors. In the first place, it can be argued that it results from path dependency or institutional inertia: negotiations began on the basis of the representation underlying the CBD and therefore had to end on the same basis. Additionally, the myth of the economic value of genetic resources, sometimes referred to as the green gold myth, is still widespread. Finally, the persistence of linking political-symbolic issues to bioprospecting (North-South trade terms, national

sovereignty, indigenous rights) explains its institutional longevity (Filoche and Foyer, 2011). Despite economic and environmental issues falling short of the initial promise, and far more than the success or proliferation of bioprospecting mechanisms, this mixture of institutional, cognitive, and political factors explains in part why bioprospecting and ABS issues have emerged as central elements in international negotiations and national institutions over biodiversity.

Concerning REDD, the “market” framing—legitimized by the relative consensus reached during the mid 2000s on the Kyoto Protocol and the associated carbon markets—contributed significantly to objectivize not-emitted tons of carbon as a basis for remuneration.. As a consequence, major investments were made to improve methods of monitoring forest areas and carbon stocks, as well as to train local stakeholders. Since post-2012 legally binding emissions reduction targets — the signature of which was initially expected in Copenhagen in 2009— have not yet been adopted, there is little visibility over the demand for carbon credits to fund REDD. Nevertheless, the results-based approach, and the expectation of funding through carbon markets, remains central in discourses, like an inevitable horizon, both through inertia, and because of the many interests that have crystallized around REDD in this construction.

Otherwise, while the UNFCCC framework is not yet settled, the process, strengthened by diplomatic success, has already begun: multilateral and bilateral funds have been launched (like the FCPF, coordinated by the World Bank); countries of the South, interested in REDD, are preparing their strategies and forming teams, organizing representation for national “civil society,” and preparing local “pilot” projects with support from international NGOs and private consultancies. The demand for REDD credits on the voluntary markets has been boosted by this greater credibility (Peters-Stanley, Hamilton, Marcello and Sjardin, 2011).

REDD are now at the frontline of the policies and strategies of all stakeholders in the forests of the global South. The Climate Convention has been recognized as the main arena where forestry issues are addressed (Carvalho, 2012) despite the existence of numerous other initiatives, and the fact that REDD increasingly takes place outside it. For each category of stakeholders, depending on the constraints associated with their activities, REDD’s success becomes both an opportunity and a near imperative, since it is becoming difficult not to get involved with its global “snowball” effect. Development aid donors and research funding agencies are strongly encouraged to support REDD-related activities: this allows for the disbursement of budgets for both development and an emblematic environmental concern, which gives them a good vantage point in negotiations and promotes their country’s expertise. Research programs and NGO projects on the topic are multiplying, in part because this allows for work on a hot topic related to a “social demand,” but also because funding is more readily available for this topic than for others, which constitutes an opportunity but also a constraint, especially for non-REDD-friendly NGOs, or for those interested in environmental or social issues that are not directly related to forest carbon but must adapt.

Similarly, the reference to ecosystem services has become essential in defining and defending environmental policies and a *sine qua non* condition to get funding. The TEEB (*The Economics of Ecosystems and Biodiversity*) study has been instrumental in imposing PES and other market-like policy instruments as the mainstay of conservation policies. The TEEB initiative was hosted by UNEP with

financial support from the European Commission, Germany, the United Kingdom, Netherlands, Norway, Sweden and Japan. Drawing inspiration from the Stern report on climate change, the biodiversity community wanted to raise public awareness about the economic benefits of conserving biodiversity, the losses associated with its erosion and the need for action. The study was led by Pavan Sukhdev, a senior banker from the Deutsche Bank and the founder of a green accounting project in India and like MA, it was based on a broad consultation and a call for contributions. The final reports were released during the tenth COP of the CBD at Nagoya in 2010. Most environmental economists were actually involved in this study, the results of which represent therefore a broad consensus across the major strands of the theoretical and political spectrum of environmental/ecological economics and embody what Clive Spash has labelled environmental pragmatism in a critical essay (Spash, 2009). Though they may not share the pro-market undertones of the study, most contributors felt they had to take part in this assessment because of the seriousness of the biodiversity crisis. The initiative was also backed by NGOs and networks such as Forest Trends or Ecosystem Marketplace. Since the whole biodiversity community was involved at some degree in the TEEB process, it raised limited criticism.

Accordingly, PES along with REDD have become the flagships of conservation funding strategies. While all environmental concerns are reshaped in terms of ES, most policy tools are redefined as PES or market-based instruments for the provision of ecosystem services, even if they do not show the structural features usually associated with market regulation. PES has become an all-encompassing and hegemonic category of policy tools, which is not defined through substantial elements but in reference to the economic promise of market development.

The promise conveyed by these mechanisms, coupled with the constant institutional dynamic of innovation, is gradually colonizing international and national negotiations and institutions. It is also a bandwagon that everyone jumps on to keep up with the latest institutional styles, like injunctions for public programs that provoke alignments (Snow, Benford et al., 1986). By entrenching themselves in national and international institutions, they also participate in their reconfiguration.

B. The evolution of discourse, representations, and practices: A dissemination of liberal and economics-based approaches

Bioprospecting, PES, and REDD mechanisms are both causes and consequences of a more structural turn in the environmental sector toward political and economic liberal approaches. The latter undeniably contribute to the infusion of liberal imaginaries, economics-based discourses, practices and management styles into those sectors.

These mechanisms have contributed, along with other instruments, to modifying the ways environmental protection, public policy, and the market are linked together. Until the 1990s, environmental regulation was based primarily on a legal and regulatory framework inspired by the “command and control” model, in which the State plays a central role. Following a period of normative inflation in the environmental sector from the 70s, the 1992 Rio agreement marked a turning point at

the international level because it included the promotion of economic instruments as part of its principles (Maljean-Dubois, 2003). Observing the failure of the deterrent sanctions policy led to the advent of new tools that had been put forth by economists a few years before: incentives rather than enforcement tools. This trend aimed at correcting what is seen as a market failure, the fact that some common-pool “resources” like water, biodiversity and climate became endangered because they lacked well-defined property rights and commercial value, in line with what Hardin called the “tragedy of the commons” (Hardin, 1968). Whether through the establishment of intellectual property rights to biological resources, payments to promote practices that contribute to the provision of ecosystem services, or through a cap and trade system in the case of climate negotiations, this confidence in economic tools marked the success of an Anglo-Saxon individualist legal conception placing value on a certain amount of flexibility in human resource management (Dron, cited by Maljean-Dubois, 2003). The promotion of these tools has taken place as the “governance” concept was on the rise in the management of public affairs. Governance refers to a management-oriented, decentralized and distributed vision of power in which the traditional lines between state, private and civil sectors are blurred. It has led to the development of public-private partnerships and a prominence of participatory approaches. The latter have been described as “functional participation in institutions whose purpose is clearly identified”—development according to the liberal model— which Campbell calls “populist managerialism” (Campbell, 2000), rather than as “effective participation in the exercise of the power to define a social project”. In the negotiations on the three mechanisms under study, we can actually observe a tendency toward legitimization and overvalorization of the local stakeholders who, while proposing critiques and modifications, do not question the overall framing of the problem or the institutional process, to the detriment of those who oppose it head-on.

Another signal of these transformations can be found in what has been described as the management-conservation revolving door (Dumoulin and Rodary, 2005), which is marked interpenetration between the conservation and corporate worlds. This interpenetration translates not only into the promotion of the aforementioned market-based tools, but also into a corporate culture, management style (the privatization of protected natural areas), and vocabulary, and a staff that is increasingly aware of economic issues or that comes directly from that sector⁴. The ever-increasing dependence of conservationist NGOs (WWF, TNC, Conservation International, *etc.*), and international institutions (IUCN, UNEP) on private funding is obviously another key factor. Symmetrically, the increasingly proactive commitment of firms in the environmental sector, whether through productive activities, CSR, or reclaiming a more significant role in international negotiations, only increases this crossover movement of liberalizing the environmental sector and ecologizing the private sector. But while the balance of power seems clearly to favour market stakeholders, this generalized trend to liberalizing management methods cannot be reduced to a simple privatization. There is indeed a porosity within the public sector (both national and international) and between the private and civil sectors. A globalized personnel circulates between major NGOs, international institutions, ministries, and large corporations (McDonald,

⁴ The most emblematic example in this respect is the Indian economist Pavan Sukhdev, former head of Deutsche Bank's Global Markets businesses in India, who was in charge of the Green Economy Initiative in UNEP, as well as the TEEB program.

2008), which contributes to the formation of a common ground that is politically and economically liberal.

Again, bioprospecting, REDD and PES are at once symptoms and causes of these general trends towards liberalism. As such, they are logically subject to critique, most often on an ideological level.

C. Counter-promise and controversies: Between critique and legitimation

As the mechanisms described here as promises became imbedded in institutions, they have been the subject of systematic counter-promises that are proportional to the enthusiasm needed to generate the promise. Just as the technological promises are accompanied by fears of their transformative power and risks, market-based conservation promises have brought reactions of radical critique. The market's miracle solution has thus been redefined in catastrophic terms. In addition to briefly describing the different campaigns led by civil society against these mechanisms and the controversies they have generated, our task here is to show not only how the counter-promise partly interferes in the implementation of the promise, but also, rather ironically, how it tends to validate or in a way strengthen the promise. Based largely on ideological criticism, and suggesting that these mechanisms are implemented as conceived, the counter-promise tends to validate, in a sense, the promise.

The promise of bioprospecting as a mechanism for sustainable development was quickly redefined and inverted by the term "biopiracy."⁵ Biopiracy has become the symbol of looting by the multinationals to the North of the local communities to the South. More generally, bioprospecting has been and remains a topic of debate through which much more general issues might be addressed, such as the extension of intellectual property rights (Matthews, 2011), the terms of North-South trade, the rights of indigenous peoples, and the commodification of life forms. Activists like Vandana Shiva and Jeremy Rifkin, NGOs like RAFI/ETC, GRAIN, the Third World Network, Biowatch, and Navdanya have begun international campaigns against biopiracy, challenging patents they deem abusive, as on plants like neem in India, quinoa in the Andes, hoodia in South Africa, or ayahuasca in the Amazon. These critical discourses and mobilization have also managed to stop bioprospecting projects in progress, as happened in Mexico with ICBG Maya (Dumoulin and Foyer, 2004), and the agreement between the UNAM (Universidad Nacional Autonoma de Mexico) and the Welsh biotech start-up Diversa. Anti-biopiracy discourse and mobilization has thus been effective in that it has helped to block the fulfillment of the promise, and has generally influenced its handling at an institutional level. Nevertheless, they have to some extent added credibility to the promise by redefining it more in terms of danger than of being unrealistic, thus validating the idea that genetic resources and traditional knowledge represent a substantial economic wealth that is immediately recoverable by biotechnology. However, as we will see in our third section, these assumptions are far from obvious.

⁵ This term was coined by the Canadian NGO RAFI/ETC in the mid-90s. On its website, the organization defines the term as follows: "Biopiracy [...] refers to the appropriation of the knowledge and genetic resources of farming and indigenous communities by individuals or institutions that seek exclusive monopoly control (patents or intellectual property) over these resources and knowledge." <<http://www.etcgroup.org/issues/patents-biopiracy>>.

While the concept of “avoided deforestation” gained ground in the climate negotiations, anti-REDD demonstrations, arguments, slogans and visuals gradually gained ground in the sidelines of conferences and on the Web. Different themes fueled NGO criticisms of the construction of REDD’s logic: refusal of financialization of nature and associated risks, counter-stories about which practices and stakeholders are to be held responsible for deforestation, denunciation of unrealistic REDD and various alternatives to deforestation cost estimates, highlighting the risks for local and indigenous communities and women in particular, as well as equity issues in benefit distribution, risks to biodiversity, and so on (FERN, 2012, The Rainforest Foundation UK⁶, Global Forest Coalition, 2009). In particular, the sharpest critics of REDD are common across the various mechanisms discussed in this article, with an anti-capitalist perspective: refusing the commodification of nature and life, the neoliberalizing of the climate, and so on.⁷

Without attempting to account for the diversity of arguments, or to analyze the relevance of REDD critiques, we will show how some of these elements paradoxically feed into the dynamics of the promise.

Caught up in an ideological clash around liberalism, and in the opportunity presented by REDD’s visibility to promote more global struggles, as well as the rhetorical constraints of mobilization (Chartier, 2005), certain anti-REDD NGOs sometimes develop mobilization materials that tend to demonize stakeholders and activities (*e.g.* industrial logging) and to emphasize the most dramatic risks. The focus on “carbon rights,” on the theft of indigenous rights by “carbon cowboys,” at times with a tone close to denouncing a capitalist conspiracy, opens itself to a relatively easy answer through success stories serving as counter-examples that show how, framed in a certain light, REDD logic can strengthen peoples’ rights.⁸ Thus, the success stories suggest that the problem is not the promise itself but its implementation that would require monitoring, investment and capacity building, through learning by doing.

While the claims to indigenous livelihoods are legitimate, they are expressed in the terms of a profit-oriented discourse, which in turn reinforces the deployment of expertise for the equitable distribution of benefits. Also, to insist on the risks of REDD, both technical (deforestation “leakage,” additionality, impermanence, *etc.*), and environmental (biodiversity and other ecosystem services), also helps to strengthen and legitimize the constant demand for more expertise, high-precision technologies, and monitoring criteria and indicators. This thus contributes indirectly to reinforcing the expertise and high-tech labyrinthine system around REDD,⁹ in which local and indigenous accounts are marginalized (Rajao, 2012).

Many stakeholders networks and institutions involved in the REDD dynamic do not fit the picture of the “evil capitalist:” the “buzz” over REDD allows, for example, the funding of many research and development programs, often in the context of decreasing funding. Any radical Manichean description of REDD shrouds, to some extent, the complexity of issues that allow the promise to enlist multiple players. Notwithstanding the relevance of certain arguments, it can paradoxically be counter-productive

⁶ See (Dyer and Counsell, 2010)

⁷ See, for example, the website NoREDD.

⁸ For example, this is the case for the so-called “Surui” project, taken up as a counter-example to discredit such opponents to REDD (The Amazon Working Group, 2012).

⁹ Some NGOs have also criticized the focus of national strategies on technical aspects at the expense of social elements (Freudenthal, Nnah and Kenrick, 2011).

and reinforce the immediate and heterogeneous driving forces under the promise rather than discarding them.

The situation and constellation of actors and interests is exactly the same concerning PES. Though the latter are generally depicted as market-based instruments, and therefore associated with the commodification and even the financialization of nature, because of the analogy between immaterial ecosystem services and financial assets, they may take a lot of different forms in practice. The description of PES as Coasian (bilateral) contracts might obscure actual power struggles and complex political and cultural interplay, implying various constituencies, institutions, norms and values. The implementation gap, *i.e.* the disconnection between neoliberal narratives supporting PES and actual institutional arrangements tends to be overlooked.

Beyond their differences, the accusations and campaigns against bioprospecting/biopiracy, REDD and PES are articulated in many respects. Sometimes, the same stakeholders bring them up, and some themes, particularly the commodification of nature, are transverse. They often serve to politicize other more general issues, and are therefore largely symbolic objects offering an outlet for other themes on the protest agenda (Dumoulin, 2003). More recently, campaigns against Green Economy as a new general marketing program for the environment tend to encompass these different mechanisms. While we share their criticism as to the ideological foundation of the free market (Tordjman and Boisvert, 2012), we distinguish ourselves from a denunciation block on commodification, by stressing that this theme relates to political phenomena that are often much more complex than domination by market stakeholders, and that the very dynamic of commodification deserves detailed analysis as to its implementation.

III: The implementation of the promise: The fictitious commodification of the environment

This section is based on the theoretical work of Polanyi on the notion of fictitious commodities (Polanyi, 1944; Postel and Sobel, 2010), and more generally on the tradition in institutional economics that tends to de-naturalize market and underscore its historically and socially constructed character (Commons, 1934). Gomez-Baggethun and Ruiz (2011), following Polanyi, distinguish four stages in the transformation of goods or services into commodities: economic framing, monetization, appropriation and commercialization. In addition to these operations, the implementation of an institutional framework is needed to enable transactions. We do not deny that the mechanisms described here are parts of a commodification process, but our goal is rather to emphasize the complexity and largely unfinished character of this process, particularly in relation to the terms of the promise.

A. Elusive commodities and the complexity of economic valuation

Genetic resources, avoided deforestation, and ecosystem services are elusive commodities, in that they are difficult to objectivize, and that it proves difficult in practice to allot to them (or to the practices of

stakeholders expected to implement the exchange) an economic value corresponding to a precisely defined environmental entity. Considerable efforts are therefore required to turn these entities into commodities, and to assign to them a credible economic value.

In the case of bioprospecting, economic valuation of genetic resources and biodiversity raises many problems. Concerning bioprospecting activities, the 'genetic resource' category itself, at the heart of the CBD, has proven inadequate and misleading given the great diversity of bioprospecting objects. Indeed, in reality, bioprospecting activities do not concern only genes; the active principles may also be molecules, proteins, alkaloids, tannins or even entire organisms like medicinal plants or extremophile microorganisms. Bioprospecting contracts thus refer to extremely varied natural entities that are not easily standardized. Assigning a clear economic value to these highly diverse natural entities is complicated as well, since they stretch out and transform all along the value-chain (Weiss and Eisner, 1998). The analysis of bioprospecting should not be limited to the initial contract. It must consider the whole value chain, and all the steps, from the collection of biological material, to the sale of a commercial product derived from this material, through extraction, screening, identification and testing of bioleads, purification, characterization and possibly synthesis, not to mention the long and expensive development process leading to the finished product (drug, cosmetics, *etc.*). Faced with this unsettled entity, whose ability to deliver value is highly uncertain — only a tiny fraction of the collected samples leads to a finished product that is actually marketed —, the *ex-ante* assessment of the real value of bioprospecting activities is difficult. Even if clear and effective valuation criteria were found, it has become obvious by now that the commercial potential of genetic resources and natural compounds had been grossly overestimated during the 1990s (Gomez Pompa, 2004, Greene and al 2004, Boisvert and Vivien, 2005). Ten Kate and Laird's detailed study on the commercial value of biodiversity thus recognizes that the biotech demand for genetic resources and natural compounds especially in the pharmaceutical industry is very weak (ten Kate and Laird 1999, Moretti and Aubertin, 2007). The tiny part of the R&D budget, often less than 1%, that is devoted to searching for natural bioleads is probably the best indicator of this lack of interest. Bristol Myers Squibb, Pfizer, Glaxo Smith Kline, and Monsanto have all closed their natural substances departments since the 1990s. In these conditions, it is understandable that the subject of bioprospecting contracts is difficult to force into a well-defined and stable commodity.

To make "avoided deforestation" visible, measurable and exchangeable requires transforming ecosystems and complex practices into a proportionate unit, the "carbon equivalent." Our point here is not to question the accuracy or legitimacy of these methods, but rather to clarify the technical and scientific infrastructure required to make forests eligible on the carbon market. The various processes involved can be considered as "conventions of equivalence" (Desrosières, 2001), in that they result from negotiations, depend on specific social and disciplinary framing, and can be performative in return.

The very existence of carbon markets depends on investments and political struggles allowing different gases to be made commensurable, and on the construction of emission rights as accounting units (MacKenzie, 2009). The carbon equivalent allows all types of forest ecosystems across the world to be accounted for through the same metric. The assessment of forests in carbon terms relies on exchanges at the international level of data and models inherited from traditional Western forestry, and on the

institutional construction of an international scientific and technical network. The climate framing of the forestry issue, through the deployment of carbon-centered and remote-sensing expertise, defines a specific way of seeing that objectivizes global governance (Boyd, 2010).

The most controversial problem is not linked to the determination of equivalents to account for deforestation, but to the equivalents associated with “avoided deforestation”. Indeed, it requires the construction of baseline scenarios to compare actual deforestation to what would happen without REDD. But the construction of these fictional scenarios to determine potential gains cannot be purely technical, and is therefore necessarily part of a techno-political co-construction determined by major challenges and conflicts of interest (Pirard and Karsenty, 2009). The very logic of allocating a prize for non-damage to the environment, beyond its largely speculative dimension, is not unproblematic because it obviously opens the door to abusive claims.

Turning ES into commodities also require preliminary operations of measurement, valuation, standardisation and (dis)aggregation. The assessment of ecosystem services is a major challenge and has been one of the main research areas in relation to this issue over the last decade. New tools and methods have been devised for that purpose, relying on the use of a set of techniques pertaining to eco-informatics. They are generally referred to as “rapid ecological assessment techniques”. They are used to list, dissect, map, and give a price to ecosystem services in order to catalogue them. The major project in that respect is the *Natural Capital Project*, hosted by Stanford University’s Woods Institute for the Environment and in which Nature Conservancy, WWF, and University of Minnesota’s Environmental Institute are also involved. This project has led to the development of software-based tools for integrated valuation of ecosystem services and trade-offs called InVEST. The same consortium also compiles and archives data on conservation projects, and plans to make them freely available in an online free-access database. This project is still at a pilot stage and it implies a titanic work.

However, the present lack of accounting units and currencies for ecosystem services does not preclude the development of PES. The adoption of ecologically friendly practices is considered as a proxy for the provision of environmental services, and the payment scheme is set up and justified based on this implicit assumption. The caveats associated with these devices are much the same as those met with concerning avoided deforestation.

B. Complex institutional arrangements, and unsettled markets

To implement bioprospecting, REDD and PES, one central argument advanced has been that the market’s mechanisms, by directly bringing together supply and demand, are the most simple and effective, especially in comparison to heavy administrative instruments put into place by the state. However, the implementation of these mechanisms remains tied up in complex institutional arrangements involving norms, negotiations and complex actors interplay that are far from the economic ideal of a direct supply-demand encounter. There is therefore a major gap between the description of these mechanisms as markets and the real-life institutional arrangements they give rise to when implemented.

According to a liberal vision inspired by the work of Ronald Coase (Boisvert and Caron, 2002), bioprospecting contracts in their CBD version were supposed to place the providers of genetic resources (local communities, universities or states in the South) and users (biotech firms) directly into contact. By bringing together the supply and demand for genetic resources, bioprospecting was supposed to reflect a contractual ideal representing the most effective formula for biodiversity valuation. However, bioprospecting projects implemented since the early 1990s have been based on often complex agreements involving a variety of stakeholders at different levels and posing many concrete problems, particularly with regard to access to genetic resources and benefit sharing. For example, the world most active institution in promoting bioprospecting—the International Cooperative Biodiversity Groups (ICBG)—was founded by several U.S. government agencies: the National Institute of Health, the National Science Foundation (NSF), and the U.S. Agency for International Development (USAID), and the bioprospecting agreements it implements are much more complex than simple bilateral contracts. Funded largely by this consortium of institutions, the projects are generally coordinated by an American university that enters into agreements with other universities or government institutions in countries in the South that may themselves hold agreements with other organizations or local authorities. Many private stakeholders (pharmaceutical, cosmetic and seed industries among others) are also involved and add to the complexity of these participatory arrangements. These projects are thus resulting from a complex set-up involving numerous stakeholders, from both the private and public sectors, with diverse hierarchical and functional levels and interests. The bilateral contracts that are part of a common bioprospecting project therefore involve a whole series of exchanges of funding, services, scientific material, biological material (samples, whole plants, *etc.*), skills, know-how, and subtle mechanisms of payment and distribution of any potential benefit. Access to resources and benefit sharing require complex negotiations among the various parties to an agreement. In their implementation, bioprospecting projects are thus quite far from a Coasian ideal of flexible and efficient bilateralism. Besides their limited scientific and economic returns, bioprospecting contracts represent political risks (particularly because of the controversies they raise) and a bureaucratic burden which is often considered too costly by firms (Firn, 2003). Due to the difficulty of turning genetic resources into commodities, and the complexity of institutional arrangements that this requires, the global market for genetic resources the advocates of the CBD and bioprospecting had wished for does not really exist (Aubertin, Hourcade and Vivien, 2006; Aubertin, Pinton and Boisvert, 2007). Neither new commercial products derived from bioprospecting nor actual positive results in terms of conservation have been publicized during the last two decades. Finally, bilateral contracts and intellectual property rights have proved ineffective, both in terms of wealth creation and preservation.

A double movement can be observed in the effervescence about REDD: on one hand, the carbon market remains a determining element of the promise, especially for enlisting Southern stakeholders, because it is implausible to expect additional subsidies from development funding assistance over the long term. To convince Northern investors, voluntary markets and initiatives like FCPF initiatives of the World Bank are used as testing grounds.

Inversely, in practice, the preparation of countries reinforces the idea that the reduction of deforestation requires economic development and the strengthening of political governance and that a

few new forestry projects will not be enough while the international demand for soybeans, palm oil and other products requiring land is intensifying.

The implementation of national REDD programs has been divided into three phases, justified as necessary steps for the countries of the South, to ultimately gain market access (Wertz-Kanounnikof and Angelsen, 2009). The first phase, which corresponds to capacity-building programs and pilot projects mostly supported by traditional development aid organizations, can be analyzed as the renewal of development aid policies, technology transfer programs (*i.e.* remote sensing), the provision of technical facilities (computers, cars, *etc.*), training, support for land tenure reform, programs to strengthen national political governance, *etc.*

Several factors, in particular in the least developed countries, may compromise the transition to an effective market-based financing of REDD national strategies. First, the capacity gap is generally significant in most countries involved, particularly concerning the technical component needed to account for actual emission reductions, and progress is relatively slow (Romijn, Herold, Kooistra, Murdiyarso and Verchot, 2012). In cases where government administrations offer precarious working conditions to their officers, capacity building can never be sufficiently built up and completed, because of a “brain drain” from public service into international and foreign bodies that provide a more comfortable standard of living and working environment (Gaillard and Gaillard, 2006).

In addition, as previously noted, it is not clear that the carbon markets, including those recognized by the climate convention, provide sufficient demand for carbon credits, and thus that the expectations generated in the Southern countries by this whole dynamic of preparation can be satisfied. The needs of donors, for example, to quickly disburse budgets, to make loans at attractive interest rates, or to maintain cooperative relations with beneficiary countries, may also contribute to an inertia that could maintain traditional development aid policies linked to REDD, rather than fostering an effective transition towards a plain market system.

Regardless of these potential brakes, the effective transition to market mechanisms cannot be achieved without funding and additional regulations. The very functioning of REDD engenders costs that depend more on the context than on the quantity of emissions avoided, so there is an adjustment issue between available funding and actual costs that cannot be solved by the market alone. Some types of forests can thus hardly be protected through private sector funding (Dutschke and Wertz-Kanounnikoff, 2008). In addition, from a pragmatic but also an ethical viewpoint, it is difficult to imagine a mechanism that would just compensate the poor for changing their practices without improving their income or standard of living. In any case, additional funding is required for the market. The various North-South subsidies also play a determining role in the participation of REDD beneficiary countries in all international negotiations that allow for the establishment and regulation of carbon markets recognizing REDD credits. The regulation of carbon markets also depends on a network of expertise on the certification of credits traded.

On the ground, the potential REDD credits do not only depend on the international carbon market, in which states would only have a remote regulatory role. For example, the possibility of implementing a REDD project in state forests will depend on the allocation of forest concessions through the usual method of public procurement, and the proposed REDD project can thus be in competition with other conservation and operation projects. The deployment of the REDD strategy in countries will therefore regardless remain tied up in networks of power struggles (Hansen, 2009), or the national government

and international relations that are much more complex than the simple supply and demand carbon credits system offered up to the imagination.

Apart from Vittel and Catskill cases that are the most often cited in the economic literature, most PES do not fit in with the criteria set in Wunder's definition, which he has himself readily acknowledged. In other terms, they do not meet the contractual ideal defined in reference to Coase's work. First, such payments almost always take place in a legal or regulatory framework. They are set up and governed on terms and conditions that those directly involved in these schemes do not control. The transactions are seldom totally voluntary: the beneficiaries of services may be incited, if not compelled, to contribute through payments to the maintenance of farming practices that are considered as environmentally friendly. Some traditional fiscal policy instruments such as taxes and subsidies are thus enjoying a second coming under the name of PES sustained by a pro-market narrative, while they had been discarded for their alleged lack of efficiency in the name of the same neoliberal discourse. Otherwise, in several national PES schemes, such as in Costa Rica beneficiaries contribute to a fund for the provision of environmental services: in such a context, direct contractual relations between ES users and providers are to a large extent mythical. The payments under PES schemes are not prices, but the result of bargaining between the parties or, in most cases, a rough estimate of the ES users willingness to pay rather than of the providers' opportunity costs, not to mention the value of the environmental services involved that are however the supposed rationale of the transactions.

Strictly speaking, the payments should be conditional upon pre-defined environmental performance being achieved or ecologically friendly practices being adopted. In practice the environmental impacts of these institutional arrangements are seldom assessed and even if they had poor results, it would be politically difficult if not unfeasible to stop payments.

Most institutional arrangements that are called PES nowadays would probably not have qualified as 'economic instruments' two decades ago. Even though they are undeniably supported by a pro-market narrative, it is simplistic to see them as mere expressions of the ongoing commodification of the environment. However, they are not strictly equivalent either to the pre-existing institutional arrangements that prevailed prior to the neoliberal turn of environmental policies. In the guise of market-based instruments, they are attached values and expectations that have impacts on their structure and performance. Some social groups or individuals, some locations and some environmental issues are selected and given prominence because they better fit into market patterns while others are made invisible, leading to a systematic misrepresentation of the actual context. In many cases, PES could rather be compared to market masquerades, to paraphrase Milne and Adams (2012) than to actual markets or contracts.

Far from representing direct arrangements between private stakeholders, the mechanisms described here reflect complex arrangements where diverse networks of actors intervene, including the national and international public bodies that often play a key role. The rhetoric of the market and its imaginary of a superior efficiency nevertheless play an important legitimizing function in a historical and institutional context where it is more politically correct to speak of governance, public-private partnership, and voluntary commitments, than of political regulation, or sanctions by central authorities. Market rhetoric serves to mask the always central role of the State, and even in certain cases to reclassify public transfer

policies that are discredited, or even prohibited, in the context of the rules of market non-distortion imposed by the WTO. It even legitimizes the global institutions that enable these mechanisms to be recognized and publicized, such as some UN agencies and the World Bank. Finally, one may wonder if these promises do not contribute primarily to nourishing a professional market of international and national environmental experts rather than to creating a market for the environment

Conclusion:

In this article, we set out to provide a common framework for analysis of different environmental policy innovations,, that are usually analyzed separately. The objective was to demonstrate that these innovations, beyond their differences and claims to represent new solutions, operate according to a shared grammar: in the rhetoric they mobilize, in their performative effects, and in their implementation alike. First, the importance of the promise relies at least as much on its performativity as on its deployment and possible outcomes. Indeed, the promise of market-environment synergy contributes rather to the permeation of a market imaginary in national and international institutions, than to the actual implementation of new market-based mechanisms for conservation. It also results in reconfigurations of power relations, both within organizations, and among them: some think tanks, research centers, international organizations and NGOs find themselves just as inevitable as the promise they promote. In direct relation to this first conclusion, we also showed the distance between the promise as it is formulated and the promise as it is implemented, particularly with regard to its market dimension. While they are promoted as market mechanisms, the practical application of bioprospecting contracts, REDD and PES usually reveals institutional configurations where commercial exchanges are relatively limited. Beyond this discrepancy between promise and implementation, we should also evaluate the gap between the promise's objectives and its actual results, particularly in terms of wealth creation and environmental preservation. The economy of promises, whether in technological or in political innovation, is inseparable from waves of enthusiasm and disillusionment, which cause speculative bubbles. In the case of bioprospecting, we know that this bubble has not burst violently, but that it is gradually deflating, as enthusiasm seems to fade away in industrialized countries and in the conservation sector. Bioprospecting contracts have not become a miracle conservation device, and still less the source of a lucrative biodiversity market. While we do not yet have enough hindsight to conclude that the results of PES and REDD in terms of market and conservation will be as disappointing as bioprospecting, the similarities in the difficulties of their implementation largely suggest as much.

From a theoretical point of view, several conclusions emerge from this paper. First, in terms of theoretical innovation, we have shown that the proposed framework of Pierre-Benoit Joly concerning technological innovation is partly transposable to certain political innovations, which confirms the often fertile relationship between the fields of STS and political sociology (Jasanoff, 2004; Latour 2007; Lascoumes and Le Galès, 2012) to deal with objects circulating between scientific and political worlds. Furthermore, the institutional economics approach allows us to extend Joly's framework to the economic realm and to account more thoroughly for the economic aspects of the life cycle of the promise. Markets have therefore been regarded in a constructivist perspective. Next, in terms of understanding market-inspired environmental policies, the proposed analytical framework is large

enough to account for phenomena and recurrent *modus operandi* beyond the mechanisms analyzed here. It would be interesting to see how far this conceptual framework can be applied to other instruments that are promoted at the international level on the basis of market-environment synergy (most are listed in the TEEB reports: different offsetting mechanisms, standards of sustainable development, *etc.*). In addition, compared to activist and scholarly critiques of the commodification of living, or neo-liberal nature, the narrative of the promise allows us to clearly distinguish the rhetoric from its performative effects and from its practical implementation. In this, the contribution of institutional economics is also valuable in showing the constructed dimension of commodification and its limited successes. This approach enables us to be more precise in describing the different processes of commodification. Far from weakening the critique of market development as an ideological program, it allows us to unpack the myth of environmental conservation via the market and, more generally, that of the market as the most efficient mechanism for resource allocation and regulation. In line with the STS approach that de-naturalizes science, institutionalism deconstructs the market, underscoring the fact that a market, especially when it comes to environmental entities, is a constructed and complex reality that is not necessarily the simplest solution and the efficiency of which is not demonstrated. Before promoting a great reconciliation between markets and the environment, and adhering to it, we should certainly venture upstream to take a look at the very conditions of those markets' existence.

References

- Akrich, M., Callon M. and Latour, B (eds.) (2006). *Sociologie de la traduction: textes fondateurs*, Paris, Mines ParisTech, Les Presses.
- Asadi, B. (2008). International forest deliberations, processes and civil society: An historical account (1992-2007). *International Forestry Review*, 10(4), pp. 657-669.
- Aubertin, C., Vivien, F.D. (1998). *Les enjeux de la biodiversité*. Paris : Economica, 112p.
- Aubertin C., Pinton, F. and Boisvert, V. (2007) *Les marchés de la biodiversité*. Paris : IRD, 269p.
- Boisvert, V., Tordjman, H. (2012), « Vingt ans de politiques de conservation de la biodiversité : de la marchandisation des ressources génétiques à la finance « verte » », *Economie appliquée*, tome LXV, n°2, pp. 107-136.
- Boisvert, V., Caron, A. (2002) "The Convention on Biological Diversity: an Institutional Perspective of the Debates", *Journal of Economic Issues*, 16(1), pp. 151-166.
- Boisvert, V., Vivien, F.D. (2005) "Tiers Monde et biodiversité: tristes tropiques ou tropiques d'abondance? La régulation internationale des ressources génétiques mise en perspective", *Revue Tiers Monde*, n°181, pp. 185-205.
- Boyd, W. (2010). Ways of Seeing in Environmental Law: How Deforestation Became an Object of Climate Governance. *ECOLOGY L.Q.* (37), pp. 843-916.
- Campbell, B. (2000). *Gouvernance, un concept apolitique ?* Dourdan, France: Séminaire d'été du Haut Conseil de la Coopération Internationale « Le développement : pour un débat politique ».
- Carvalho, F. V. (2012). The Brazilian position on forests and climate change from 1997 to 2012: from veto to proposition. *Revista Brasileira de Política Internacional* (55), pp. 144-169.

- Castree, N. (2008a). "Neoliberalising nature: the logics of deregulation and reregulation". *Environment and Planning A*. 40: 131-152.
- Castree, N. (2008b). "Neoliberalising nature: processes, effects, and evaluations". *Environment and Planning A* 40: 153-173.
- Chartier, D. (2005). ONG internationales environnementalistes et politiques forestières tropicales. L'exemple de Greenpeace en Amazonie. *Anthropologie et sociétés*, 29(1), pp. 103-120.
- Chapin, M. (2004) "A challenge to conservationists", *World Watch Magazine*, vol. 17, n°6. pp. 17-31
- Coalition for Rainforest Nations (2005). *Submissions from Parties*.
<http://unfccc.int/resource/docs/2005/cop11/eng/misc01.pdf>, (accessed 6 May 2013)
- Commons, J. R. (1934). *Institutional Economics: Its Place in Political Economy*. New York: Macmillan.
- Desrosières, A. (2001, juin 4). Entre réalisme métrologique et conventions d'équivalence : les ambiguïtés de la sociologie quantitative. *Genèses*, pp. 112-127.
- Dumoulin, D. (2004) "Les savoirs locaux dans le filet des réseaux transnationaux d'ONG : perspectives mexicaines" *Revue Internationale de Sciences Sociales*, n° 178. pp. 655-666.
- Dumoulin, D. et Foyer, J. (2004) "ONG transnationales et experts dans le débat démocratique : bioprospection et savoirs indigènes au Mexique" *Problèmes d'Amérique Latine*, n°54, pp. 95-122.
- Dumoulin, D. et Rodary, E. (2005) « Les ONG et le secteur mondialisé de la conservation », In Aubertin, C. (coord.) : *Représenter la nature. ONG et biodiversité*, Paris, Presse de l'IRD, pp. 59-98.
- Dutschke, M., Wertz-Kanounnikoff, S. (2008). How do we match country needs with financing sources? In A. Angelsen (Ed.), *Moving ahead with REDD: issues, options, and implications*. Bogor: CIFOR, pp. 41-52.
- Dyer, N., Counsell, S. (2010). *McREDD: how McKinsey 'cost-curves' are distorting REDD*. London: Rainforest Foundation.
- Ehrlich, P., Mooney, H. (1983). Extinction, substitution and ecosystem services. *BioScience* 33(4): 248-254.
- FAO (2007), *The State of food and agriculture. Paying farmers or environmental services*, Rome: FAO.
- Farnsworth, N. (1988) "Screening plants for new medicines" In Wilson, E. O. (Ed) *Biodiversity, National Forum on Biodiversity, Washington D.C. 1986*. Washington D.C: National Academy Press, pp. 83-97.
- Farnsworth, N. (1990),"The role of ethnopharmacology in drug development". In *Bioactive compounds from plants. Ciba foundation symposium, n°154*. Baffins Lane: John Wiley . pp. 2-23.
- Fialka, J. J. (2011, November 17). *How a Republican anti-pollution measure, expanded by Democrats, got rooted in Europe and China*. <http://www.eenews.net/public/climatewire/2011/11/17/1> (accessed 6 May 2013).
- Filoché G. (2012), " Biodiversity Fetishism and Biotechnology Promises in Brazil: From Policy Contradictions to Legal Adjustments", *Journal of World Intellectual Property*, 15 (2), pp. 133-154.
- Filoché, G. et Foyer, J. (2011) « La bioprospection au Brésil et au Mexique : un eldorado ? Entre instabilité des pratiques et permanence des représentations », *Revue d'anthropologie des connaissances*, vol. 5, n° 2, pp. 234-259.
- FERN (Director). (2012). *The story of REDD: A real solution to deforestation?* [Movie].

- Firn D., R. (2003) "Bioprospecting – Why is it so unrewarding?" *Biodiversity and Conservation* n° 12. pp. 207-216.
- Fletcher R. (2010) « Neoliberal environmentalism: Towards a poststructuralist political ecology of the conservation debate ». *Conservat Soc*, n°8, pp. 71-81.
- Foyer, J (2010) *Il était une fois la bio révolution: Nature et savoirs dans la modernité globale*. Paris: Presses Universitaires de France.
- Foyer, J., (2012) « Le réseau global des experts-militants de la biodiversité un acteur central des controverses socio-techniques », *Hermès*, n° 64, pp. 155-163.
- Foyer, J. (2013), Dumoulin, D., « L'environnementalisme social mexicain, une version endémique de l'écologie politique », *Écologie et Politique*, n° 46, 2013, p. 83-94.
- Freudenthal, E., Nnah, S., and Kenrick, J. (2011). *REDD and rights in Cameroon. A review of the treatments of indigenous peoples and local communities in policies and projects*. Forest Peoples Programme.
- Gaillard, A.-M., and Gaillard, J. (2006). Fuite des cerveaux, circulation des compétences et développement en Afrique : un défi global. In M. Pilon (Ed.), *Défis du développement en Afrique subsaharienne : l'éducation en jeu*. Nogent-sur-Marne: CEPED.
- Global Forest Coalition. (2009). *REDD Realities: How strategies to reduce emissions from deforestation and forest degradation could impact on biodiversity and Indigenous Peoples in developing countries*.
- Gomez-Baggethun, E. and M. Ruiz-Perez (2011). "Economic valuation and the commodification of ecosystem services." *Progress in Physical Geography* 35(5), pp. 613-628.
- Gómez-Baggethun, E., de Groot, R., Lomas, P., Montes, C. (2010). "The history of ecosystem services in economic theory and practice: From early notions to markets and payment schemes", *Ecological Economics*, 69(6), pp. 1209-1218.
- Gómez-Pompa, A. (2004) "The Role of Biodiversity Scientists in a Troubled World", *BioScience*, vol. 54, n°3. pp. 217-225
- Greene, S., Banerjee, S., Bannister, K. and Brush, S. (2004) "Indigenous People Incorporated ? Culture as Politics, Culture as property", *Current Anthropology*, vol. 45, pp. 211-237.
- Haas, P. (1992) "Epistemic communities and international policy coordination", *International Organisation*, 46(1), pp. 1-35.
- Hamel, O. (2013). *Contraintes et opportunité des mécanismes financiers liés au "carbone" dans le contexte des pays du Bassin du Congo*. CIRAD.
- Hamilton, K., Bayon, R., Turner, G., and Higgins, D. (2007, July 18). *State of the Voluntary Carbon Markets 2007: Picking Up Steam*. http://ecosystemmarketplace.com/documents/acrobat/StateoftheVoluntaryCarbonMarket18July_Final.pdf (accessed 6 May 2013).
- Hansen, C. L. (2009). Neither fast, nor easy: the prospect of Reducing Emissions from Deforestation and Degradation (REDD) in Ghana. *International Forestry Review*, 11 (4), pp. 439–455.
- Hardin, G. (1968). "The Tragedy of the Commons", *Science*, 162 (3859), pp. 1243-1248.

- Hayden, C. (2003) *When Nature goes public, the making and unmaking of bioprospecting in Mexico*. Princeton: Princeton University Press.
- Humphreys, D. (2001). Forest Negotiations at the United Nations: Explaining Cooperation and Discord. *Forest Policy and Economics*, 2(1), pp. 125-135.
- Igoe, J. and Brockington, D., (2007) "Neoliberal Conservation: A Brief Introduction" *Conservation and Society*, n°5, pp. 432-449.
- Jasanoff, S. (2004) The idiom of co-production, In JASANOFF, S. (Ed.) *States of Knowledge. The co-production of science and social order*. London, New York, Routledge, pp.1-12.
- Joly, P.B. (2010). "On the economics of technoscientific promises", in Akrich; Barthe, Muniesa, Mustar, *Débordements - Mélanges offerts à Michel Callon*, Paris: Presse des Mines, pp. 203-222.
- Ten Kate, K. and Laird, S. (1999) *The commercial use of biodiversity. Access to genetic resources and benefit-sharing*. London : Earthscan.
- Kosoy, N. and E. Corbera (2010). "Payments for ecosystem services as commodity fetishism." *Ecological Economics* 69(6), pp. 1228-1236.
- Lascoumes P and Le Galès P. (2004), *Gouverner par les instruments*, Paris, Presses de Sciences Po « Académique ».
- Lascoumes, P and Le Galès (2012), P. *Sociologie de l'action publique. (2nd edition)*, Armand Colin, coll. « 128 ».
- Latour, B. (2007) Turning around politics: A Note on Gerard de Vries' Paper. *Social Studies of Science*, 37, 811-820.
- MacKenzie, D. (2009). Making things the same: gases, emissions rights and the politics of carbon markets. *Accounting, Organizations and Society* (34), pp. 440-55.
- Maljean-Dubois, S. (2003). *La mise en œuvre du droit international de l'environnement*. Studies: Iddri.
- Matthews, D. (2011) *Intellectual property, human rights and development: the role of NGOs and social movements*. Cheltenham, UK; Northampton, MA: Edward Elgar.
- McAfee, K. (2012). "The Contradictory Logic of Global Ecosystem Services Markets." *Development and Change* 43(1), pp. 105-131.
- McAfee, K., Shapiro, E. (2010). "Payment for Ecosystem Services in Mexico: Nature, Neoliberalism, Social Movements, and the State." *Annals of the Association of American Geographers* 100(3), pp.579-599.
- McCarthy J, Prudham S. (2004), "Neoliberal nature and the nature of neoliberalism." *Geoforum* 35, pp. 275-283.
- McDonald, K.I. (2008) «Business, Biodiversity and New 'Fields' of conservation: The world conservation congress and the renegotiation of organisational order » *Conservation and Society*, 8, pp. 256-75.
- Méral, P. (2012) Le concept de service écosystémique en économie: origine et tendances récentes. *Natures Sciences Sociétés* 20, pp. 3-15.
- Millennium Ecosystem Assessment (2005). *Ecosystems and human well-being: A Synthesis*. Washington, DC: Island Press.
- Milne, S., Adams, B. (2012). "Market Masquerades: Uncovering the Politics of Community-level Payments for Environmental Services in Cambodia." *Development and Change* 43(1), pp. 133-158.

- Moretti, C., Aubertin C. (2007). "Stratégies des firmes pharmaceutiques: la bioprospection en question" In Aubertin C., Pinton, F. and Boisvert, V. *Les marchés de la biodiversité*. Paris : IRD, pp. 27-54.
- Moutinho, M. C. (2011). The emerging REDD+ regime of Brazil. *Carbon Management*, 2(5).
- Muradian, R., Rival, L. (2013). *Governing the Provision of Ecosystem Services*. Springer.
- Mooney, H.A., Ehrlich, P.R. (1997). Ecosystem services: A fragmentary history, in Daily, G. (Ed.), *Nature's Services: Societal Dependence on Natural Ecosystems*, Washington (DC), Island Press, 11-19.
- Noble, I. (2003). *The World Bank's BioCarbon Fund*. in Australasian Emissions Trading Forum Review: <https://wbcarbonfinance.org/docs/BioCarbonFundAETFArticle.pdf> (accessed 6 May 2013),
- NoREDD. (n.d.). <http://noredd.makenoise.org/> (accessed 4 April 2013)
- Orsini, A. (2010). *La biodiversité sous influence ? Les lobbies industriels face aux politiques internationales d'environnement*, Bruxelles, Éditions de l'Université de Bruxelles.
- Pagiola, S., Bishop, J., Landell-Mills, N. (Eds.) (2002), *Selling forest environmental services: market-based mechanisms for conservation and development*, Earthscan, London.
- Pedroni, L. (2008). *Methodology for Estimating Reductions of GHG Emissions from Mosaic Deforestation*. Washington: BioCarbon Fund.
- Pesche, D., Méral, P., Hrabanski, M., and Bonnin, M. (2011). *Services écosystémiques et paiements pour services environnementaux: les deux faces d'une même logique ?* Programme Serena - IRD, CIRAD, Working Paper, Montpellier.
- Peters-Stanley, M., Hamilton, K., Marcello, T., and Sjardin, M. (2011). *Back to the Future. State of the Voluntary Carbon Markets 2011*. Ecosystem Marketplace, Bloomberg New Energy Finance.
- Pirard, R., and Karsenty, A. (2009). Climate Change Mitigation: Should "Avoided Deforestation" Be Rewarded? *Journal of Sustainable Forestry*, 28(3-4).
- Plotkin, M. (1988). "The Outlook for new agricultural and industrial products from the tropics" In Wilson, E.O., *Biodiversity, National Forum on Biodiversity, Washington D.C. 1986*. Washington D.C : National Academy Press. Pp. 106-116.
- Polanyi, K. (1983). *La grande transformation. Aux origines politiques et économiques de notre temps*, [1944], Paris : Gallimard.
- Postel N. and Sobel R. (2010), « Le concept de marchandise fictive, pierre angulaire de l'institutionnalisme de Karl Polanyi ? », *Revue de Philosophie économique*, 11(2), pp. 3-36.
- Randall, A. (1988) "What mainstream economists have to say about the value of biodiversity". In Wilson, E.O. *Biodiversity, National Forum on Biodiversity, Washington D.C. 1986*. Washington D.C: National Academy Press. pp. 217-223
- Rajao, R. (2012). Representations and discourses: the role of local accounts and remote sensing in the formulation of Amazonia's environmental policy. *Environmental Science and Policy*.
- Reid, W. (coord.) (1993). *Biodiversity prospecting*. Washington DC: World Resource Institute.
- Romijn, E., Herold, M., Kooistra, L., Murdiyarsa, D., and Verchot, L. (2012). Assessing capacities of non-Annex I countries for national forest monitoring in the context of REDD+. *Environmental Science and Policy*, 19-20, pp. 33-48.

Santilli, M., Moutinho, P. S., Nepstad, D., Curran, L., and Nobre, C. (2003). Tropical Deforestation and the Kyoto Protocol: A new proposal. *COP 9, UNFCCC*, December 2003. Milan.

Spash, C. (2009). The new environmental pragmatists, pluralism and sustainability. *Environmental Values*, 18(3), pp. 253-256.

Stern, N. (dir.) (2006). *Stern Review Report: The economics of climate change*. Cambridge: Cambridge University Press.

The Amazon Working Group (2012). *600-Strong Coalition Says No REDD Campaign Is Way Off-Target. An Open Letter*.

http://www.ecosystemmarketplace.com/pages/dynamic/article.page.php?page_id=9428§ion=news_articles&eod=1 (accessed 6 May 2013)

Weiss, C. and Eisner, T. (1998). "Partnerships for value-added through bioprospecting » *Technology and Society*, vol. 20, n°4, pp. 481-498

Wertz-Kanounnikof, S., Angelsen, A. (2009). Global and national REDD+ architecture. Linking institutions and actions. In A. Angelsen (Ed.), *Realising REDD+* (pp. 13-24). Bogor: CIFOR.

Wilson, E. O. (ed.) (1988) *Biodiversity, National Forum on Biodiversity, Washington D.C. 1986*. Washington D.C : National Academy Press.

Wilson, E. O. (1993) *La diversité de la vie*. Paris : Odile Jacob.