# Chapter 24
# Ecosystem Services, Payments for Environmental Services, and Agri-Chains: What Kind of Regulation to Enhance Sustainability?

**Estelle Biénabe, Céline Dutilly, Alain Karsenty, and Jean-François Le Coq**

No agricultural production system anywhere in the world can today afford to ignore environmental issues, a reality that is widely reflected in the increasingly significant agroecological movement, which is pushing for the promotion of agri-environmental practices, control over pollution and emissions of greenhouse gases, a halt to deforestation, and, in general, the prevention of the artificialization of natural areas, the adoption of ecological compensation mechanisms, etc. The political and social recognition of what we shall hereafter refer to as ecosystem services, which sometimes have a global scope (global public goods such as biodiversity and climate), complements that of services usually expected from agriculture at local and national scales: income, employment, food security, and local development. This chapter contributes to this part of the book, which examines the role of agri-chains as arenas of regulation of sustainable development, by addressing this issue more specifically through the use of ecosystem services and payments for environmental services, as a complement to approaches built within the agri-chains. We first clarify these concepts and show how payments for

E. Biénabe (✉)
CIRAD – UMR Innovation, F-34398 Montpellier, France
e-mail: estelle.bienabe@cirad.fr

C. Dutilly
CIRAD – UMR Selmet, Montpellier, France
e-mail: celine.dutilly@cirad.fr

A. Karsenty
CIRAD – UPR BSEF, Montpellier, France
e-mail: alain.karsenty@cirad.fr

J.-F. Le Coq
CIRAD – UMR Art-dev – UNA, Heredia, Costa Rica
e-mail: jean-francois.le_coq@cirad.fr



E. Biénabe et al. (eds.), *Sustainable Development and Tropical Agri-chains*,
DOI 10.1007/978-94-024-1016-7_24

environmental services have evolved from an initial, very 'Coasian'[1] concept of 'polluted pays' to a public action instrument that aims to promote agroecological transitions at large territorial scales. After noting the benefits and limitations of environmental and sustainable labels in relation to payments for environmental services, we propose an original and integrative approach to such payments, which combines agri-chain approaches (labels, zero deforestation in particular) and territorial approaches to reconcile the conservation and development of territories by ensuring the sustainability of agricultural activities.

## 24.1 Ecosystem Services, Environmental Services, and Payments for Environmental Services: Concepts to Be Defined

### *24.1.1 Origins of the Concepts*

The concept of ecosystem services was introduced in the 1970s by the ecological and economic disciplines, with the aim of encouraging a global perspective of environmental problems. It was first popularized in the late 1990s by Costanza et al. (1997), who calculated an overall economic value of all ecosystem services provided by the biosphere (even though this term was not used), and, subsequently, by the Millennium Ecosystem Assessment (2005). The latter proposed a typology of ecosystem services[2] based on a comprehensive schematic framework of the links between these services and human well-being. Metaphors to illustrate the dependence of human societies on ecosystems (Norgaard 2010), ecosystem services are now increasingly being used to highlight the benefits people derive from nature, resulting in the development of approaches to recognize, measure, and integrate these services in private and public decision making.[3]

Payments for environmental services are, in fact, a set of empirical practices and mechanisms to manage water and soil at the watershed scale or to protect forests.

[1] Applying the 'Coase theorem' to the identification of payments for environmental services suggests that 'in a world where transaction costs are zero, and where property rights are clearly defined, a free play of negotiations results in an optimum independent of the initial allocation of rights' (Bertrand and Destais 2002).

[2] Provisioning services, i.e., products (food, water, energy, etc.) obtained from ecosystems; cultural services and amenities (spiritual, recreational, aesthetic benefits, etc.); regulation services linked to ecosystem processes (climate regulation, water and air purification, etc.); services that help maintain conditions suitable for life on earth, i.e., those necessary for the provision of all other services (nutrient cycling, formation and retention of soil and humus, creation and maintenance of natural habitats, etc.).

[3] The Economics of Ecosystems and Biodiversity (TEEB) initiative, which proposes, in continuation of the Millennium Ecosystem Assessment, an economic framework and methodological tools for the conservation of ecosystem and biodiversity services, is a prominent illustration.

They are all based on the direct incentives for conservation offered to local actors whose practices are potentially harmful to ecosystems and who have 'property rights'[4] that permit such practices. The use of the term 'payments for environmental services' gained currency with Costa Rica's national PSA[5] programme in 1996. Other programmes were implemented at the same time or later, including China's Grain for Green programme in 1999, Mexico's payment for hydrological environmental services programme (PSA-H) in 2003, Ecuador's *Sociobosque* programme in 2008 as well as many local initiatives.[6]

Since payments for environmental services were based on direct incentives, contracts, and conditional remunerations, institutions and development agencies quickly showed interest in them. They are *a priori* considered to be more efficient and better able to mobilize private sector resources than 'command and control'[7] measures and integrated conservation and development[8] programmes (Gómez-Baggethun and Muradian 2015). S. Wunder, a CIFOR researcher, proposed a definition of payments for environmental services in 2005 that was simple and seemingly clear. An initial ideal type of payment for environmental services emerged from his definition that was subsequently widely used: 'a voluntary transaction where a well-defined environmental service (or a land-use likely to secure that service) is being 'bought' by a (minimum one) environmental service buyer from a (minimum one) environmental service provider if and only if the environmental service provider secures environmental service provision (conditionality).' This definition, based on a commercial exchange (buyer, supplier), has led to a persistent misunderstanding on the nature of the instrument.

The fact that this definition was proposed in 2005 led to a confusion between the environmental services of PES[9] and the 'ecosystem services' of the Millennium Ecosystem Assessment, which were popularized in the same year, and contributed to the misunderstanding regarding the instrument. Few researchers clearly differentiate between ecosystem services ('benefits that men derive from nature') and

[4] The concept of property rights is used here in its Anglo-Saxon sense ('bundle of rights' proposed by Schlager and Ostrom 1992) and is not limited to strict ownership as defined in the Civil Code with the *usus*, *fructus* and *abusus* attributes. 'Property rights' also include the rights of access, extraction, management, exclusion, etc. With regard to land issues, E. Le Roy (1996) proposed to use the concept of 'land control' for property ('maîtrises foncières' in French).

[5] The 'A' corresponds to *ambiental*, which means 'environmental' in Spanish.

[6] One oft-quoted pioneering local experiment is that of Vittel, but many more experiments have been recorded (Ezzine de Blas et al. 2015).

[7] 'Command and control' measures are those in which the State fixes rules, usually coercive, and enforces them. Examples are bans on deforestation, prohibitions in protected areas, etc.

[8] Beginning in the 1980s, integrated conservation and development projects were rolled out with the aim of reconciling the management of protected areas and the interests of local populations.

[9] Depending on the authors, PES stands for payments for environmental services or payments for ecosystem services.

environmental services, which are human practices that affect nature.[10] Ecosystem services obviously constitute a reductive and anthropocentric notion, but their function is primarily to convince society to become aware of the value of protecting nature. The concept of ecosystem services lends itself poorly to an economic analysis insofar as it encompasses marketable or potentially marketable goods (wood, fibre, water, food) as well as positive externalities (by definition without a market) such as climate and water cycle regulation, biodiversity, etc. Within the context of payments for environmental services, remuneration obviously concerns the actions of actors (or the practices they give up), and the amount of remuneration is more likely to be determined based on the producers' loss of earnings (or opportunity costs) than on an overall economic value of ecosystem services (which, in any case, is rarely possible to calculate). In addition, there exist some uncertainties regarding the level of ecosystem services that payments for environmental services would like to promote and the practices actually paid for: the relationship between the maintenance of forest cover and the quantity and/or quality of the water downstream of a watershed is sometimes complex. Remuneration thus pertains to 'proxies', practices that are presumed to be favourable to different ecosystem services (water quality, biodiversity, carbon sequestration, etc.), which are often associated together in the objectives of payment for environmental services, since they cannot be precisely measured. This led Farley and Costanza (2010) to suggest that even though ecosystem services are often poorly defined in the context of payments for environmental services, this does not constitute a serious problem.

### *24.1.2 'Commodification' of Nature?*

Contrary to the suggestion of the 2005 definition by Wunder, there is no 'market for ecosystem services'.[11] Payments for environmental services are designed to promote the production of only those ecosystem services that are 'positive externalities', i.e., those services which, by definition, have no market. These particular ecosystem services are public goods (biodiversity, climate regulation, scenic beauty, etc.) or collective goods (water quality in a watershed), and do not lend themselves to privatization.[12] Yet 'an essential pre-condition for price-making

[10] One can note the definition of environmental service by Aznar and Perrier-Cornet (2003): 'an intentional contribution to the management of a given space with an environmental and collective goal' (which entails a remuneration as part of 'payments for environmental services') or by Karsenty and Ezzine de Blas (2014): 'the services that men render amongst themselves to maintain or increase certain ecosystem services'.

[11] There do exist markets for certified reductions of greenhouse gas emissions (commonly known as carbon credits), but they are quasi-monetary instruments and not benefits derived from nature.

[12] The fact that a water company can directly benefit from the water quality of a watershed does not imply that it prevents other users of the watershed to also benefit from this quality (non-rivalry and non-exclusivity).

markets is the existence of well-defined and enforced property rights over the good or service to be exchanged' (North 1977, p. 710). Payments for environmental services are therefore not 'market instruments', even if the level of remuneration results from 'bargaining', to quote the apt term used by Boisvert (2015). As noted by Wunder and Vargas (2005): 'If [an urban water utility] thinks the price for watershed protection charged by upstream farmers is too high, usually it cannot just go to the next three watersheds for better offers.'

This does not prevent either the selection of the 'providers' of environmental services through competitive mechanisms (reverse auctions, to select the lowest bidders to maintain certain habitats on their lands) as is done in Australia and the United States. Nor even some payments for environmental services being financed by the sale of carbon credits, marketable goods created by a specific mechanism (including measurements and certification) and which are contingent on the payment for environmental services instrument (Karsenty et al. 2014). But this does not mean that payments for environmental services are instruments to 'commodify nature' (Karsenty and Ezzine de Blas 2014). Non-market definitions do exist; for instance, that of Muradian et al. (2010, p. 1205), which incorporates not only the incentive nature of the instrument, but also the political and institutional challenges of its implementation: 'a transfer of resources between social actors, which aims to create incentives to align individual and/or collective land use decisions with the social interest in the management of natural resources.' In 2015, Wunder proposed a new ideal-typical definition of payments for environmental services that avoided the use of business language this time, and even steered clear of the initial idea of a 'well-defined environmental service'. This proposal, however, clearly did not bring an end to the debate.[13]

Like any instrument, payments for environmental services can generate adverse effects. In principle, they are meant for actors who have (ownership) rights and who are willing to suspend those that are harmful to the environment. However, it is common for incentives to be offered as payments for environmental services even though regulations already exist to prohibit the concerned practices that are harmful to the natural environment. Such a situation risks eroding the civic spirit in this domain. Will actors choose, in the future, to conform to restricting regulations only if they are paid to do so?[14] More generally, payments for environmental services may lead actors to adopt the following reasoning: if there is no other motive than a (monetary) interest in conserving nature, then we can legitimately be 'irresponsible' the moment this starts costing us something. In other words, will a generalization of payments for environmental services reduce the likelihood of selfless conservation action (Karsenty 2013)?

[13] Wunder now only retains the following characteristics: (1) voluntary transactions, (2) between service users, (3) and service providers, (4) who comply with agreed rules of natural resource management, (5) to generate off-site services (Wunder 2015, p. 9).

[14] However, we must differentiate between the cases of poor populations (who do not have the means to comply) and those of enterprises (which tend to chase windfall profits).

### 24.1.3 A Co-evolution of the Concept and Implementation Practices

It is common to portray payments for environmental services as being based on the 'polluted pays' principle, as against the better known 'polluter pays' principle on which environmental taxes are founded. With regard to water, several qualified initiatives on payments for environmental services (often retrospectively) have contributed to this understanding. The case of Vittel corresponds well to the 'polluted pays' scenario: it has, from the early 1990s, paid farmers whose farms border the water source to stop using pesticides and to permanently modify their farming and livestock rearing practices. Practitioners have thus often sought out beneficiaries of the service, in order to get them to fund payments for environmental services. Many public or private companies that generate hydro-electric power or distribute municipal water levy specific charges that are included in users' bills to fund a compensation scheme for farmers located upstream of the watershed. If the contractual (and thus voluntary) nature of payments for environmental services remains an essential feature of the instrument, funding by end users is often enforced through the billing system.

Successes in implementing private governance mechanisms to supply quality water to catchment areas are more the exception than the rule. In the case of these payments for water-related environmental services, the beneficiaries are limited in number and can be identified. This allows bilateral agreements between a group of farmers and a company or local authority (one can think of this as a short value chain). However, payments for environmental services pertaining to biodiversity or carbon, which generate global services, do not have specific beneficiaries and require different institutional mediations at national and international levels, i.e., on the international market of emission permits, with the involvement of international funding entities, national or local organizations that offer contracts for the provision of services and remuneration, etc. The vast majority of current payments for environmental services are publicly governed, with the State setting payment levels, identifying the beneficiaries, and, as part of government regulations, defining the environmental responsibilities included in the instruments.[15] This broadly relativizes the 'polluted pays' principle to which payments for environmental services are often equated.

Furthermore, although crop cultivation and livestock rearing have always been based on the provision of agricultural products and derivation of value from them, and although agricultural production has always benefited from various ecological functions (for example, pollination), until recently agriculture was mainly considered a threat to nature and the environment. However, the idea that agriculture can also contribute to the preservation of the environment, which was already at the heart of discussions on multi-functionality in the 1990s, is seeing a growing and

[15] According to Vatn (2014), the contribution of public funding towards payments for environmental services amounts to at least 90 %. This form of funding is partly based on taxes.

general interest subsequent to the Millennium Ecosystem Assessment. The agroecosystem is not only considered as a provider of provisioning services (agricultural products), but also of other services (carbon sequestration, maintenance of open landscapes for biodiversity, etc.).[16] And, in line with the 'greening' of agricultural policies of the countries of the North, the rationale of compensation for environmental services rendered is increasingly being accepted by the agricultural sector.

## 24.2 Payments for Environmental Services and Environment Labels in the Countries of the South: Some Key Lessons Learned

### *24.2.1 Payments for Environmental Services in Countries of the South: Experiences from Costa Rica and Mexico*

The impact assessments of payments for environmental services in Costa Rica (PSA) and Mexico (PSA-H), which are among the most iconic and the oldest of their kind, validate and improve the analysis of payments for environmental services in the countries of the South. They show that the environmental additionality of payments for environmental services,[17] contrary to expectations, is often limited, (Alix-Garcia et al. 2012; Le Velly et al. 2015b; Legrand et al. 2013). Moreover, analyses of PSA-H's implementation in Mexico reveal leakage effects, i.e., the shifting of activities that affect the environment outside the area of implementation of the mechanism. Thus, in Chiapas, the programme of payment for environmental services (PSA-H) led farmers to give up their practices of fallowing and slash-and-burn and to compensate for lower soil fertility and the development of diseases by using the payments received to buy fertilizers and pesticides, with the negative ecological effects of these forms of intensification of agricultural practices in areas adjacent to forests under contract. These developments had not been anticipated by the mechanism. Similarly, in Yucatan State, payments help overcome credit constraints, leading some farmers to invest in cattle with significant risks of rebound effects at the end of the conservation contracts. These indirect effects seriously call into question the sustainability of actions taken as a result of the payments for environmental services if they are not designed in an integrated manner with cultivation and livestock activities. On the other hand, Legrand et al.

[16] For more information, see the reference fact sheets for environmental services and agriculture (http://www.gred.ird.fr/programmes-de-recherche/programmes-acheves/serena, in French).

[17] Additionality seeks to measure the extent to which land uses promoted by payments for environmental services would not have been adopted without them.

(2013) highlight the many beneficial spill-over effects of payments for environmental services in Costa Rica. By considering contracts protecting agricultural land on which a forest is regenerated as admissible, the funding has helped change the use of land in ways that are favourable to conservation. Payments for environmental services have also contributed significantly to an increase in environmental awareness in both these countries, and to the acceptance of the ban on deforestation enshrined in forest laws (Legrand et al. 2013; Shapiro-Garza 2013), even though questions may remain about the future attitudes of the beneficiaries vis-à-vis the regulations if these payments were to stop in the future.

Furthermore, although payments for environmental services have been promoted with an explicit reference to environmental additionality, the negotiation processes of their implementation has led to the inclusion of social objectives. In the case of payment for environmental services in Costa Rica, beneficiaries are not identified on the basis of criteria of deforestation risk or maximizing environmental services, and payments are not differentiated according to opportunity costs or the ability to provide environmental services. The underlying logic was to limit the risk of environmental blackmail by those excluded from the programme and to provide equal opportunities to receive payments for environmental services as a form of social justice (Karsenty and Ezzine de Blas 2014). However, even though payments for environmental services include modalities to favour small and medium producers, several studies have shown that the main beneficiaries are wealthy landowners, most of whom do not even live on the properties for which they receive payments for environmental services, and whose primary sources of income are non-agricultural activities (Zbinden and Lee 2005). In the case of Mexico, on the other hand, McAfee and Shapiro (2010) show how the payment for environmental services have been developed as a hybrid instrument in the course of multi-actor negotiations in the early years of its implementation, by including a form of subsidy to fight rural poverty and target the most marginal communities. Payments for environmental services in Mexico have mainly benefited poor communities, helped contain migration flows, and maintain some rural populations (Le Velly et al. 2015a). Moreover, a real environmental labour market (green labour) has developed in the State of Mexico. Since it may be socially unacceptable to be seen to be receiving a direct payment for conservation, collective payment is redistributed on condition that there is participation in collective work for forest maintenance, such as the construction of firebreaks.

### *24.2.2 Complementarity Between Payments for Environmental Services and Labels*

Payments for environmental services, mainly implemented in countries of the South, are now acquiring a certain measure of political legitimacy. They are evolving under the impetus of international funding entities and large agrifood companies. New mechanisms are being established, enabling cultivation and

livestock rearing activities to provide environmental services. The issues of sustainability of agricultural activities began to be managed through quality standards (eco-labels) well before the advent of payments for environmental services. And zero deforestation commitments by companies, an example of other agri-chain approaches promoted for agricultural activities, are emerging as a new way of introducing payments for environmental services (Boucher 2015). A few countries, such as Indonesia and Côte d'Ivoire, have started supporting such approaches.

While the funding and governance of payments for environmental services are mainly under State purview, monetary premiums for labels are provided privately by agri-chains and managed by them. In the case of labels, the remuneration of producers depends on the quantity of products sold, the level of premiums, and the nature of beneficial practices mandated (included in the specifications), while in the case of payments for environmental services, usually on a specific land use, established on the basis of a multi-year contract (Le Coq et al. 2011). The performance of labels in providing ES is very variable as has been observed for PES. For example, Quispe (2007) shows that despite significant changes being observed in practices adopted by organic coffee producers, the changes are more limited in the case of farmers certified by UTZ Certified, Rainforest Alliance, and Starbucks.

Moreover, although labels can have a significant effect on the individual practices that farmers adopt, it is much more difficult to incorporate territorial planning in the definition of specifications (Biénabe 2013). Thus, for coffee, while the factor of shade management is included – with high variability – in the contract specification, the distance to wooded areas, which is also significant in the provision of environmental services, is not (Soto and Le Coq 2011). More generally, there are many and substitutable environmental degradation factors in a territory. This also applies to zero deforestation approaches. Even a successful effort to manage the production conditions of farmers in an agri-chain does not imply control over other degradation factors – cultivation of other crops, livestock rearing, or activities such as making charcoal and collecting lumber or timber. Good environmental practices promoted by agri-chains are not sufficient if other factors and activities that degrade the environment still persist. This confirms the relevance of efforts to develop public and private regulation instruments, both at the level of agri-chains (with companies and producers) and of territories (with communities on their land).

## 24.3 A Proposed Integrative Approach Between Territorial and Agri-Chain Approaches for Designing PES

We propose an integrative approach for designing payments for national environmental services that addresses the limitations of current designs and developments presented in this chapter. This approach is currently proposed for Côte d'Ivoire, which is committed to implementing a REDD+ strategy (Reducing Emissions from

Deforestation and Forest Degradation). The Ivorian strategy is based on zero-deforestation agriculture supported by a mandatory national sustainability standard and a system of payments for environmental services, much like the existing instruments in Costa Rica and Mexico.[18] The goal is to delink agricultural production from deforestation for the main agri-chains by relying on private sector initiatives that favour supply chains that cause no deforestation. It is a matter of promoting agroforestry and other intensive agricultural practices with reduced environmental impacts, and to put a forest monitoring system in place.

This integrative approach seeks to benefit from synergies between different instruments and initiatives by combining a 'top-down' approach at the national level, and a 'bottom up' approach in territories that can be considered 'coherent' from the perspective of social, economic, and environmental (soil, supply basin, etc.) dynamics. The first is controlled by the State (through the national system for payment for environmental services). It encompasses the initiatives of private firms and NGOs that are part of agri-chain based rationales and those behind the improvement of producer practices (zero deforestation programme, management of supply chains, improvement in the environmental quality of territories) through common operational rules and coordination of different sources of funding (State development assistance, funding from agri-chains, etc.). The second relies on engaging the communities that use these territories and their ability to undertake common territorial projects. These two approaches intersect through the definition of these territorial projects, which translate the goals and initiatives of interest to entities at the national (and international) levels.

As far as the design of specific instruments is concerned, the first principle of the proposed approach is a rational distinction between – and combination of – payments for environmental services that are aimed at restricting land use and payments for environmental services for asset building.[19] In the first type of payment, which is based on the agreed suspension of actual rights or those deemed locally legitimate in exchange for recurring remuneration, the opportunity cost for giving up certain practices forms the basis for negotiations to determine compensation. The second type, on the other hand, concerns remuneration for the adoption and implementation of new practices.[20] The second principle involves combining individual and collective commitments by linking individual and collective conditionalities, creating a mandatory solidarity to ensure conservation and thus limiting the risk of opportunistic behaviour. Finally, the implementation of these contractual mechanisms requires the recognition of individual and collective rights over different spaces and resources, and, consequently, the securing of exclusive land rights.

[18] For a more detailed presentation, see Karsenty (2015).

[19] For details on the relevance of this distinction, see Karsenty and Ezzine de Blas (2014).

[20] The remuneration can be based on the cost of the work put in (e.g. minimum agricultural wage) or it can be variable depending on the practices concerned and the locations of implementation.

### 24.3.1 Payments for Environmental Services to Households, Oriented Towards Investment and Funded by Enterprises

Payments for environmental services for investments negotiated at the level of individual producers can be implemented by a specialized operator and funded by enterprises. Conditionalities of practices and technical itineraries can be based on different existing recommendations (including approaches proposed in the framework of sustainability labels and standards adopted by different agri-chains). The investments also include financial incentives for land users to plant trees or hedges, or restore degraded areas of land they own or control directly.

### 24.3.2 Collective Payments for Environmental Services, Mainly Oriented Towards the Conservation and Sustainability of Territories

Complementing these mechanisms by actions at the scale of territorial projects involves defining, when the social contexts permit it, collective payments negotiated at the community level, in compensation for the restriction of usage rights. Thus, this territorial approach to payments for environmental services aims to create a collective dynamic to underpin commitments regarding land use (agreement on a land use plan within clearly defined territories and, if necessary, agreement to discontinue certain practices or techniques). In an implicit manner, this reflects the idea of creating a territorial project that is sustainable or causes zero deforestation. Thus, in the approach planned by Côte d'Ivoire for payments for environmental services, the concepts of High Conservation Value (HCV)[21] and High Carbon Stock will be useful in dividing the territories into zones where new cocoa or oil palm plantations can be established. High Conservation Value (HCV) distinguishes ecosystems of varying importance depending on different criteria (e.g., biodiversity and socio-cultural ones). And High Carbon Stock distinguishes forests which, even when disturbed, provide important environmental services (carbon sequestration, of course, but also biodiversity and specific social contributions) from highly degraded forests which can be converted into agricultural plantations. Participatory zoning based on these principles could form the basis for implementation of collective payments for environmental services. The contractual commitment of a community using a piece of land could lead to the development of environmental quality indicators for the territory through discussion with the local populations. Payments for environmental services will help finance improvements in environmental quality, which depend on collective

[21] See also Chap. 22.

actions, and to provide collective benefits (land tenure security through demarcation and/or the registration of individual plots, drinking water supply, warehouse facilities, rural roads, schools, clinics, etc.), by making them conditional on the maintenance or improvement of environmental quality that is measured and recorded jointly.

### *24.3.3 Public Investments Needed to Clarify Land Ownership and Secure Contracts*

Since payments for environmental services are destined for actors who have rights over the land and the resources they use, it is essential to clarify and recognize land rights (at the very least, exclusion rights) to be able to establish the rights and responsibilities without which no contractual agreement can be entered into. These collective and individual contracts will have to be in written form and be verified at regular intervals to justify the continuity of benefits or payments. To map individual plots on which farmers must fulfil their contractual obligations, the approach could be that of rural land-tenure plans (cadastral map with identification of plots and right holders, indication of the exact nature of individual and collective rights) (Lavigne-Delville 2010). While it is possible that large corporate entities may agree to contribute to the funding of such systems in their supply basins, large public investments will certainly be necessary, mainly to finance payments for collective environmental services targeting the territories. Funds earmarked for climate-related issues, in the context of the fight against deforestation, can be mobilized for this purpose.

## 24.4 Conclusion

Payments for environmental services are instruments that are still evolving and whose limits are still not clearly defined, to the extent that this term includes – often retrospectively – a set of practices and initiatives with certain common features (mainly the voluntary, contractual, and conditional aspects), but also with local design and implementation specificities. Although certain payments for environmental services, particularly with regard to water, adequately reflect the ‘polluted pays’ principle, which is often associated with the instrument, it is not so for payments for environmental services for biodiversity, carbon sequestration, and other global public goods (often associated in the objectives). In addition, although payments for environmental services have often been implemented for the suspension of usage rights, a growing proportion of initiatives aim to combine compensation for conservation and investment in sustainable agro-silvo-pastoral practices (Karsenty 2011).

Payments for environmental services are becoming increasingly similar, in their implementation, to transfers used by States to fund landowners and communities, either to reward their environmental commitment (stewardship) or to offset opportunity costs of the restrictions on land use, with impacts that are not only environmental but also social. They thus constitute public policy instruments to promote ecological transitions in rural areas.

Instead of compartmentalizing into distinct services and managed areas, which could lead, in particular, to leakage effects, this chapter shows that, to be effective and fair, payments for environmental services must reflect different territorial levels in an integrated design of environmental and developmental efficiency, by establishing coherency between instruments of sectoral (agricultural, social, environmental) public policies and those of business policies. We believe that payments for environmental services can contribute to changes in practices by building capacity of producers and other actors to achieve sustainable management of agriculture, livestock rearing, forestry, etc. We have thus proposed an integrative approach combining a territorial and collective approach with a 'top-down' approach that incorporates sustainability strategies of agri-chains.

## References

Alix-Garcia J, Shapiro E, Sims K (2012) Forest conservation and slippage: evidence from Mexico's national payments for ecosystem services program. Land Econ 88(4):613–638

Aznar O, Perrier-Cornet P (2003) Les services environnementaux dans les espaces ruraux : une approche par l'économie des services. Économie rurale 273(1):153–168

Bertrand E, Destais C (2002) Le « théorème de Coase », une réflexion sur les fondements microéconomiques de l'intervention publique. Reflets et perspectives de la vie économique 41(2):111–124

Biénabe E (2013) Towards biodiverse agricultural systems: reflecting on the technological, social and institutional changes at stake. In: Hainzelin E (ed) Cultivating biodiversity to transform agriculture. Springer, London, pp 221–261

Boisvert V (2015) La compensation écologique : marché ou marchandage ? Revue internationale de droit économique 29(2):183–209

Boucher DH (2015) The REDD/carbon market offsets debate: big argument, small potatoes. J Sustain For 34(6–7):547–558

Costanza R, d'Arge R, de Groot R, Farber S, Grasso M, Hannon B, Naeem S, Limburg K, Paruelo J, O'Neill RV, Raskin R, Sutton P, van den Belt M (1997) The value of the world's ecosystem services and natural capital. Nature 387:253–260

Ezzine de Blas D, Dutilly C, Lara JA, Le Velly G, Guevara-Sanginés A (2015) Payment for environmental services in a policymix: spatial and temporal articulation in Mexico. PloS One (à paraître)

Farley J, Costanza R (2010) Payments for ecosystem services: from local to global. Ecol Econ 69 (11):2060–2068

Gómez-Baggethun E, Muradian R (2015) In markets we trust? Setting the boundaries of market-based instruments in ecosystem services governance. Ecol Econ 117:217–224

Karsenty A., 2011. Coupler incitation à la conservation et investissement. Perspective n°7. Montpellier : Cirad

Karsenty A (2013) De la nature des « paiements pour services environnementaux ». Revue du Mauss 42:261–270

Karsenty A (2015) Mettre les PSE au service de l'agriculture « zéro déforestation ». Perspective 36
Karsenty A, Ezzine de Blas D (2014) Du mésusage des métaphores. Les paiements pour services environnementaux sont-ils des instruments de marchandisation de la nature ? In: Halpern C, Lascoumes P, Galès P (eds) L'instrumentation de l'action publique : controverse, résistances, effets. Presses de Sciences Po, Paris, pp 161–189
Karsenty A, Guingand A, Langlais A, Polge MC (2014) Du Sud au Nord : regards croisés sur les paiements pour services environnementaux. Compte rendu de l'atelier international Pesmix. Les cahiers de Biodiv' 50(2), CDC-Biodiversité
Lavigne-Delville P (2010) Conceptions des droits fonciers, récits de politique publiques et controverses. Les Plans fonciers ruraux en Afrique de l'Ouest. In: Colin J-P, Le Meur P-Y, Léonard E (eds) Les politiques d'enregistrement des droits fonciers. Du cadre légal aux pratiques locales. Karthala, Paris, pp 69–103
Le Coq J-F, Soto G, González HC (2011) PES and eco-label. A comparative analysis of their limits and opportunities to foster environmental services provision. In: Rapidel B, DeClerk F, Le Coq J-F, Beer J (eds) Ecosystem services from agriculture and agroforestry: measurement and payment. Earthscan Publications, London, pp 237–264
Le Roy E (1996) La théorie des maîtrises foncières. In : Le Roy E, Karsenty A, Bertrand A, dir (eds) La sécurisation foncière en Afrique, pour une gestion viable des ressources renouvelables. Karthala, Paris
Le Velly G, Dutilly C, de Blas E, Fernandez C (2015a) PES as compensation? Redistribution of payments for forest conservation in Mexican common forests. Études et documents 28, Cerdi. Retrieved 26 June 2016, http://cerdi.org/production/show/id/1758/type_production_id/1
Le Velly G, Sauquet A, Cortina-Villar S (2015b) PES impact and leakages over several cohorts: The case of PSA-H in Yucatan, Mexico. Études et documents 29, Cerdi. Retrieved 26 June 2016, http://cerdi.org/production/show/id/1759/type_production_id/1
Legrand T, Froger G, Le Coq J-F (2013) Institutional performance of payments for environmental services: an analysis of the Costa Rican program. Forest Policy Econ 37:115–123
McAfee K, Shapiro E (2010) Payments for ecosystem services in Mexico: nature, neoliberalism, social movements, and the state. Ann Assoc Am Geogr 1000(3):579–599
Millenium Ecosystem Assessment (2005) Ecosystems and human well-being: synthesis. Island Press, Washington, DC, 155 p
Muradian R, Corbera E, Pascual U, Kosoy N, May PH (2010) Reconciling theory and practice: an alternative conceptual framework for understanding payments for environmental services. Ecol Econ 69(6):1202–1208
Norgaard R (2010) Ecosystem services: from eye-opening metaphor to complexity blinder. Ecol Econ 69(6):1219–1227
North DC (1977) Markets and other allocation systems in history: the challenge of Karl Polanyi. J Eur Econ Hist 6(3):703–716
Quispe J (2007) Caracterización del impacto ambiental y productivo de las diferentes normas de certificación de café en Costa Rica. Mémoire de master. Catie, Turrialba. 137 p
Schlager E, Ostrom E (1992) Property-rights regimes and natural resources: a conceptual analysis. Land Econ 68(3):249–262
Shapiro-Garza E (2013) Contesting the market-based nature of Mexico's national payments for ecosystem services programs: four sites of articulation and hybridization. Geoforum 46:5–15
Soto G, Le Coq J-F (2011) Certification process in the coffee value chain: achievements and limits in the coffee value chain. In: Rapidel B, DeClerk F, Le Coq J-F, Beer J (eds) Ecosystem services from agriculture and agroforestry: measurement and payment. London, Earthscan Publications, pp 319–345
Vatn A (2014) Markets in environmental governance: from theory to practice. Ecol Econ 105:97–105
Wunder S (2005) Payment for environmental services: Some nuts and bolts. Cifor occasional paper, no. 42. Cifor, Jakarta. 24 p

Wunder S (2015) Revisiting the concept of payments for environmental services. Ecol Econ 117:234–243

Wunder S, Vargas MT (2005) Beyond "markets". Why terminology matters. Retrieved 26 June 2016, http://sanrem.cals.vt.edu/1010/Wunder2005_Beyond Markets terminology matters.pdf

Zbinden S, Lee D (2005) Paying for environmental services: an analysis of participation in Costa Rica's PSA program. World Dev 33:155–272