Ecological Economics 69 (2010) 1228–1236

Contents lists available at ScienceDirect

Ecological Economics

journal homepage: www.elsevier.com/locate/ecolecon

Payments for ecosystem services as commodity fetishism ☆

Nicolás Kosoy [a,*], Esteve Corbera [b,c]

[a] Ecosystem Service Economics Unit, Division of Environmental Policy Implementation, United Nations Environment Programme, 00100 Nairobi, Kenya
[b] School of International Development, University of East Anglia, Norwich NR4 7TJ, United Kingdom
[c] Tyndall Centre for Climate Change Research, Zuckerman Institute for Environmental Connective Research, University of East Anglia, Norwich NR4 7TJ, United Kingdom

ARTICLE INFO

Article history:
Received 29 April 2009
Received in revised form 2 November 2009
Accepted 3 November 2009
Available online 16 December 2009

ABSTRACT

Payments for Ecosystem Services (PES) economically reward resource managers for the provision of ecosystem services and are thus characterised by (i) an ecological function subject to trade; (ii) the establishment of a standard unit of exchange; (iii) and supply, demand and intermediation flows between those who sell and buy ecosystem services. This paper departs from the term commodity fetishism, broadly understood as the masking of the social relationships underlying the process of production, to illuminate three invisibilities in the commodification of ecosystem services. Firstly, we argue that narrowing down the complexity of ecosystems to a single service has serious technical difficulties and ethical implications on the way we relate to and perceive nature. Secondly, the commodification of ecosystem services denies the multiplicity of values which can be attributed to these services, since it requires that a single exchange-value is adopted for trading. Finally, we suggest that the process of production, exchange and consumption of ecosystem services is characterised by power asymmetries which may contribute to reproducing rather than addressing existing inequalities in the access to natural resources and services.

1. Introduction

According to the Millennium Ecosystem Assessment (MEA), ecosystem services can be understood as those benefits obtained from nature that satisfy human needs and simultaneously fulfil other species requirements (Daily, 1997; Costanza et al., 1997; MEA, 2005). The flow of these services, derived from stocks of natural resources, is recognised as 'important elements in overall wealth along physical, financial, human, and social capital' (Vira and Adams, 2008, pp. 2). The MEA classifies ecosystem services in four categories, namely provisioning services, which include food, water, timber and genetic resources; regulating services, such as the regulation of climate, floods and waste treatment; cultural services, such as recreation and aesthetic enjoyment; and supporting services such as soil formation, pollination and nutrient cycling. Nevertheless, discussions on how to classify ecosystem services to inform natural resource management and policy decisions continue (Carpenter et al., 2006; Boyd and Banzhaf, 2007; Wallace, 2007; Fisher et al., 2009). This is a consequence of the application of the 'ecosystem service concept' to several policy contexts and in many initiatives worldwide (Fisher and Turner, 2008; Muradian et al., 2010-this issue).

Following mainstream economic rationality, ecosystem services are externalities since they provide benefits which are not paid for and therefore are not internalised in economic decisions. Various organisations and researchers argue that the degradation of ecosystem services can be reversed through Payments for Ecosystem or Environmental Services (PES), which can in turn alleviate poverty and establish a new 'urban–rural compact' by transferring funds from 'consumers' to 'providers' of these services (Pagiola et al., 2005; Gutman, 2007). Nevertheless, others suggest that it may be counterproductive to expect that PES can address both environmental degradation and poverty. Wunder (2008), for example, highlights that an excessive focus on poverty can deviate attention from those areas where the loss of ecosystem services is more acute and where payments could make a difference in changing unsustainable land-use patterns.

PES are often defined as voluntary transactions where a well-defined ecosystem service is bought by a buyer (i.e. someone who is willing to pay for it), if and only if the provider secures the provision of such service (Wunder, 2005). However, this prescriptive definition is problematic because it excludes a variety of PES schemes operating under different principles, with ill-defined ecosystem services or under inefficient provision levels (Muradian et al., 2010-this issue). The most common PES schemes include local initiatives for conserving watershed services and regional and global markets for biodiversity and carbon sequestration services (Corbera et al., 2007). Landell-Mills and Porras (2002) have also identified markets for landscape beauty or 'bundled services' which sell several ecosystem services either together or individually. National governments and public–private partnerships involving local communities, NGOs, firms and municipalities are among

☆ This article is a contribution to the forthcoming Special Section. "Payments for Ecosystem Services: Alternative approaches from Ecological Economics" edited by Unai Pascual, Esteve Corbera, Roldan Muradian and Nicolas Kosoy.

* Corresponding author. Tel.: +44 1603 592813; fax: +254 20 7624249, +44 1603 591170.
E-mail address: nicolas.kosoy@unep.org (N. Kosoy).

0921-8009/$ – see front matter © 2009 Elsevier B.V. All rights reserved.
doi:10.1016/j.ecolecon.2009.11.002

the many actors driving these initiatives (Engel et al., 2008), which differ in the level of complexity and accuracy in the monitoring of ecosystem services, the mechanisms for price formation (i.e. set by the State, by a monopoly, by a monopsony or by the "invisible hand" of the market), payment origins (e.g. public versus private resources), buyers' characteristics (e.g. public or private actors), and the rules governing the contract among parties and intermediaries (e.g. with divergent compliance and conditionality rules). This diversity also influences participant and non-participants' responses to PES and the outcomes of these schemes (Vatn, 2010-this issue; Fisher et al., 2010-this issue; Sommerville et al., 2010-this issue).

Some PES schemes function as policy instruments through which it is possible to subsidise environmental stewardship (Corbera et al., 2009; Corbera and Brown, 2008) while others are actual markets which are dependent on other existing commodities. For instance, the trading of carbon sequestration services generated by newly afforested land through the Kyoto Protocol's Clean Development Mechanism (CDM) is a good example where prices for such service are influenced by project characteristics (e.g. transaction costs, risk-sharing among participants), by the evolution of other CDM and energy-related emission reductions or, even more widely, by price trends of carbon credits in the European Union Emissions Trading Scheme which in turn are driven by changes in energy demand levels and the cost of coal, oil and gas.

As for any other monetary market, PES also involve i) the definition of one or various and sometimes 'bundled' services, which become a commodity subject to trade; (ii) the establishment of a standard unit of exchange for such services; (iii) and supply, demand and intermediation flows between those who affect, control or manage the provision of these services and those who are willing to pay for them. This process of commodification (i.e. the transformation of goods and services into objects meant for trading commodities) involves three necessary stages. First, it involves narrowing down an ecological function to the level of an ecosystem service, hence separating the latter from the whole ecosystem. Second, it assigns a single exchange-value to this service and, third, it links 'providers' and 'consumers' of these services in market or market-like exchanges.

The analysis of emerging markets for nature's services is considered one of the most important themes in critical geography and environmental research. There is therefore a need to identify and address their pitfalls, and challenge their logic by looking at whose interests pricing and marketing serve, and why money and monetary valuation are considered so useful and persuasive as a sign of ultimate worth (Nelson, 2001; Liverman, 2004; O'Neill, 2007). In this regard, McAfee (1999) argues that the idea of 'selling nature to save it' legitimises the behaviour of those who frame policy for their own direct benefit and advocate for markets as the best strategy to strike a balance between nature conservation and the expansion of capitalism. Vatn (2000) suggests that treating the environment as a commodity can create, on the one hand, technical problems derived from the process of defining boundaries in ecological systems and addressing the complementary of goods and services and, on the other, ethical dilemmas as a result of using a purely economic logic to pursue or discard environmental conservation. In this sense, there have been calls against the commodification of nature's services and for their conservation based on aesthetic and ethical arguments (McCaulay, 2006), as we further elaborate below. Corbera et al. (2007) also suggest that an excessive focus on economic efficiency can make PES 'blunt instruments with respect to issues such as procedural fairness and equitable distribution of project outcomes' (Corbera et al. (2007), pp 608), thereby undermining environmental stewardship (Pascual et al., 2010-this issue). This follows Martinez-Alier's (2002) view that changing the logic of resource use and conservation from multiple non-monetary to monetary values can be counterproductive for conservation.

This paper contributes to these debates by identifying the theoretical and practical limitations of PES through the lens of commodity fetishism, understood here as the masking of the social relationships underlying the process of production (Marx, 1867). The argument is supported with other considerations from the field of ecological economics and political ecology, such as the existence of multiple languages of valuation and unequal power in access to the construction and implementation of environmental science and policy (Forsyth, 2003). Our critique is based on the identification of three inherent invisibilities in the commodification of ecosystem services, which include simplifying the complexity of natural ecosystems, prioritising a single exchange-value, and masking the social relations embedded in the process of 'producing' and 'selling' ecosystem services.

The following section reviews what is meant by commodity fetishism and how this concept has been framed and applied by different scholars. It also discusses how market environmentalism can be seen as the extension of commodity fetishism into the realm of environmental policy, and how both fetishism and existing critiques of market environmentalism can help us structuring the theoretical and practical limitations of PES. The third section elaborates on these limitations using examples from carbon sequestration, watershed protection and biodiversity conservation services while the fourth section summarises the paper and suggests potential areas for future PES-related research.

2. An Overview of Commodity Fetishism

2.1. Explaining the Commodity

Commodities are, by definition, an object outside us, a thing that by its properties satisfies human wants of some sort or another. It is in the sense of human satisfaction that commodities have use-value; i.e. 'the utility of a thing makes it a use-value' (Marx, 1867, pp. 2). In turn, commodities have an exchange-value, which represents 'the proportion in which values in use of one sort are exchanged for those of another sort and in a relation constantly changing with time and place' (Marx, 1867, pp. 3). This is what in the money economy is expressed as relative prices. Value, in turn, represents the socially necessary labour time underlying the production of any commodity. The magnitude of the value of any article is the amount of labour socially necessary, or the labour time socially necessary for its production. Each individual commodity is therefore considered as an average sample of its class. Commodities, therefore, in which equal quantities of labour are embodied, or which can be produced in the same time, have the same value (Marx, 1867).

More recent definitions of the commodity relate it more explicitly to the social norms and relationships which make possible its production and sale through the market. Appadurai (1986) defines a commodity as 'any object intended for exchange' (pp. 9) whilst Polanyi (1968)refers to commodities as 'goods produced for sale in price-making markets' (pp. 33; cited in Stone et al., 2000, pp. 7). It is argued that the commodity needs to meet at least two pre-requisites. On the one hand, it needs to be owned, including the right to trade, and, on the other, it needs to have boundaries, as without them there is no way a property right can be executed (Vatn and Bromley, 1994; Vatn, 2000).

2.2. Commodity Fetishism

The term fetish was originally coined by sixteenth century Portuguese colonialists to refer to the mystical human properties of objects, and studies on the anthropology of religion refer to fetishism as the 'attribution of human mental facilities to non-human objects' (Hornborg, 2001, pp. 474). During the industrial revolution, however, Marx used it to refer to the process of objectifying human beings and human relations through the production of commodities in modern societies, and called it the 'fetishism of commodities', which is

discussed in his first volume of Capital (1867) and more recently elsewhere (Wells, 1981; Jhally, 1987; Prudham, 2008). Marx's passage setting the foundations of commodity fetishism reads as follows:

> 'A commodity is therefore a mysterious thing, simply because in it the social character of men's labour appears to them as an objective character stamped upon the product of that labour; because the relation of the producers to the sum total of their own labour is presented to them as a social relation, existing not between themselves, but between the products of their labour… There, the existence of the things qua commodities, and the value-relation between the products of labour which stamps them as commodities, have absolutely no connexion with their physical properties and with the material relations arising therefrom. There it is a definite social relation between men, that assumes, in their eyes, the fantastic form of a relation between things… This I call the Fetishism which attaches itself to the products of labour, so soon as they are produced as commodities, and which is therefore inseparable from the production of commodities' (Marx, 1867, pp. 34–35).

Marx aimed to unravel what happened when goods are produced and exchanged, insofar they make invisible the information about the social relations behind their production (Jhally, 1987). For him, there is no mystery in a commodity as long as it is only conformed only by use-value; its fetishistic character arises with exchange-value, when it is produced for the market.

Following Marx, Jhally (1987, pp. 29) argues that commodity fetishism derives from the fact that things appear to have value when, in fact, it is humans who imprint such value. Fetishism then arises from two main processes: firstly, from the exchange of commodities in the marketplace, which contributes to mask the social relations of production, thereby naturalising properties in commodities which are in fact social and seeing historically specific social relations as eternal and natural; secondly, from the creation of surplus value which, in turn, is dependent on labour and capital. A worker is able to unravel the amount of labour embodied in the creation of a particular commodity but it is impossible for him to quantify the surplus her/his labour produces. In Marx's own words:

> 'If the price of his labouring power is three shillings, in which six hours of labour are realized, and if he works twelve hours, he necessarily considers these three shillings as the value or price of twelve hours of labour, although these twelve hours of labour realize themselves in a value of six shillings' (Marx, 1898, section IX)

The worker has thus little knowledge of difference between the price of labouring power and the value realised in these hours of labour –surplus– that is ultimately appropriated by the capitalist. It is on this asymmetry of power that the fetishism of commodities rests and gets perpetuated.

Beyond Marxist economic theory, anthropologists pay attention to the fetishistic character of gift economies, looking at how the latter personify objects and create qualitative relations between them, in contrast with commodity economies which treat human parts as objects and are meant to establish quantitative equivalence value between objects (Graeber, 2001). However, they also suggest that commodities and gifts, as well as their diverse relational connotations, are fluid categories which are historically mediated. For Appadurai (1986), for example, it is important to recognise the forms of solidarity and cultural dimensions of exchange existing in societies dominated by market exchange, and to identify the calculative dimensions of exchange in societies defined by solidarity and reciprocity (Appadurai, 1986). Following this view, anthropologists working on globalisation note that the exchange of commodities through global networks 'also embody cultural categories and political and social relationships that define a world that is globalized in new ways' (Stone et al., 2000, pp. 1).

The term commodity fetishism has also been used to refer to the implications of pricing and exchanging all kinds of goods and services. In debates about sustainable consumption, Hirsch (2006) uses the term to point out the inherent bias of modern societies towards material commodities, and particularly to the attribution of monetary values and the commercialisation of public goods and services, like landscapes, public security or medical services (see also Strasser, 2003). Other researchers examine the production conditions of different commodities and the exchange through global market networks (Bernstein and Campling, 2006a,b). These analyses identify key issues regarding scale and competition in global trade, and include propositions to upgrade actors in the value chain and to improve access to information as potential solutions to the fetishism of commodities. For instance, Hudson and Hudson (2003, pp. 413) argue that fair trade coffee represents an initial attempt to counter the pervasiveness of commodity fetishism because the fact of increasing farmers' profits, reducing intermediation and improving consumers' access to information represents in itself a strategy to unveil the unfair and unsustainable practices of conventional coffee trading. Some ecological economists also highlight that the economic valuation of environmental goods and services can lead to commodity fetishism by obscuring the existence of multiple languages of valuation and simplifying complex socio-ecological processes (Martinez-Alier et al., 1998; Vatn, 2000).

Overall, commodity fetishism remains a powerful concept for the study of commodification processes, insofar it reflects the complex trajectories and valences of commodities and the increasing complexity of their provision in terms of chains, networks or circuits in a globalising world (Prudham, 2008). It enriches PES-related research in three ways: first, it permits to think critically about the fact that an ecosystem service can become a commodity subject to trade, even if most ecosystem services are public goods and they do not require of any capital or labour to be produced; second, it contributes to highlight how ecosystem services' exchange-value arises and to discuss which other values (and of whom) are left behind; and third, commodity fetishism allows to shed light on the relations of exchange among market actors across scales, existing power asymmetries, and the attempt to popularise the idea that all ecosystem services can be marketed for the benefit of conservation and human well-being. Before this analysis proceeds, however, it is worth depicting, albeit briefly, the ideology which has given prominence to the commodification of nature's goods and services and to sketch some of its more prominent critiques.

2.3. Market Environmentalism Propositions and Critiques

PES advocacy is embedded in the wider ideology of market environmentalism which has been promoted since the late 1980s. Market environmentalism is a consequence of the broader ideology which finds in market-led capitalism the way to solve the world's development and environmental problems (Berthoud, 1992). Essentially, market environmentalism promotes the pricing of nature's services, the assignation of property rights and the expansion of commodity markets into the realm of nature's services. It argues that efficient resource management requires the allocation of individual titles in land and resources and the trading of these resources and rights within a market that will assign high prices to scarce resources and encourage the sustainable management of renewable resources (Smith, 1995; Liverman, 2004). Therefore, it is suggested that adequate resource stewardship is entirely dependent on how well social institutions harness self-interest through individual incentives, because individual property owners are better suited than government bureaucracies to manage natural resources. Such a view is grounded upon the well-known caricature of the Tragedy of the Commons (Hardin, 1968), which prescribes that establishing well-defined, enforceable, and preferably

private property rights is a necessary step for the conservation of environmental resources. Once property rights are established, private right-holders can decide whether to use the resource and exclude others from using it. But they can also transfer their resource rights to other parties and by doing so profit economically from such a transaction. This, in theory at least, presents a 'win–win' situation for both the environment and the economy.

However, market environmentalism has been viewed with scepticism from various standpoints. Some argue that markets alone will never fully take into account environmental costs and will ultimately undermine environmental reproduction (Bellamy Foster, 2002). O'Connor (1994), for example, writes that the outcome of bringing the presently non-commodified nature into the realm of tradable commodities is 'a terrible, abject competitiveness on all counts — a political and military struggle to have particular interests and capitals valorised at the expense of others, and to lay claim to scarce resources (raw materials and environmental services) needed to assure sustenance of the particular interests or capital stock' (pp. 126).

Based on the wetland banking system in the United States, Robertson shows that wetlands commodification involves a simplification of ecological relations, allowing for example to equate the value of a wetland in one place to the same type of ecosystem elsewhere (Robertson, 2004). In one of his latest works, Robertson (2006) points out the trade-offs scientists face when policy-makers encourage them to quantify and value wetlands characteristics and functions so that these can become tradable commodities. He shows that ecosystem functions that cannot be simply measured in weight units, such as biodiversity and habitat integrity or hydrological storage, become difficult to measure and describe qualitatively. As a result, scientific outcomes are costly, uncertain and strongly mediated by the interests of market regulatory agents. In Robertson's own words, 'in having created an articulation with the realm of scientific knowledge, both the state and capital begin to ask science to do things it cannot do in a stable way. As capitalists argue for ever-finer distinctions to be defined by ecologists, science thus helps to create a more and more differentiated realm for the circulation of capital; but ecosystem science is ever less able to offer stable metrics which measure those differentiations in a replicable way. The apparent systematicity and stability of scientific taxonomies and hierarchies looks extremely tempting to ecosystem services entrepreneurs, many of whom view the potential multiple markets in finely divided ecosystem services as a chance to multiply the value of their assets' (2006, pp. 384).

These tensions between scientific assessment and commodification are somewhat replicated when nature's functions are to be priced. Vatn (2000), for example, argues that the economic valuation of ecosystem services is inadequate for a number of reasons. First, ecosystem services often have unclear or absent property rights and this complicates valuation exercises, which are influenced by 'who owns' the good in question. Second, and as argued above, certain aspects of the environment may be incommensurable. And third, ecosystem services are ill-bounded, inter-related and critical in understanding ecosystems' resilience (Chee, 2004). Such resilience is not altered, however, by marginal changes in an ecosystem function but often by combined changes in a range of ecosystem elements and functions. This suggests that valuation exercises of single ecosystem functions are rather misleading because their search for marginal values may have no real meaning, particularly when the critical question is how to protect ecosystems' resilience.

3. Payments for Ecosystem Services as Commodity Fetishism

3.1. Invisible Complexity

The first dimension of PES as commodity fetishism consists of itemising ecosystem services for the purpose of monetary valuation, pricing and exchange, thus obscuring ecosystems' complexity and establishing boundaries within ecosystems which are difficult, if not impossible to draw. Itemisation in this paper brings together the individuation and abstraction stages of the commodification process (Castree, 2003) which involve putting legal and material boundaries around phenomena so that they can be bought, sold and used by equally 'bounded' individuals, groups or institutions and assimilating the qualitative specificity of any individualized thing to the qualitative homogeneity of a broader type or process, respectively (Castree, 2003, pp. 280–281). Castree also suggests that abstraction is made of two inter-dependent functional and spatial dimensions. The former 'involves looking for real and classifiable similarities between otherwise distinct entities as if the former can be separated out from the latter unproblematically' while the latter 'involves any individualized thing in one place being treated as really the same as an apparently similar thing located elsewhere' (Castree, 2003, pp. 281, emphasis in the original).

Itemisation is thus sustained on scientific expertise which separates ecosystem functions into discrete units of trade, as discussed earlier, and on managerial principles which define specific land-use management strategies that can potentially enhance the provision of such ecosystem functions. However, we already highlighted that the idea of compartmentalising nature's goods and services has been challenged from a technical perspective, as it neglects the relational aspects of nature and masks the fact that each ecosystem function is dependent upon others (Vatn, 2000). Ecosystem services are complex because biotic and non-biotic components interact to produce such services and, in turn, such components are also inter-connected (Saundberg, 2007). For instance, primary and secondary productions are the result of a multiplicity of factors such as temperature, nutrients, and soil horizons –among physical variables– and species composition and co-evolution with humans — among biotic ones. Seemingly, the regulation of surface and groundwater flows is a function of vegetal cover, species composition, type of soil, soil biota, and temperature, among others. Therefore, the selection of one ecosystem service over others contributes to mask the relational aspects of such service with the broader ecosystem and, in addition, the managerial options promoted may also be counterproductive for the provision of the same or other ecosystem properties and functions (Turner et al., 2003).

In the current trend towards the commodification of primary production through global carbon markets, itemisation results from the separation of such biological function from existing forests or from future planted trees and forested areas. This function becomes represented and measured through biomass content and growth models which translate it into tones of carbon dioxide stored in trees (at present or in the future) and which result tradable in markets and comparable to emission reductions achieved through energy-related projects. Precisely, this entails a high level of functional and spatial abstractions because both the quantification exercise and carbon markets make emission reductions across other projects in the forestry and energy sectors interchangeable regardless of tree species, ecosystem and project types.

The itemisation of ecosystems' net primary production has already led towards the conservation and planting of certain tree species above others, such as those with the largest carbon content or higher growth rates. Ongoing carbon forestry projects in Ecuador and Mexico have encouraged the plantation of fast-growing tree species in already standing forests or in the high paramo, thereby changing current species richness and density, and disrupting water flows (Corbera et al., 2007; Granda, 2005). Furthermore, in the future, the global interest in enhancing primary production, jointly with the existence of a more mature and potentially more lucrative market for this service may lead governments, private firms and landowners to invest preferably in tree plantations more than encouraging the restoration or conservation of complex tropical and sub-tropical ecosystems (Hunt, 2008).

Seemingly, when functions such as erosion control or groundwater flow regulation in critical river basins are itemised for trading purposes, there is an initial presumption that increased forest conservation or the implementation of ecologically-sound management activities (e.g. no tillage agriculture or reducing the use of pesticides) will lead to higher quality and more constant water flows downstream. However, while increased forest cover may indeed reduce nutrient, chemical outflow rates and runoffs (Ayward, 2005), these may also be influenced by other factors such as topography, the upstream forest type or land-use and preventive infrastructure, which may fall beyond the control of those who manage the watershed (Muñoz-Piña et al., 2008; Kosoy et al., 2007; Grip et al., 2005). Furthermore, if a catchment area is managed for maximising the amount of controlled water flows reaching downstream, then an efficient management solution may become to minimise forest species' water consumption (thus controlling for species types and biomass density) while increasing percolation. Such management practices may then lead to trade-offs between watershed regulation and carbon capture and storage, as the latter would be enhanced by increasing biomass growth.

The case of marketing biodiversity is far more complex. Biodiversity is characterised at taxonomical, genetic and ecological levels (Brisby, 1995), providing a reference system for all organisms, knowledge on the gene variations within and between species, and knowledge on the varied ecological systems in which taxonomic and genetic diversity is located (Chopra and Kumar, 2004). Biodiversity is about endemic and endangered species as much as it is about gene pools and flows, and relations and interactions between species and ecosystems. This complexity is what makes it impossible to define boundaries and explains why most biodiversity PES have established proxies for trading purposes, like protected areas, bio-prospecting access rights, biodiversity-friendly products and biodiversity credits, among others (Landell-Mills and Porras, 2002). Proxies emphasise a range of values for biodiversity, like option value, its role in ecosystems' resilience and existence value, but fail to acknowledge that their own social construction involves trade-offs across biodiversity elements. Examples of unexpected effects that arise when managing a system focusing on one particular species abound in the literature (Matarczyk et al., 2002). O'Neill (2007), for example, notes that 'increasing the diversity of native tree species in forests is in conflict with the aim of protecting the native species of red squirrel, which fares better than the immigrant grey in conifers; it conflicts also with the protection of the goshawk, which flourishes in spruce plantations' (pp. 36).

Therefore, itemisation contributes to veil important ecosystem interactions and reduces our perception of what actually an ecosystem is and how it functions. Following Vatn (2000), itemisation shifts our perspective away from a realistic understanding of how ecosystems and their processes operate, what causes their loss and how this destructive process can be reversed. One way of confronting such reductionism would be bundling multiple ecosystem services in order to optimising ecosystem services provision rather than maximising a single ecosystem service (Wendland et al., in press). This, however, cannot be done unproblematically as some ecosystem elements and services are rival in their provision at different geographical scales (Kareiva et al., 2007; Chan et al., 2006). This, in turn, involves difficulties in establishing ecosystem services' provision baselines, identifying trade-offs across space, time, their reversibility, and recognising uncertainties in their future provision levels (Rodríguez et al., 2006).

Furthermore, research on biocomplexity recognises that ecosystems' properties emerge from the interplay of behavioural, biological, physical, and social interactions that affect, sustain, or are modified by living organisms, including humans. These properties are also subject to nonlinear or chaotic dynamics, unpredictable behaviour and interactions that span multiple levels of biological organisation or spatio-temporal scales (Michener et al., 2001; Cottingham, 2002; Cadenasso et al., 2006). This remarks that human managerial interventions can affect ecosystems in both predictable and unpredictable ways and it demonstrates that itemisation faces the challenge of incorporating uncertainty into the calculus of ecosystem services' provision while remaining attentive to the dynamics of complex socio-ecological systems, which far from being a closed system producing predictive outcomes behave as open entities subject to variation and complex interactions with internal and external elements and processes (e.g. changes in species composition or climate change). These insights also suggest that further interdisciplinary research is needed to understand ecosystem services' flows and their systemic interactions, as well as to investigate the resilience of ecosystem services in different socio-ecological contexts (Carpenter and Folke, 2006; Pascual and Perrings, 2007).

3.2. Invisible Values

The second dimension of PES as commodity fetishism involves assigning a single exchange-value, i.e. a monetary value and a price to an ecosystem service. We suggest that this contributes to make human–nature relationships invisible through imposing a single language of valuation. It also represents a reductionist approach to our understanding of human–nature relationships, which goes far beyond the support for what is or is not worth in monetary terms. Ecosystem goods and services are worth much more than a predefined price. As Vatn (2000) notes, 'the price of even the most simple commodity only captures a subset of the dimensions of its importance, worth and meaning to humans' (pp. 495). It is thus critical to recognise that ecosystem goods and services are valued (in the broader sense) differently by multiple stakeholders located in multiple geographies, from the local to the regional and global levels (Brown and Adger, 1994), and that these values may not necessary be captured by market prices alone (O'Neill, 2007). An individual or a community may value a particular ecosystem for its beauty, the historical socio-ecological relations it inherently represents, the biodiversity it contains, or the importance it may have for future generations, among others. This is not to say, of course, that all goods and services provided by this ecosystem cannot be traded, but rather that the monetary valuation of all or some of its components may not be accepted. For some Peruvian indigenous groups, certain potato varieties are traded in local barter markets, but other varieties are not traded and they are used exclusively for subsistence (Marti and Pimbert, 2007).

Carbon sequestration was attributed a monetary exchange-value when international markets for greenhouse gas emissions were established and such value can fluctuate depending on the cost of reducing one tonne of carbon dioxide elsewhere and by other means. As illustrated earlier, this implies that technological change in the industrialised world and ecosystem functions can be measured through the same exchange-value and this may have different consequences for different people. In the case of a timber company who owns land for the development of commercial logging, a price over carbon sequestration may involve a slow-down of the optimal rotation cycle in order to maximise the exchange-value of this service. For an indigenous community who owns and manages a track of tropical forest, a carbon price may imply assigning a monetary value to a forest deity. For other land managers, such price may modify existing land-use management rules and lead to potential conservation outcomes and/or to conflicts regarding the re-assignation of 'virtual' or actual property rights over carbon (Corbera, 2008).

In the case of biodiversity, trade based on a single exchange-value imposes a language of valuation that can lead to a hegemonic worldview of nature. In this sense, Gowdy (1997) remarks that although market exchange-values of environmental services may be useful for biodiversity protection, exchange-value 'constitutes a small

proportion of total biodiversity value' (pp. 25). Biodiversity, as we have seen in the section above, is very complex and any managerial intervention would also imply predictable and unpredictable outcomes. To look at biodiversity through a single exchange 'lens' leads to a false feeling of control and understanding which in turn contributes to neglect other values that play an important role in biodiversity conservation. For instance, Melanesians' wives and husbands help raise pigs to show their commitment to their marriage, they devote labour and resources to raising heavy and healthy pigs. Households even grow extra starch-rich produce to feed their pigs. However, the pig is an embodiment of such a marital relationship until it leaves the domestic sphere and enters the public sphere of male ceremonial exchange, where its exchange-value comes to embody the importance of relations between men (Graeber, 2001, pp. 41). Male pride at the centre of this exchange does not account for the value of women's labour and indigenous knowledge also embedded in the pig. Although women are fully aware of their inputs in raising pigs, they remain excluded from the exchange process, leading to asymmetries in access to information and power.

Watershed regulatory functions are also subject to commodification, and in particular to market forces whereby economic efficiency is claimed to increase due to assigning a monetary exchange-value to these services. However, Kosoy et al. (2007) show that water users' fees in Central America are so small that it hardly creates an incentive for saving water, and that PES compensations to upstream providers hardly cover opportunity costs. On the one hand, it seems that assigning an exchange-value to these services is not improving the system's efficiency nor helping conserve these services. On the other, commodification of watershed regulatory functions rests on various beliefs. One of which assumes that an increase in forest cover leads to improvements in water quality and quantity, which is not supported by the evidence of some scientific hydrological studies (Calder, 2004; Bruijnzeel et al., 2005). Such beliefs are not the result of deliberative and fully informed collective choices, thus they are inefficient conventions that should not be chosen from an evolutionary perspective (Ostrom, 2000). However, beliefs — as the ones described for the relationship between forests and water services — may be stable even though they may eventually reduce Pareto-efficiency (Muradian et al., 2010-this issue). Furthermore, local stakeholders are willing to engage in a PES scheme as a result of their own social norms rather than the monetary incentives. Therefore, using a water fee to improving users' water quality and quantity and paying landowners for land-use changes may impose a chrematistic worldview, which in turn erodes traditional institutions for the sake of strengthening market institutions as a means to achieving economic efficiency.

The use of money as a single unit for exchanging ecosystem services may also 'crowd out' future environmental conservation behaviour. This may happen in those places where, from an economic point of view, payments have been inefficient and directed towards supporting ongoing sustainable land-use rather than new management practices for the provision of ecosystem services. The 'crowding-out' hypothesis derives from Titmuss' (1970) argument that blood donors were not motivated by money but by moral concerns, and that monetary compensation for donating blood would 'crowd out' its supply. This has been recently proven to be the case, particularly for women (Mellström and Johannesson, 2008), and other studies have shown that the use of financial incentives may sometimes contravene or undermine civic duty in particular situations (Frey and Oberholzer-Gee, 1997; Bowles, 2008).

Sensitivity to value-diversity is thus necessary to ensure that PES goals are plural in a substantial and formal sense, meaning that they arbitrate between actors' different views regarding desirable environmental and other outcomes and strike a balance between values based on different ethical premises (Adger et al., 2003; Paavola, 2003). Pluralism is reflected upon competing views at international and local levels, where some actors are fundamentally opposed to marketing nature's services for conservation while others are not, and also at local level, where resource managers may have conflicting views on which ecosystem services should be prioritised, as some services accrue more directly to local communities, and distinct ethical premises about the role of forests in community life and culture may also co-exist (Brown and Adger, 1994). In a practical sense, pluralism involves the development of consensus-building processes, so as to gather existing knowledge, views and diverse values, and to define the most appropriate combination of monetary and non-monetary incentives. In this sense, the 'crowding-out' effect needs to be considered, and the conditions through which both long-term individual and collective interest for conservation can be harnessed with and without financial incentives need to be addressed.

3.3. Invisible Institutional Asymmetries: Price Formation and Property Rights Allocation

The last dimension of PES as commodity fetishism concerns, on the one hand, the way in which prices for ecosystem services are established and, on the other, the inequalities underlying the access to these services, mediated through property rights and other institutional means. Following an economic logic and considering that PES participation is voluntary, the price paid for ecosystem services provision would be fair as long as it is accepted by resource managers, and the payment would be efficient as far as it covered the forgone opportunity costs, whilst inducing land-use sustainable practices and providing the maximum service output (Pagiola, 2005). However, it is our view that such perspective masks underlying power asymmetries in defining what represents a fair price and in PES decision-making processes.

Let's use again the example of carbon sequestration. As noted earlier, the monetary value of this service is influenced by the emission reductions imposed by the carbon market, the demand of and prices for fossil fuels worldwide and the cost of technological change, among others. Carbon prices, however, also indirectly reflect the politics in climate negotiations. If poor countries would be able to claim the carbon debt or have the right to achieve certain development threshold in a carbon emissions constrained world, they could impose a much quicker decrease in carbon emissions in developed countries and they would potentially see how the resources available for forest conservation would increase if cooperative trading frameworks were developed (Baer et al., 2007). Therefore, the development of market-based mechanisms to tackle greenhouse gas emissions has contributed to mask important issues concerning global environmental justice. The idea that a price for carbon sequestration services is fair when people are willing to participate in emissions trading projects obscures the existence of structural poverty conditions and the fact that 'the poor sell cheap' (Hornborg, 1998; Martinez-Alier, 2002; Muradian et al., 2010-this issue). In a carbon forestry project in Mexico, for example, farmers sign a 25-year contract during which they will receive upfront payments during the first 10 years in exchange of the expected sequestered carbon over the contract period. Payment amounts are defined according to investors' willingness to pay for the carbon when the contract is signed, minus a project management fee of forty percent over the total investment; this translates into direct payments which oscillate between 280 to 800 US$/ha over the 25-year period (Corbera, 2005). Farmers accept these payment conditions because, on the one hand, they require upfront investment to develop planting activities and, on the other, they secure income and reduce risk by accepting a safe ten-year reward instead of selling their carbon periodically in a market with fluctuant prices. This last option is nevertheless difficult, as farmers would lack knowledge and skills to trade in such markets.

In the context of biodiversity payments, buyers also control price formation, as potential supply outstrips demand. Landell-Mills and Porras (2002) illustrate this neatly when they note that 'The incentive

to pool funds is high since a larger area can be conserved, economies of scale may reduce transaction costs per dollar spent, and cooperation awards buyers a degree of monopsony power in determining prices at which they purchase conservation' (pp. 35). Furthermore, Perfecto et al. (2005) highlight how the price difference between biodiversity-friendly and normal coffee does not have to do with compensation of opportunity costs or the real improvement in biodiversity terms at local level, but on consumption strategies at global levels (e.g. advertisement, market penetration), political influence (i.e. lobbying for local subsidies or tax exemptions in consumer countries), and on access to market information by intermediaries. In the case of watershed services, examples from Central America reveal that prices are not the result of supply and demand curves for water. In Costa Rica, upstream wealthy-powerful landowners refrain from accepting compensation from downstream private water users because they prefer keeping full rights on their lands and water resources while waiting for urban sprawl (Kosoy et al., 2007). In this case, providers have access to information on land price trends and their income is generated through off-farm activities, which allows them to have a strong negotiating position in front of the intermediary and the compensation offered.

These considerations show that prices for ecosystem services do not follow changes in the quantity or quality of these services, but they are socially constructed and reflect the intensity of social preferences towards them. High levels of competition in supply, i.e. there are a lot of poor people out there who live in rural areas and healthy ecosystems, will tend to push prices for ecosystem services towards very low levels, for which they may be willing to accept compensation.

Nevertheless, price formation is not the only manifestation of power asymmetries in the development of PES initiatives. The attribution of property rights over ecosystem services plays a critical role in influencing who can claim ownership and who can trade in PES (Brown and Corbera, 2003; Turner et al., 2003; Corbera et al., 2007; Vatn, 2010-this issue). The mainstream view is that the existence of formal de jure rights over the ecosystems from which such services are derived define ownership over these services and permit to define contracts in the most efficient way, while acknowledging whose opportunity costs need to be met and separating rights to these services from broader rights to the forest and land (Peskett and Harkin, 2007). It is also acknowledged that demarcating property rights over ecosystem services, as well as securing such property and monitoring their provision, can be extremely costly (Vatn, 2000).

The attribution of property rights over ecosystem services is likely to be contested and subject to participants' willingness and power to negotiate and claim rights during PES design. Currently, very little is known about how competing claims over ecosystem services are dealt with and negotiated in practice, especially when ecosystems are held in common and there are overlapping right claims by diverse social groups, as in the case of common property regimes (Ostrom and Schlager, 1996). In this sense, there are experiences in which rights over carbon sequestration services have been allocated to collective institutions which misrepresent the rights of women and do not take into account their priorities in project setting and benefit distribution (Corbera et al., 2007). There is also evidence in which forest owners give up their supposed rights over carbon sequestration services and transfer them to private actors, in exchange of financial or technical support (Corbera, 2008).

As O'Neill (2001) and Vatn (2001) point out, where new property rights regimes are introduced, there is an inherent risk that these are defined by those with economic and social power and, consequently, legitimise a particular social order. This means that markets of whatever kind are social constructs in which participants are positioned differently, with divergent assets, interests and negotiating power. PES are thus no different and resource managers who are persuaded by NGOs, state governments and logging companies to participate (voluntarily) in PES schemes may not understand what they are selling, where it will be sold, and who will gain the most along the commercialisation chain, as the exchange of ecosystem services differs substantially from selling traditional crops or other rural products due to the fact that what you sell is not what you materially 'produce'. Consequently, participants depart from a limited knowledge position, which could lead them to give up their rights or, alternatively, to demand more transparency in PES design and implementation or to reject altogether such an approach for environmental conservation.

4. Conclusions

Marx would probably be awestruck to see that nowadays nearly everything is for sale, as capitalism and market-based exchange have further extended into the day-to-day lives of local remote societies and penetrated industrial societies more intensely, as a result of technology, telecommunications, cheap but environmentally costly transportation and the free movement of capital (Kuttner, 1996). The impetus for repackaging existing commodities, creating new ones and inducing new social 'wants' sits in the centre of global capitalism as we know it today. However, amidst a deep global financial crisis which has been fundamentally caused by an excess of liquidity and growth beyond biophysical limits (Daly, 2009), we may have reached the time where those who have called for reducing consumption, limiting growth and re-thinking the relationship between humans and nature play a more prominent role in policy formation and the orientation of future economic development.

This paper has critically engaged with the current trend in promoting PES as a means to protect environmental goods and services. Ecosystems are being degraded at the highest rate ever and most of such destruction is led by human-induced processes of unsustainable and uneven economic, technological and social developments (MEA, 2005). However, we have argued that PES represent a symptom and a consequence of commodity fetishism in the context of market-based environmental governance. This fetishistic character of PES takes a three-dimensional form that has implications on the way nature is perceived, human–nature interactions are constructed (through monetary values) and how unequal social relations are reproduced. PES disregard ecosystems complexity in order to facilitate market transactions based on a single exchange-value, thus imposing a trend towards monetary, market-driven conservation. The monetary valuation of ecosystem services fails to account for value in a broader sense (beyond monetary value) and obliterates other social and ecological qualities embedded in these services and which are perceived by those who benefit from ecosystem services at different scales. PES also create power asymmetries across those involved in market development through price formation mechanisms, which do not account for the actual availability of ecosystem services over time, locally or globally, and the attribution of property rights. When ecosystem services are commodified, they become the basis for new socio-economic hierarchies, characterised by the re-positioning of existing social actors, the emergence of others and, very likely, the reproduction of unequal power relations in access to wealth and environmental resources.

This paper has also pointed out that each of these concerns can be addressed in a more or less meaningful (but still reformist) manner, through bundling ecosystem services, acknowledging plural values in the construction of markets and addressing inequities in access to ecosystem services and market exchange. Yet a more radical take on PES would concentrate instead on environmental ethics, re-claiming the public good character of environmental services and discarding any attempt to price and market them as a way to foster conservation. As O'Neill puts it,

> 'The boundaries that separate the 'free' unpriced world of knowledge, the body and soul on from those of the market are being eroded. The appropriate response to the erosion of such boundaries

is not to make sure that, as they disappear, the best price is achieved. It is rather to resist the disappearance of the proper boundaries between the different spheres…The same is true of environmental goods. It may be the case that the environment is unpriced and in a world in which market norms predominate this might be a problem… We best serve environmental goals by resisting the spread of market norms' (2007, pp. 45).

To conclude, we think that future PES research should address a number of issues, including the emerging trade-offs in PES implementation across diverse and changing socio-ecological contexts, such as scientific accuracy versus simplification and reduced costs, or economic efficiency versus equitable provision; the application and usefulness of deliberative methods for the valuation of ecosystem services; the extent to which participation in PES enhances or undermines resource users' commitment to long-term conservation by changing perceptions, management objectives and shifting incentives; and the role of politics, culture and existing institutions in mediating the support for or rejection of market-based environmental governance. Exploring these questions will hopefully expand our understanding of PES and inform broader debates about environmental governance and the commodification of nature.

Acknowledgements

This paper has benefited from comments by Joan Martinez-Alier, Katrina Brown, Giorgos Kallis, Unai Pascual and two anonymous reviewers. The authors acknowledge the financial support of the Institute for Environmental Sciences and Technology, Universitat Autònoma de Barcelona, and the Tyndall Centre for Climate Change Research. Any errors or omissions remain our own responsibility.

References

Adger, W.N., Brown, K., Fairbrass, J., Jordan, A., Paavola, J., Rosendo, S., Seyfang, G., 2003. Governance for sustainability: towards a 'thick' analysis of environmental decisionmaking. Environment and Planning A 35 (6), 1095–1110.
Appadurai, A., 1986. The Social Life of Things: Commodities in a Cultural Perspective. Cambridge University Press, Cambridge.
Ayward, B., 2005. Land use, hydrological function and economic valuation. In: Bonell, M., Bruijnzeel, L. (Eds.), Forests, Water and People in the Humid Tropics. Cambridge University Press/UNESCO, Cambridge and Paris.
Baer, P., Athanasiou, T., Kartha, S., 2007. The Right to Development in a Climate Constrained World. Heinrich Böll Stiftung, Berlin.
Bellamy Foster, J.B., 2002. Ecology Against Capitalism. Monthly Review Press, New York.
Bernstein, H., Campling, L., 2006a. Commodity studies and commodity fetishism I: trading down. Journal of Agrarian Change 6 (2), 239–264.
Bernstein, H., Campling, L., 2006b. Commodity studies and commodity fetishism II: 'profits with principles'? Journal of Agrarian Change 6 (3), 414–447.
Berthoud, G., 1992. Market. In: Sachs, W. (Ed.), The Development Dictionary. A Guide to Knowledge as Power. Zed Books, London and New York.
Bowles, S., 2008. Policies designed for self-interested citizens may undermine "the moral sentiments": evidence from economic experiments. Science 320, 1605–1609.
Boyd, J., Banzhaf, S., 2007. What are ecosystem services? The need for standardized environmental accounting units. Ecological Economics 63 (2–3), 616–626.
Brisby, F.A., 1995. Characterisation of biodiversity. In: Heywood, V.H. (Ed.), Global Biodiversity Assessment. Cambridge University Press, Cambridge.
Brown, K., Adger, N., 1994. Economic and political feasibility of international carbon offsets. Forest Ecology and Management 68, 217–229.
Brown, K., Corbera, E., 2003. Exploring equity and sustainable development in the new carbon economy. Climate Policy 3 (S1), 41–56.
Bruijnzeel, L.A., Bonell, M., Gilmour, D., Lamb, D., 2005. Forests, water and people in the humid tropics: an emerging view. In: Bonell, M., Bruijnzeel, L. (Eds.), Forests, Water and People in the Humid Tropics. Cambridge University Press/UNESCO, Cambridge and Paris.
Cadenasso, M.L., Pickett, S.T.A., Grove, J.M., 2006. Dimensions of ecosystem complexity: heterogeneity, connectivity, and history. Ecological Complexity 3, 1–12.
Calder, I.R., 2004. Forests and water: closing the gap between public and science perceptions. Water Science and Technology 49 (7), 39–53.
Carpenter, S.R., Folke, C., 2006. Ecology for transformation. Trends in Ecology and Evolution 21 (6), 309–315.
Carpenter, S.R., Bennett, E.M., Peterson, G.D., 2006. Scenarios for ecosystem services: an Overview. Ecology and Society 11 (1), 29.
Castree, N., 2003. Commodifying what nature? Progress in Human Geography 27 (3), 273–297.
Chan, K., Shaw, R., Cameron, D., Underwood, E., Daily, G., 2006. Conservation planning for ecosystem services. PLoS Biology 4 (11), 2138–2152.
Chee, Y.E., 2004. An ecological perspective on the valuation of ecosystem services. Biological Conservation 120, 549–565.
Chopra, K., Kumar, P., 2004. Forest biodiversity and timber extraction: an analysis of the interaction of market and non-market mechanisms. Ecological Economics 49, 135–148.
Corbera, E., 2005. Interrogating Development in Carbon Forestry Activities: A Case Study from Mexico. Doctoral dissertation, School of Development Studies, University of East Anglia, Norwich, United Kingdom.
Corbera, E., 2008. Who own forest carbon? Paper presentedat the International Workshop on Rural Property and Inequality,University of East Anglia, September 2008.
Corbera, E., Brown, K., 2008. Building institutions to trade ecosystem services: marketing forest carbon in Mexico. World Development 36 (10), 1956–1979.
Corbera, E., Kosoy, N., Martínez-Tuna, M., 2007. The equity implications of marketing ecosystem services in protected areas and rural communities: case studies from Meso-America. Global Environmental Change 17, 365–380.
Corbera, E., González Soberanis, C., Brown, K., 2009. Institutional dimensions of payments for ecosystem services. An analysis of Mexico's carbon forestry programme. Ecological Economics 68, 743–761.
Costanza, R., d'Arge, R., de Groot, R., Farber, S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., O'neill, R.V., Paruelo, J., Raskin, R.G., Sutton, P., van den Belt, M., 1997. The value of the world's ecosystem services and natural capital. Nature 387 (6630), 253–260.
Cottingham, K., 2002. Tackling biocomplexity: the role of people, tools, and scale. BioScience 52, 793–799.
Daily, G.C., 1997. Nature's Services: Societal dependence on natural ecosystems. Island Press, Washington, DC.
Daly, H., 2009. From a failed growth economy to a steady-state economy. International Society for Ecological Economics Newsletter, October 2009, pp. 7–11.
Engel, S., Pagiola, S., Wunder, S., 2008. Designing payments for environmental services in theory and practice: an overview of the issues. Ecological Economics 65, 663–674.
Fisher, B., Turner, R.K., 2008. Ecosystem services: classification for valuation. Biological Conservation 141, 1167–1169.
Fisher, B., Turner, R.K., Morling, P., 2009. Defining and classifying ecosystem services for decision making. Ecological Economics 68, 643–653.
Fisher, B., Kulindwa, K., Mwanyoka, I., Turner, R.K., Burgess, N., 2010. Common pool resource management and PES: lessons and constraints for water PES in Tanzania. Ecological Economics 69 (6), 1253–1261.
Forsyth, T., 2003. Critical Political Ecology. The Politics of Environmental Science. Routledge, London and New York.
Frey, B.S., Oberholzer-Gee, F., 1997. The cost of price incentives: an empirical analysis of motivation crowding-out. The American Economic Review 87 (4), 746–755.
Gowdy, J., 1997. The value of biodiversity: markets, society and ecosystems. Land Economics 73 (1), 25–41.
Graeber, D., 2001. Toward an Anthropological Theory of Value. Palgrave, New York.
Granda, P., 2005. Carbon sink plantations in the Ecuadorian Andes: Impacts of the Dutch FACE-PROFAFOR monoculture tree plantations' project on indigenous and peasant communities. Acción Ecológica and World Rainforest Movement, Brazil.
Grip, H., Fritsch, J.-M., Bruijnzeel, L., 2005. Soil and water impacts during forest conversion and stabilization to new land use. In: Bonell, M., Bruijnzeel, L. (Eds.), Forests, Water and People in the Humid Tropics. Cambridge University Press/UNESCO, Cambridge and Paris.
Gutman, P., 2007. Ecosystem services: foundations for a new rural–urban compact. Ecological Economics 62 (3–4), 383–387.
Hardin, G., 1968. The tragedy of the commons. Science 162, 1243–1248.
Hirsch, F., 2006. The new commodity fetishism. In: Jackson, T. (Ed.), The Earthscan Reader in Sustainable Consumption. Earthscan, London.
Hornborg, A., 1998. Towards an ecological theory of unequal exchange: articulating world system theory and ecological economics. Ecological Economics 25, 127–136.
Hornborg, A., 2001. Symbolic technologies: machines and the Marxian notion of fetishism. Anthropological Theory 1 (4), 473–496.
Hudson, I., Hudson, M., 2003. Removing the veil? Commodity fetishism, fair trade, and the environment. Organisation & Environment 16 (10), 413–430.
Hunt, C., 2008. Economy and ecology of emerging markets and credits for biosequestered carbon on private land in tropical Australia. Ecological Economics 66, 309–318.
Jhally, S., 1987. The Codes of Advertising: Fetishism and the Political Economy of Meaning in the Consumer society. Frances Printer, London.
Kareiva, P., Watts, S., McDonald, R., Boucher, T., 2007. Domesticated nature: shaping landscapes and ecosystems for human welfare. Science 316 (5833), 1866.
Kosoy, N., Martinez-Tuna, M., Muradian, R., Martinez-Alier, J., 2007. Payments for environmental services in watersheds: insights from a comparative study of three cases in Central America. Ecological Economics 61 (2–3), 446–455.
Kuttner, R., 1996. Everything for Sale: The Virtues and Limits of Markets. Knopf, New York.
Landell-Mills, N., Porras, I., 2002. Silver Bullet or Fools' Gold? A Global Review of Markets for Forest Environmental Services and Their Impacts on the Poor. International Institute for Environment and Development, London.
Liverman, D., 2004. Who governs, at what scale and at what price? Geography, environmental governance, and the commodification of nature. Annals of the Association of American Geographers 94 (4), 734–738.
Marti, N., Pimbert, M., 2007. Barter markets for the conservation of agro-ecosystem multi-functionality: the case of the chalayplasa in the Peruvian Andes. International Journal of Agricultural Sustainability 5, 51–69.
Martinez-Alier, J., 2002. The Environmentalism of the Poor. Edward Edgar, London.

Martinez-Alier, J., Munda, G., O'Neill, J., 1998. Weak comparability of values as a foundation for ecological economics. Ecological Economics 26, 277–286.
Marx, K., 1867. Capital, Volume One, Part One: Commodities and Money. Online version at http://www.marxists.org/archive/marx/works/1867-c1/ch01.htm.
Marx, K., 1898. Value, Price and Profit, Chapter IX Value of Labour. Online version at http://libcom.org/book/export/html/132.
Matarczyk, J., Willis, A., Vranjic, J., Ash, J., 2002. Herbicides, weeds and endangered species: management of bitou bush (Chrysanthemoides monilifera ssp. rotundata) with glyphosate and impacts on the endangered shrub, Pimelea spicata. Biological Conservation 108 (2), 133–141.
McAfee, K., 1999. Selling nature to save it? Biodiversity and green developmentalism. Environment and Planning. D, Society and Space 17 (2), 133–154.
McCaulay, J., 2006. Selling out on nature. Nature 443, 27–28.
Mellström, C., Johannesson, M., 2008. Crowding out in blood donation: Was Titmuss right? Journal of the European Economic Association 6 (4), 845–863.
Michener, W.K., Baerwald, T.J., Firth, P., Palmer, M.A., Rosenberger, J.L., Sandlin, E.A., Zimmerman, H., 2001. Defining and unraveling biocomplexity. BioScience 51, 1018–1023.
Millennium Ecosystem Assessment, 2005. Ecosystems and Human Well-being Synthesis. Island Press, Washington, DC.
Muñoz-Piña, C., Guevara, A., Torres, J.M., Braña, J., 2008. Paying for hydrological services of Mexico's forests: analysis, negotiations and results. Ecological Economics 65, 725–736.
Muradian, R., Corbera, E., Pascual, U., Kosoy, N., May, P., 2010. Reconciling theory and practice: An alternative conceptual framework for understanding payments for environmental services. Ecological Economics 69 (6), 1202–1208 (this issue).
Nelson, A., 2001. The poverty of money: Marxian insights for ecological economists. Ecological Economics 36, 499–511.
O'Neill, J., 2007. Markets, Deliberation and Environment. Routledge, London.
O'Connor, M., 1994. On the misadventures of capitalist nature. In: O'Connor, M. (Ed.), Is Capitalism Sustainable? Political Economy and the Politics of Ecology. Guilford Press, New York.
Ostrom, E., 2000. Collective action and the evolution of social norms. Journal of Economic Perspectives 14 (3), 137–158.
Ostrom, E., Schlager, E., 1996. The formation of property rights. In: Hanna, S., Folke, C., Maler, K.G. (Eds.), Rights to Nature. Ecological, Economic, Cultural and Political Principles of Institutions for the Environment. Island Press, Washington, DC.
Paavola, J., 2003. Environmental justice and governance: theory and lessons from the implementation of the European Union's habitat directive. Working Paper EDM 03-05. Centre for Social and Economic Research on the Global Environment, Norwich.
Pagiola, S., 2005. Assessing the Efficiency of Payments for Environmental Services Programs: A Framework for Analysis. World Bank, Washington, DC.
Pagiola, S., Arcenas, A., Platais, G., 2005. Can payments for environmental services help reduce poverty? An exploration of the issues and evidence to date from Latin America. World Development 33 (2), 237–253.
Pascual, U., Perrings, C., 2007. Developing incentives and economic mechanisms for in situ biodiversity conservation in agricultural landscapes. Agriculture, Ecosystems, and Environment 121, 256–268.
Pascual, U., Muradian, R., Rodríguez, L.C., Duraiappah, A., 2010. Exploring the links between equity and efficiency in payments for environmental services: A conceptual approach. Ecological Economics 69 (6), 1237–1244 (this issue).
Perfecto, I., Vandermeer, J., Mas, A., Soto Pinto, L., 2005. Biodiversity, yield, and shade coffee certification. Ecological Economics 54, 435–446.
Peskett, L., Harkin, Z., 2007. Risk and responsibility in reduced emissions from deforestation and degradation. Forestry Briefing, vol. 15. Overseas Development Institute, London.
Polanyi, K., 1968. The economy as an instituted process. In: LeClair, E., Schneider, H. (Eds.), Ecoomic Anthropology: Readings in Theory and Analysis. Holt, Reinhart and Winston, New York.
Prudham, S., 2008. "Commodification" in A Companion to Environmental Geography. In: Castree, N., Demeritt, D., Liverman, D., Rhoades, B. (Eds.). Wiley-Blackwell, pp. 123–142.
Robertson, M.M., 2004. The neoliberalization of ecosystem services: wetland banking and problems in environmental governance. Geoforum 35, 361–373.
Robertson, M.M., 2006. The nature that capital can see: science, state, and market in the commodification of ecosystem services. Environment and Planning. D, Society and Space 24, 367–387.
Rodríguez, J.P., Beard, T.D., Bennett, E.M., Cumming, G.S., Cork, S., Agard, J., Dobson, A.P., Peterson, G.D., 2006. Trade-offs across space, time, and ecosystem services. Ecology and Society 11 (1), 28.
Saundberg, A., 2007. Property rights and ecosystem properties. Land Use Policy 24, 613–623.
Smith, F.L., 1995. Markets and the environment — a critical reappraisal. Contemporary Economic Policy 13 (1), 62–73.
Sommerville, M., Jones, J.P.G., Rahajaharison, M., Milner-Gulland, E.J., 2010. The role of fairness and benefit distribution in community-based Payment for Environmental Services interventions: A case study from Menabe, Madagascar. Ecological Economics 69 (6), 1262–1271 (this issue).
Stone, M.P., Haugerud, A., Little, P.D., 2000. Commodities and globalization: anthropological perspectives. In: Haugerud, A., Stone, M.P., Little, P.D. (Eds.), Commodities and Globalization. Anthropological Perspectives. Rowman & Littlefield Publishers, Lanham.
Strasser, S. (Ed.), 2003. Commodifying Everything: Relationships of the Market. Routledge, New York.
Titmuss, R.M., 1970. The Gift Relationship. Allen and Unwin, London.
Turner, R.K., Paavola, J., Cooper, P., Farber, S., Jessamy, V., Georgiou, S., 2003. Valuing nature: lessons learned and future research directions. Ecological Economics 46 (3), 493–510.
Vatn, A., 2000. The environment as a commodity. Environmental Values 9, 493–509.
Vatn, A., 2010. An Institutional Analysis of Payments for Environmental Services. Ecological Economics 69 (6), 1245–1252 (this issue).
Vatn, A., Bromley, D., 1994. Choices without prices without apologies. Journal of Environmental Economics and Management 26, 129–148.
Vira, B., Adams, W.M., 2008. Institutional complexity, biodiversity and ecosystem services. Paper presented at Governing Shared Resources: Connecting Local Experience to Global Challenges, 12th Biennial Conference of the International Association for the Study of Commons, Cheltenham, England, July 14–18, 2008.
Wallace, K.J., 2007. Classification of ecosystem services: problems and solutions. Biological Conservation 139 (3–4), 235–246.
Wells, D., 1981. Marxism and the Modern State. An Analysis of Fetishism in Capitalist Society. The Harvester Press, Sussex. Humanities Press, New Jersey.
Wendland, K.J, Honzák, M., Portela, R., Vitale, B., Rubinoff, S., Randrianarisoa, J. in press. Targeting and implementing payments for ecosystem services: Opportunities for bundling biodiversity conservation with carbon and water services in Madagascar. Ecological Economics. doi: http://dx.doi.org/10.1016/j.ecolecon.2009.01.002
Wunder, S., 2005. Payments for environmental services: some nuts and bolts. Occasional Paper No. 42. Center for International Forestry Research, Bogor.
Wunder, S., 2008. Payments for environmental services and the poor: concepts and preliminary evidence. Environment and Development Economics 13, 279–297.