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Issues in the economics of ecosystems and biodiversity

Recent instances for debate

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Abstract

After 1992 many conservation biologists thought that the use of economic instruments would be more effective to halt biodiversity loss than the policies based on setting apart some natural spaces outside the market. At the same time there was a new elaboration of the concept of ecosystem services and, since 1997, there were attempts at costing in money terms the loss of ecosystem services and biodiversity including the high profile TEEB project (2008-2011). Our discussion rests on instances showing the analytical implications of three main socio-economic meanings of biodiversity loss: a) the loss of natural capital, b) the loss of ecosystems functions, c) the loss of cultural values and human rights to livelihood. We review several approaches to include economic considerations in biodiversity conservation. We show cases where monetary valuation is relevant and other cases where it is controversial and even counterproductive, as it undermines the objectives of conservation.

Keywords

Chevron- Texaco case
cost-benefit analysis
commensuration
discount rate
economic valuation
ecosystem services
GDP of the poor
languages of valuation
mangroves
Natural capital
Net Present Value
Niyamgiri Hill
Rights of Nature
TEEB
use and non use values
value incommensurability
valuation languages
Yasuni ITT

Contents

Acronyms

ATCA	Alien Tort Claims Act
CBA	Cost-Benefit Analysis
CBD	Convention on Biological Diversity
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CSO	Civil society organisation
DIPSIR	Driving forces – Pressures – State – Impacts – Responses
EJO	Environmental justice organisation
EROI	Energy return on energy input
ES	Ecosystem service
FACE	Forest Absorption of Carbon Dioxide Emissions
GDP	Gross Domestic Product
HANPP	Human Appropriation of Net Primary Production
IIRSA	*Iniativa para la Integración Regional de Infraestructuras Suramericanas*
	[Initiative for the Regional Integration of the South American Infrastructures]
ITT	Ishpingo-Tambococha-Tiputini
IUCN	International Union for Conservation of Nature
MA	Millennium Ecosystem Assessment
NPP	Net primary production
NPV	Net Present Value
PES	Payment for ecosystem services
REDD	Reducing Emissions from Deforestation and Forest Degradation
TEEB	The Economics of Ecosystems and Biodiversity
UNEP	United Nations Environment Programme
WFD	Water Framework Directive

Foreword

Conflicts over resource extraction or waste disposal increase in number as the world economy uses more materials and energy. Civil society organizations (CSOs) active in Environmental Justice issues focus on the link between the need for environmental security and the defence of basic human rights.

The EJOLT project (*Environmental Justice Organisations, Liabilities and Trade*, www.ejolt.org) is an FP7 Science in Society project that runs from 2011 to 2015. EJOLT brings together a consortium of 23 academic and civil society organizations across a range of fields to promote collaboration and mutual learning among stakeholders who research or use Sustainability Sciences, particularly on aspects of Ecological Distribution. One main goal is to empower environmental justice organisations (EJOs), and the communities they support that receive an unfair share of environmental burdens to defend or reclaim their rights. This will be done through a process of two-way knowledge transfer, encouraging participatory action research and the transfer of methodologies with which EJOs, communities and citizen movements can monitor and describe the state of their environment, and document its degradation, learning from other experiences and from academic research how to argue in order to avoid the growth of environmental liabilities or ecological debts. Thus EJOLT will increase EJOs' capacity in using scientific concepts and methods for the quantification of environmental and health impacts, increasing their knowledge of environmental risks and of legal mechanisms of redress. On the other hand, EJOLT will greatly enrich research in the Sustainability Sciences through mobilising the accumulated "activist knowledge" of the EJOs and making it available to the sustainability research community. Finally, EJOLT will help translate the findings of this mutual learning process into the policy arena, supporting the further development of evidence-based decision making and broadening its information base. We focus on the use of concepts such as ecological debt, environmental liabilities and ecologically unequal exchange, in science and in environmental activism and policy-making.

The overall **aim** of EJOLT is to improve policy responses to and support collaborative research on environmental conflicts through capacity building of environmental justice groups and multi-stakeholder problem solving. A key aspect is to show the links between increased metabolism of the economy (in terms of energy and materials), and resource extraction and waste disposal conflicts so as to answer the driving questions:

Which are the causes of increasing ecological distribution conflicts at different scales, and how to turn such conflicts into forces for environmental sustainability?

This report contributes to this aim reviewing some of the cross-cutting concepts of the work package on Evaluation and liabilities, to be applied in the diverse thematic areas of the project. Based on a range of case studies relevant to EJOs, the report argues that the suitability of different (e)valuation approaches and tools depends on the interpretation given to biodiversity loss, interpretations that often clash with each other according to the position of the stakeholders involved. Further the report helps to understand when money valuation of loss of ecosystems services and biodiversity is or is not appropriate.

1 Introduction

Economic growth and human population growth are forces driving biodiversity loss.
Might economics provide concepts and instruments for biodiversity conservation?

The Nagoya Conference of the Parties of the Convention on Biodiversity in October 2010 had the economics of biodiversity as one of its core topics. Some weeks before the meeting, the economic media insisted on the relevance of biodiversity. As an example, *The Economist* devoted fourteen pages to the pressures on the world's forests, mentioning among the responses to save them the information of the TEEB initiative (*The Economist*, 29/09/2010). The UNEP sponsored The Economics of Ecosystems and Biodiversity (TEEB) reports (Kumar 2010; ten Brink 2011) that were born from an initiative in 2007 to have an economic analysis of biodiversity loss parallel to that of the Stern report on climate change. It was expected that economic valuation would make biodiversity loss more visible socially and politically.

Economic growth and human population growth are forces driving biodiversity loss. Therefore, the idea that economics (which generally preaches economic growth) may provide concepts and instruments for biodiversity conservation is at first sight surprising. We side with the sceptics (McCauley 2006; Kosoy and Corbera 2009; Spangenberg and Settele 2010) but we understand the logic of those who are keen to apply monetary valuation and payment for ecosystem services. In some instances (for example, a court case for damages to the environment and to human health) money valuation is appropriate, as we see in the Chevron and Shell cases in Ecuador and Nigeria (in the third section of this report). However, in a dispute on shrimp farming in Ecuador or on bauxite mining in Orissa (described in the third and fifth sections), should cost-benefit analysis be applied (calculating all positive and negative impacts in monetary terms and choosing the option representing the highest economic value), or should the relevant environmental, social and cultural values have a chance to be deployed in their own units of account as in (some forms of) multi-criteria evaluation?

Chrematistic valuation might enhance the social visibility of biodiversity. However it also might diminish the visibility of other attributes. One early TEEB public meeting took place at the World Conservation Congress in Barcelona in October 2008. An observer wrote that *TEEB Advisory Board member Joan Martinez-Alier endorsed an approach of epistemic pluralism. The ecological economist supported TEEB for tactical reasons but sparked spontaneous applause when he argued for an 'orchestra of instruments'. Economic valuation is an instrument that some people understand very well, and it is very relevant, but we have a whole orchestra of instruments to talk about different valuations. Territorial rights,*

aesthetics, ecological sacredness for many people around the world, tribal people, are also very relevant values. There is an incommensurability of values that we have to recognise (Monfreda 2010: 284).

After this introduction, the next section analyzes the main driving forces of biodiversity loss and the birth of the economics of conservation as a response to this process. The rest of the report argues, using examples where the authors have been involved to some extent, that economics can be used in different modes, in support to alternative approaches to conservation.

One is the valuation of ecosystem products and services (Fearnside 1997; Costanza et al. 1997). If an area of mangroves or tropical rainforest disappears, how much is lost in money terms from the products and services foregone? The third section analyses efforts to halt or reverse or compensate for biodiversity loss by monetary valuation (TEEB, mangroves, Chevron-Texaco).

Another approach, described in the fourth section, includes proposals to halt biodiversity loss through the protection of ecosystem functions and services, where the assessment not necessarily involves monetary valuation of all costs and benefits. For instance, as explained below, the European Water Directive asks for certain qualities to be maintained or achieved (in terms of physical, chemical and biological attributes of the river), and one can then compute the monetary costs of doing so. This approach is related to that of counting the opportunity costs of the Yasuni ITT initiative in Ecuador also described below.

A third approach encompasses attempts to halt biodiversity loss through the prevalence of non-chrematistic cultural and livelihood values. The fifth section looks at the deployment of plural values, like livelihood, human rights, sacredness and the Rights of Nature in controversies of conservation, using cases from India (the Niyamgiri Hill) and Ecuador (the defence of mangroves by local communities, the enforcement of Rights of Nature). The final section contains the conclusions.

2 Driving forces of biodiversity loss and the emergence of socio-economic approaches to conservation

2.1 The failure to halt biodiversity loss

The conservation movement is over one hundred years old. It arose in many countries. Perhaps the figure of John Muir in the United States is the best known (Worster 2008). The science of conservation biology supporting it is a bit younger. Similarly, the discussion on the human influence on climate change because of excessive carbon dioxide emissions is over one hundred years old (Arrhenius 1896).

Not so long ago, wetlands and mangroves were described as ‘malarial swamps’ that should be drained. Now we have the Ramsar Convention on Wetlands of 1971. Deforestation in order to put fields into cultivation or pastures was seen as progress in European history. It was subsidized in Brazil and other Amazon countries until very recently. Now we have REDD+, paying for avoided deforestation to reduce carbon dioxide emissions. It took time for biodiversity conservation and climate change to become central to politics.

The term biodiversity is a neologism used by Walter Rosen (in Wilson and Peter 1988) meaning biological diversity. The most cited definition of biodiversity is that of the 1992 United Nations Convention on Biological Diversity (CBD, art. 2), inspired by conservation biologists, stating that biodiversity means the variability among living organisms at three levels of organisation (genes, species and ecosystems).

An example from agrobiodiversity will illustrate these three levels and also in this case its relationship with human agency (**Fig. 1**). There are more than 256 varieties of maize (*Zea mays*), more than 30 of them in great risk of disappearance (Machado et al. 1998). This is one single species. It is very likely that this variability is the outcome of the coevolution of the wild plant *teocintle* and 7000 years of Mesoamerican and Andean cultures. Apart from the genetic level, this variability expresses itself in the agroecological association of maize in traditional fields (*milpa*) with other (also genetically diverse) useful species, like beans, squash and the maize parasite fungus *huitlacoche*, as well as many other edible weeds. The maize crop has been adapted to different cultural and environmental conditions, creating in Mexico agro-ecosytems as diverse as the *milpa lacandona* (in the tropical rainforest) and the *milpa taraumara* of the Rarámuri (above the 3000 m.a.s.l).

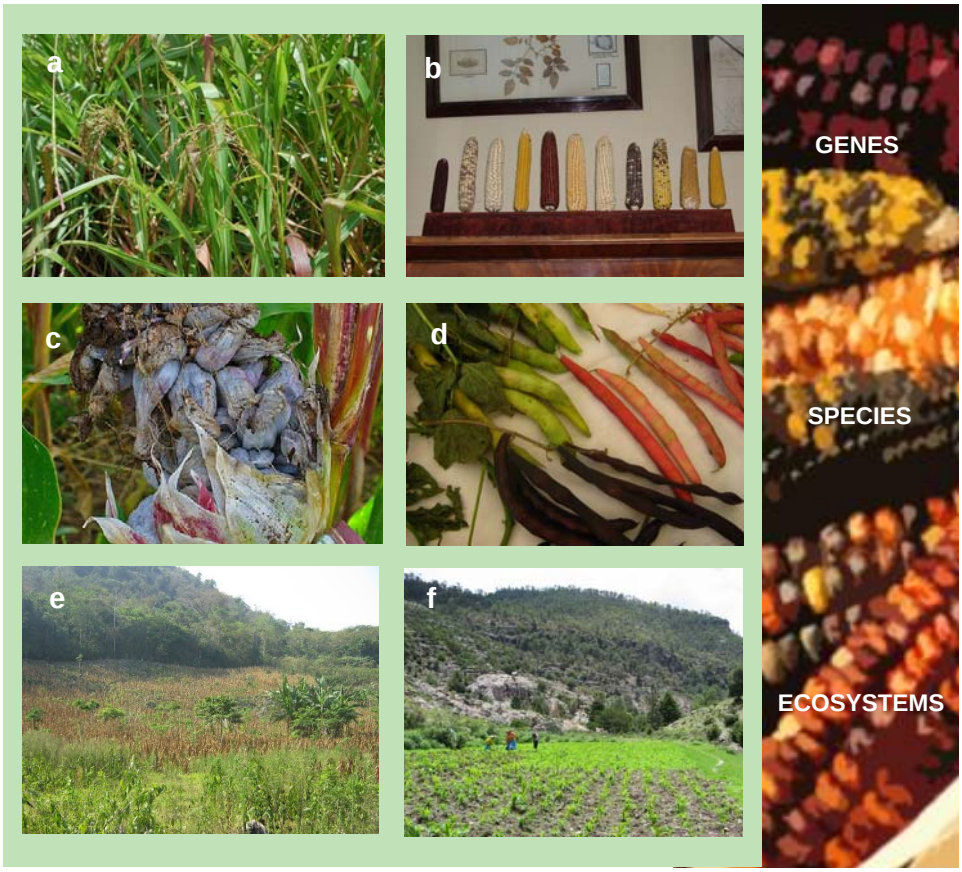

Fig. 1

Images on biodiversity levels related to maize cultivation

Teozintle (a) is the possible ancestor of maize. Through domestication, the genetic diversity of the species has increased to encompass multiple varieties, some of them exposed in Vavilov's office (b). Other (genetically diverse) species are related to maize cultivation: the parasite fungus huitlacoche (*Ustilago_maydis*) (c), or associated crops like beans (d). Maize cultivation interacts with environments as different as the lush vegetation of the Papaloapan region (e) or the highlands of the Sierra Tarahumara (f)

Photo credits: (a) Bernardo Bolaños; (b) Luigi Guarino; (c) H. Zell; (d,e) Heike Vibrans; (f) © Moore-Blooms/ Flickr

This example is similar to that of rice and other crops. They are exceptional among the millions of species that evolved long ago totally independently of human action. Still it is useful to illustrate how human agency (much before there was a generalized market system) could enhance genetic and phenotype diversity. There is in general an association between biodiversity and presence of indigenous groups (Toledo 2000), while among the main pressures for the disappearance of maize diversity in Mexico there is nowadays the homogenisation of commercial crops and the trade in maize under the North American Free Trade Agreement.

The well known DPSIR scheme (EEA 2011) (Driving forces – Pressures – State – Impacts – Responses) describes interactions between society and the environment. According to this approach, social and economic developments (or Drivers) exert Pressures on the environment, changing its State. As a consequence there are Impacts on the ecosystems - and on the ensuing social benefits obtained from them- which elicit societal Responses, feeding back on different stages of the process. Whereas the linearity of the DPSIR approach led to its reframing (Maxim et al. 2009), it is useful to organise information about the relation between socio-economic developments and biodiversity and we use its terminology in this section.

The Millennium Ecosystem Assessment (MA) was an authoritative statement of the situation of the world ecosystems and the threats to them. It demonstrated an increased intensity and effect of the core driving forces of biodiversity loss, mainly attributed to the trends in land use and the human appropriation of biomass. Economic growth goes together with increased material and energy flows including those in the form of biomass. The MA corroborated thus the fundamental conflict between biodiversity conservation and economic growth (Czech 2008).

The Millennium Ecosystem Assessment demonstrated an increased intensity and effect of driving forces of biodiversity loss, mainly related to land use and human appropriation of biomass. This confirms the fundamental conflict between biodiversity conservation and economic growth.

Such driving forces are worsening the state of biodiversity. The living planet index, a global assessment based on 7,953 populations of 2,544 species of birds, mammals, amphibians, reptiles, and fish shows a decline of around 30% from 1970 to 2007 (WWF/ZSL 2010). In Europe, the Biodiversity Action Plan failed in its objective of halting biodiversity loss in the region by 2010. The assessment in the EU-25 made by the EEA (2010) indicated that the conservation state of all evaluated taxonomic groups was mostly unfavourable, across practically all the EU biogreographic regions.

Looking at big infrastructure projects in Latin America, such as the IIRSA[1] projects (and how they open the fields to the transformation of the rainforest to cattle farming or sugar cane and soybean crops, see **Fig. 2**), it is clear that the growing social metabolism goes hand in hand with increasing material flows and appropriation of net primary production.

1 *Iniciativa para la Integración Regional de Infraestructuras Suramericanas* [Initiative for the Regional Integration of the South American Infrastructures, www.iirsa.org].

Fig. 2

A growing social metabolism leads to increasing human appropriation of net primary production

The Peruvian government announces the completion of the last section of the road connecting the Peruvian and the Brazilian Amazonian regions (a)
As the travellers cross the border, the deforested landscape greets them (b)

Photo credits: B. Rodríguez-Labajos

This is reflected in the computations of the Human Appropriation of Net Primary Production (HANPP) (Vitousek et al. 1986; Haberl et al. 2007) including the 'embodied' HANPP in exports (Haberl et al. 2009). For instance, ethanol exports from Brasil do not only imply an increase in the biomass from sugar cane, they also entail the destruction of the vegetation pre-existing in the fields turned now into sugar cane plantations. This would be also shown in the EROI (the energy return on energy input).

If humans consume more biomass, then there is less biomass available for other species. This rests on Wright's 'species richness-energy hypothesis' (Wright 1983), which states that the number of species is related to levels of available energy. There is at least some evidence supporting the hypothesis that more HANPP means less biodiversity (Haberl et al. 2005) and hence that HANPP might be a suitable indicator of pressure on biodiversity.

The mangrove vs. shrimp farming conflict analysed below is a conflict over the HANPP (who destroys the NPP, to the benefit of whom). Similarly, socio-environmental conflicts on tree plantations and deforestation such as the old Chipko movement in Garwhal and Kumaun (Guha 1989, new ed. 2010) may be

seen as historical struggles over the HANPP, where the actors used different valuation languages. 'Tree plantations are not forests' is a slogan used against eucalyptus, pine, rubber and palm oil plantations around the world by the World Rainforest Movement (www.wrm.org.uy), a straightforward struggle for the appropriation of the NPP (Gerber 2011)[2]. A study on land grabbing in the Tana Delta in Kenya (Temper 2011) explicitly asks: who gets the NPP? Pastoralists, agriculturalists, wildlife, or the new sugar cane plantations? Local stakeholders ask for a proper valuation of the existing ecosystems services thinking that this might be effective against land grabbing: "*We will show that conserving the Tana Delta is more valuable for farmers, pastoralist and fishermen than to transform it in sugarcane fields for ethanol*" (Serah Munguti, Nature Kenya, pers. comm, 30/04/11).

Certainly, human beings sometimes encourage ecological (and biological) diversity by creating diverse and inhomogeneous habitats, provided humans are not too thickly spread on the ground. So, HANPP statistics cannot be used to argue against human presence on Earth. We saw this above in relation to *teocintle*. Thus, we read in Matt Ridley's blog (2010) that "*the flowers and birds of farmland where I live - cornflowers and peewits and partidges, for example - must have been very few and far between when this was just a monotonous oak forest. Likewise, the cliff-nesting birds that abound now - house martins and sparrows and rock doves - must have been scarce before towns. We create lots of different habitats - urban, rural, agricultural, forested, scrubby and so on - where before there was uniformity. Of course, in the process, we upset balances, drive species locally extinct and so on. But half the time we are taking away what we created… The most sustainable societies on the planet are the ones that don't rely on charcoal for fuel, or wild game for food*".

Such anti-environmentalist rhetoric posits that the growing human economy is always good for biodiversity. However nowadays industrial agriculture is leading to a steep decline in biodiversity due to landscape homogenisation and loss of traditional knowledge.

2.2 Three socio-economic approaches to conservation analysis and practices

From the above we realize the relevance of economic developments as drivers and pressures on the state of biodiversity. The conservation tools that may be used to respond to such pressures are diverse. One main point in this report is that the conservation tools used in each case are consistent with different interpretations given to the impact of biodiversity loss in the socio-environmental literature. **Table 1** shows three (contested) socio-economic approaches to biodiversity conservation, the type of assessments consistent with such approaches and the proposed conservation tools in each case.

[2] See the EJOLT report 3 for a full assessment of tree plantation conflicts in the world.

Table 1
Interpretations of biodiversity loss and socio-economic approaches
Source: Own elaboration

Interpretation of biodiversity loss	Type of assessment	Conservation tools
Loss of natural capital	Cost-benefit analysis (Using monetary valuation of biodiversity and bioeconomic optimisation)	• (Re)allocation of access and property rights, including intellectual property rights. • Economic instruments (e.g. taxes, quotas) • Net positive impact, and habitat trading • Monetary compensations (for environmental liability or restoration costs)
Disruption of the ecosystem functioning and ecosystem services provision	Cost-effectiveness analysis Multi-criteria evaluation Risk assessment Material and Energy Flows Analysis	• - Regulatory protection • - Land use planning (incl. protected areas such as Natura 2000) • - Red lists
Cultural impairment, damage to human rights and Rights of Nature	Social multi-criteria evaluation Integrated assessment Scenario development Deliberative valuation	• Indigenous territorial rights, Convention 169 of ILO • Defence of institutional capabilities • Claims of the ecological debts (not in money terms) • Ecosystem approach to integrated management

The first interpretation, loss of natural capital, is linked to the tradition of economic studies analysing biodiversity under a neoclassical inspiration. **Table 2** summarizes the main contributions.

Neoclassical economic analysis sees the benefits of global biodiversity as a public good, different to private goods that can be easily traded in markets. That is, individual consumption of the benefits from global biodiversity does not deplete their availability to others (non-rival good) and it is difficult to exclude people from accessing such benefits (non excludable) through pricing. By the same token, global biodiversity loss is a global public bad that affects all consumers.

Environmental costs are often called ‘externalities’, precisely because they remain outside the economic accounts. This approach recommends the use of tools that allow internalizing externalities back into the price system. For doing so commensuration (Espeland and Stevens 1998) is a prerequisite. In the discussion on valuation, the emphasis is put on the goods and services fostered by biodiversity. The monetary value of biodiversity at the level of species could be ascertained by contribution to marketed production or by the prices of bioprospecting contracts or by other stated preferences (willingness to pay in contingent valuation). However, there is a difference between biological resources (which are used in different processes and can be valued with the methods described here) and biological diversity, an abstract good which is not directly available for human use or appropriation. In most valuation processes, the components of biodiversity, the concrete biological resources are valued, but not biodiversity as such.

One could in theory imagine an industrial economy where all the environmental costs (counted as damage costs or repair costs) would be included in the accounts. There are immense technical difficulties of doing so, e.g. how to count the economic values of biodiversity loss, what to include, which discount rates to apply. We do not know which species are disappearing. In any case, the pattern of prices would be very different.

Topic	Reference	Contribution	Limits
(Biologic) renewable resource management	Gordon (1954)	Bioeconomic model of fish bank exploitation (economics of maximum sustainable yield)	• Optimisation methods that allow partial representation of complexity (exclusion of factors in favour of theoretical simplification) • The complete set of states of nature must be known • Biodiversity is mistaken for biological resource
	Clark (1973)	Dynamic bioeconomic model of animal species extinction	
	Perrings and Walker (1995)	Consequences of discontinuous biotic changes	
	Swanson and Barbier (1992)	Biological assets as 'inferior' investment in society's portfolio	
Monetary valuation of biodiversity	Perrings (1995)	Components of Total Economic Value of biodiversity	• Evaluation of biological resources rather than integral evaluation of biodiversity. • Impossibility of coping with collective values
	OECD (2004)	Compilation of methods for valuation of biodiversity	

Table 2 Contributions of economics of biodiversity from a neoclassical perspective
Source: Rodríguez-Labajos et al., 2009

Within this approach the analysis focuses on the erosion of the involved economic assets, in monetary terms. The relevant issue is not the loss of biodiversity per se but the effect of this in the flow of environmental services translatable as income. For this reason, substitutability is not only accepted but also promoted as a management strategy. Now that several commercial tuna species (*Thunus thynnus*, *T. Maccoyii*, *T. obesus*) are severely depleted at the global scale (Collete et al. 2011), the interest for the exploitation of the smaller, but relatively common *Auxis* sp. (FAO 2011a, b), of similar use in the canning industry, is growing.

Meanwhile hundreds of thousands of unknown species are disappearing. We could say that a tropical rainforest that has lost only 10 per cent of its surface is in a relatively good state, but this is compatible with the irreparable loss of many unknown endemic species and their genetic variability.

The second interpretation given to biodiversity loss is the disruption of ecosystem functioning and ecosystem services provision. Ecosystem service (ES) is a notion that had success since the writings of Gretchen Daily (1997) and Rudolf de Groot in the 1990s.

The MA concluded that 60% of the assessed environmental services (15 of 24) were being degraded or used unsustainably (MA 2005) and determined that the ES degradation significantly impairs human wellbeing. The MA did not emphasize 'market failure' as much as the TEEB reports would do in 2008-2011, and deliberately refrained from calculating monetary values (Norgaard 2010). Similarly, for climate change one may emphasize the main driving forces (economic growth linked to consumption of fossil fuels and therefore increased carbon dioxide emissions) or one may emphasize 'market failure' in a neoclassical welfare economics mould. Among ecological economists, many think with K.W. Kapp (1950) that market failures are better seen as cost-shifting successes. In economic theory, a zero price should signal non scarcity of a good or service relative to its demands over the relevant time horizon. However zero price paid for

the destruction of a mangrove forest, a piece of rainforest or a coral reef, does not indicate so much a market failure as a relation of power (O'Connor 2000).

When we consider biodiversity loss as loss of ecosystem functions and services, the evaluation directly includes indicators for the involved biophysical processes. Cost of action can be included as one element to consider in the decision. However the evaluation method will not require the translation of all elements into money terms. Metrick and Weitzman (1994) introduced cost-effectiveness analysis (alternatives of action are compared in terms of monetary costs, but their effects are expressed in biophysical units) of 'optimal' biodiversity conservation. However, they worked under the assumption of substitutability between species, which does not differ essentially from the postulates of neoclassical economics.

As explained above, the calculation of HANPP (Vitousek 1986; Haberl et al. 2007) is just one of the methods for the study of social metabolism. The debates on agrofuels are debates on the HANPP, on the EROI, and on the 'virtual water' – the water used to grow them. Agrofuels increase the HANPP to the detriment of other species, and also to the detriment of some human groups. There are links between the increased Social Metabolism and biodiversity loss. There are also links to Environmental Justice Movements when poor people are often on Nature's side because of their own cultural values and their livelihood needs, as we shall see below in the cases of mangroves in Ecuador and bauxite mining in Orissa.

And here the third interpretation of the impacts of biodiversity loss arises. Some languages of valuation (livelihood, sacredness) that were powerful in the past, are slowly becoming worthless in this era of the generalized market system where even 'the fetishism of fictitious commodities' (Kosoy and Corbera 2010) is in the ascendant in PES schemes. Meanwhile, other non-economic languages (e.g. human rights or environmental justice against 'environmental racism') are gaining in strength. The language of indigenous rights is perhaps also becoming more powerful in megadiverse countries, while (as shown in **Section 5**) the Rights of Nature are now included in some new Constitutions in Latin American countries.

Ecological distribution conflicts are expressed as conflicts over valuation, inside a single standard of value or across plural values (Martinez-Alier 2002). As shown in the next section, an agreement with a company or redress for an injustice may be sought by appealing to the common language of monetary valuation, trying to value in a court of law the monetary compensation for damages. Such exercises in commensuration of values are technically difficult to achieve but not impossible. However, monetary reductionism (as well as other forms of reductionism) might harm the social legitimacy of other values, as shown in **Section 5**.

So far, we have presented three different socio-economic approaches to conservation. In the rest of the report, the strengths and weaknesses of these different approaches will be contextualised to illustrate the situations in which each one may be more or less applicable. The examples for each approach also point at the institutional or social dynamics that allow such approaches to get heard (and when political dynamics may cause an approach to get in conflict in practice with other approaches).

The conservation tools used by each socio-economic approach are consistent with different interpretations given to the impact of biodiversity: loss of natural capital, loss of functional values of the ecosystems or cultural impairment. Ecological distribution conflicts emerge when the diverse interpretations conflate in the same case

3 Protecting through monetary valuation? The mantra of substitutability

In 1997, Philippe Fearnside published an article on the economic values that primary forest Amazon territory in Brazil (threatened by cattle ranching) could provide if the forest was maintained. One family could live in 100 ha from its own sustainable collection of products and from the payments for non-timber products, from (notional) payments for carbon uptake (or avoided carbon loss), evapotranspiration (rainwater in Sao Paulo and Buenos Aires comes from the Amazon), and bioprospecting (Fearnside 1997). In the same year, Costanza et al. published a famous article on the value of ecosystem services and the world natural capital. All environmental services from ecosystems were supposed to provide per year the equivalent to about twice the world GDP. This was an article attracting much attention. One major criticism was that one could not easily extrapolate economic value from marginal losses (e.g. the services lost when one hectare of mangrove is lost) to the total economic value of the services provided (e.g. by all standing mangroves in the world).

Since then, there has been a strong movement to see the monetary valuation of ecosystem services (and indeed, the payment for environmental services, PES) as instruments for conservation. Let us now analyze some cases of valuation is different contexts and scales.

3.1 Mangroves vs shrimp: the value of ecosystem services

Using cost-benefit analysis, we realize that the value added from shrimp production can be notably smaller than the value of mangrove preservation, when we consider externalities

This case is written with acknowledgement to Barbier and Sathiritai (2004), who did one of the first Cost-Benefit Analysis (CBA) of shrimp farming compared to mangrove preservation. In our typology of socio-economic approaches, this would be a clear example of the first type.

Let us plausibly assume that one shrimp farm produces per ha/year about 4000 kg of shrimp, selling at a farm price of USD 5 per kg, the gross revenue is then USD 20,000 per ha/year. This is difficult to match by the (market and non-market) economic values provided by one hectare of mangroves.

However, the shrimp pond lasts perhaps only five years, while the mangrove destruction is forever or at least for a few years after the end of shrimp farming when the soil becomes less acidic and allows replanting. So, we have 5 years of shrimp revenue to compare, say, to 15 years (5 plus 10) of loss of mangrove revenue. Certainly, we should deduct from the gross revenue, the monetary costs of producing the shrimp such as nutrients and antibiotics.

Moreover, we deduct the amortization of the investment costs, about USD 10,000 per ha, i.e. USD 2,000 per ha/year. We then deduct externalities, such as the costs of water pollution. There are two methods available: the economic value of the damage produced, or the cost of the abatement of pollution down to the desired level. We also deduct other externalities (illnesses suffered by women and children collecting seedlings, and new resistance to antibiotics). Moreover, assume that an obligation is imposed of replanting mangroves once the farm is abandoned after five years. Costs could amount to USD 300 per ha or to USD 8,000 per ha according to different sources. Depending then on various assumptions, we have a figure for value added from shrimp production (net of market and non-market costs) equivalent to USD 10,000 ha/year, or even less.

If, instead, we keep the mangroves, which are the market and non-market revenues produced by hectare? Here we distinguish between direct and indirect economic values. The direct values are derived from the products collected from the mangroves (shells, crabs, fish, honey, wood…) for self-consumption or marketing. A mangrove forest will produce over ten tons of biomass per year, mostly as detritus from fallen leaves. A small part of the biomass would be collected by humans, who depend on the mangrove forest for their livelihood.

However, in money terms this biomass in the form of fish, crabs, shellfish, wood, is not worth much (say, USD 100 or 200 ha/year) because the prices it would fetch in the market are low. This is what the TEEB report, as we shall see below, calls ‘the GDP of the poor’. Indirectly, the mangroves provide other current or future (optional) benefits that must be valued in money terms in order to complete the CBA. These range from being a nursery for off-coast fisheries to coastline defence, including also carbon uptake, repository of salinity-resistant genetic resources, and other forms of unused biodiversity, sometimes recreation values also.

Mangroves may be defended or attacked through cost-benefit analysis.
Much depends on the discount rate and the methods of economic valuation

The coastal defence service is valued at the 'replacement cost'; a wall would be built instead. Then, this reaches thousands of dollars per hectare of mangrove. For biodiversity, there is no 'replacement cost' (as in a 'Jurassic Park') of the disappearing species. We could resort to extrapolations from payments in bio-prospecting contracts, or to 'willingness-to-pay' valuations, or to production losses. Finally, net carbon uptake may be given different values according to the CDM case we take as comparison. This 'price' does not reflect the usefulness of the carbon uptake service for humans and nature but it depends on the Kyoto and post-Kyoto commitments[3].

Bringing it all together, one could argue that the economic value of the standing mangroves amount, per ha/year, up to USD 10,000 or more. The benefits from shrimp farming accrue in the first few years, while the benefits from the mangroves are foregone at least until successful replanting. Mangroves may be defended or attacked through CBA. Much depends on the discount rate (see below), and the methods of economic valuation. Nevertheless, it could be than the administrative authority contemplating a fine on an illegal shrimp farm or an environmental group suing a shrimp farm in a court of a law for damages, would find such estimates of losses of environmental services quite useful.

As regards discounting, one could apply Krutilla's rule, putting a very low or a zero rate of discount on the future services from mangroves because they are becoming increasingly scarce (Krutilla 1967). On the other hand, a pro-shrimp economist could reinforce arguments for shrimp farming by plausibly using a higher discount rate, by lowering the replanting costs, and by giving a high value to the export revenues obtained because foreign exchange might be a limiting factor to economic growth.

3.1.1 The discount rate and the optimist's paradox

The results of any CBA depend on the discount rate (Krutilla 1967). John Gowdy criticized in the main TEEB report (Kumar 2010: 264-7) the use of a high discount rate by Nordhaus in his climate change models. Gowdy cautiously praises Stern's approach. And nevertheless, even Stern discounts the future too much as we shall now explain. Gowdy writes that the assumed per capita rate of growth of the economy in the Stern report ranges between 1.5% and 2.0%, and this is a lot. Discounting the future is justified by the assumption that those living in the future will be better off than those living today. Notice that this future improvement in the standard of living is attributed to economic growth rather than to the population decline that will presumably take place at world level after 'peak population' is reached by 2050.

In the first TEEB report (EC 2008: 30), Martinez-Alier argued that the assumption of growth leads to the "optimist's paradox" because it justifies the present use of more resources and more pollution because our descendants will be better off.

[3] See EJOLT report 2 for a thorough critique of carbon pricing and trading.

The assumption of growth would leave in fact future generations with a degraded environment and a lower quality of life. In other words, applying a high discount rate because of assumed future prosperity leads to compromising this very prosperity by giving now low weight to future resource exhaustion and environmental impacts in terms for instance of biodiversity loss, climate change, or production of nuclear waste. Growth turned into a faith creates the conviction that it is possible to live beyond one's current sustainable means (economic and environmental) as all liabilities or debts can be paid back (by hypothesis) from tomorrow's higher income (Martinez-Alier, 1987: 156-171, 2002: 45-46).

The 'optimist's paradox':
The assumption of growth leads to increasing use of resources and sinks in the present, undermining the material basis of prosperity in the future

3.2 Money valuation in a forensic context – environmental liabilities of Chevron Texaco and Shell, and climate justice

Industrial economies, even without economic growth, need fresh supplies of energy and materials. The energy in the fossil fuels is 'dissipated' by use; it cannot be recycled and used again. The materials (copper, aluminium, steel) are recycled only in part. Moreover the world economy is still growing. Therefore, there is increasing pressure at the 'commodity frontiers' and there are also increasing waste disposal conflicts (like the excessive amounts of carbon dioxide on the atmosphere and the acidification of the oceans).

In the balance sheet of any company, there are Assets and Liabilities (or Debts). However, environmental liabilities do not appear in the balance sheets unless they are claimed by the potential creditors through court cases or through direct action, or unless there would be state regulations to that effect. As the companies do not include environmental liabilities in their accounts, this means that they do not appear either in the macro-economic accounts. Thus the economy works in practice by shifting costs to poor people, to future generations, and to other species.

Such environmental liabilities appear in the public scene when there are complaints, or when there are sudden accidents (BP in the Gulf of Mexico, 2010, TEPCO in Fukushima, 2011): the pedagogy of catastrophes or *catastrophisme éclairé* that Jean-Pierre Dupuy (2002) relies upon. This section focuses on two court cases related to oil extraction where the costs are assessed (by the plaintiffs and/or the judges) in billions of dollars: the operation of Texaco (now Chevron) in Ecuador between 1965 and 1990 and Shell in the Niger Delta since the 1970s.

3.2.1 Chevron Texaco in the Ecuadorian rainforest

As in the rest of the Amazon, the biodiversity of the Ecuadorian rainforest provides its inhabitants with food, fibres and medicinal resources. It is the resource base for the livelihood of indigenous communities, some of which are still voluntarily isolated from the market economy.

Texaco (Chevron) was present from 1965 to 1990 in the northern part of the Amazon of Ecuador. To save costs, the company dumped the 'extraction water' to

ponds that frequently overflow, and which were not lined to prevent seepage. Gas was flared, but (different to the Delta of the Niger) this has not been a matter of controversy in the Ecuador court case. Many indigenous groups living in the forest suffered very much, like the: Cofanes, Secoyas... Two groups (Tetetes and Sansahuari) went extinct. Settlers were attracted by the roads opened by the oil company, they also suffered from pollution.

Fig. 3
Gas flaring near Lago Agrio, Ecuador, 2007
Photo credit: M. Walter

The origins of the court case go back to 1993 when a 'class action' suit against Texaco was brought in a court in New York under the ATCA (the Alien Tort Claims Act). Indigenous and settler representatives from Ecuador went to New York. The company insisted (as so often happens in other ATCA cases) that the US court was a *forum non conveniens*. In 2003 the case went to Ecuador (Sucumbios), obviously a better place in order to do local inspections and ask local witnesses. Chevron agreed to this.

On 14th February 2011, Judge Nicolas Zambrano gave a court decision in Sucumbios, Ecuador. This well-argued decision has 188 pages and reviews the case since it started in 1993. It is available in Spanish and also in English in the website of Business & Human Rights (www.business-humanrights.org). Judge Zambrano focused mainly on two issues. First, the dumping of extraction water into the environment (instead of reinjecting it, or keeping it in properly designed ponds). Second, the damage to human health. The evidence was collected in in

situ judicial inspections, listening to the local people in an exercise of 'popular epidemiology' in a territory where there were no reliable official health statistics at the time (Brown 1993; Novotny 1998).

The technology for water reinjecting already existed at the time. Judge Zambrano mentions a Primer of Oil Production of 1963 co-authored by Texaco engineers. This technology was not applied in the Amazon of Ecuador to save costs, increasing profits and increasing also the likelihood of damages. The court decision quotes Chevron-Texaco's own sources recognizing over 15 billion gallons of water dumped in ponds. In fact, standards in the Amazon should have been more strict that in other less vulnerable ecosystems.

The decision fined Chevron Texaco with USD 9.5 billion that would be doubled unless Chevron apologized within 15 days to the victims of pollution. The items in the compensation are presented in **Fig. 4**.

Notice that the main item is a carefully calculated amount (USD 5,396 million) for remediation of the areas with extraction water ponds. There is an unavoidable mixture of items (compensation for irreparable damages together with sums for remediation), notice also the different values involved (human health, damage to 'fauna and flora' counted at remediation costs, with no item for irreparably lost biodiversity and a small item for cultural damages). Judge Zambrano determined that the payment by Chevron Texaco must go into a Trust Fund set up by the *Frente de Defensa de la Amazonia* (not the national or provincial governments of Ecuador) on behalf of the plaintiffs. The beneficiaries would be tens of thousands of people in Sucumbios and Orellana. There is would be a 10 per cent additional payment for administration of the Trust Fund.

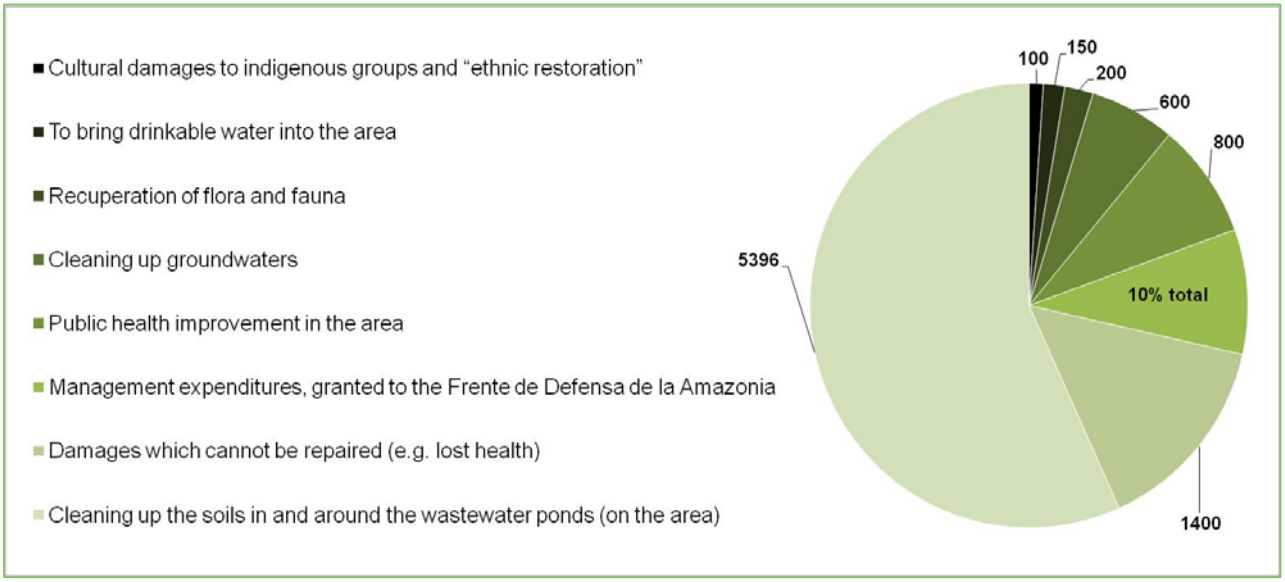

Fig. 4 Items in the compensation of the Chevron-Texaco case (in USD million)
Source: Own elaboration based on the court decision

The court case has been supported by both indigenous and settler populations. From the start of operations in 1970 to 1990 Texaco took 1.5 billion barrels of oil from Ecuador. The payment that Chevron-Texaco must do now is then of the order of USD 6 per barrel. One must take into account the depreciation of the dollar and also the time that has passed since then. It is a reasonable amount that Chevron can afford because its annual profits are in the last few years larger than this. This court decision was ratified by a three-member court in Sucumbios on 3th January 2012, and later it has gone on appeal to a national court in Quito.

On 30th May 2012 it was announced that Ecuadorean plaintiffs filed a lawsuit in Ontario, Canada as a first move outside their country to try and enforce the USD 18 billion court judgment against oil company Chevron for polluting the Amazon. The 2011 judgment against Chevron is one of the biggest rulings ever for environmental damage. The new lawsuit, filed in the Superior Court of Justice in Ontario, Canada targets Chevron and various subsidiaries that together hold significant assets in Canada. According to lawyer Pablo Fajardo, Chevron might think it can ignore court orders in Ecuador but not in Canada where a court may seize the company's assets if necessary to secure payment (*Financial Times*, 31/05/2012; *Reuters Canada*, 31/05/2012).

3.2.2 Shell in the Delta of the Niger

The current case against Shell in The Netherlands is also relevant for our discussion on monetary valuation. Over the last 50 years there have been many other attempts to bring Shell to court for damage done in the Delta of the Niger due to oil spills and gas flaring. Nigeria has been the largest oil exporter in Africa, number 11 in the world. The Delta of the Niger is the 'world capital' of oil pollution.

One Nigerian court decision on 5th July 2010 by Judge Ibrahim Buba awarded compensation payments worth USD 105 million to a small community, Ejama Ebubu, for oil spills since 1970 in an area of only 2.5 km^2. The plaintiffs first went to court in 2001 after the end of the military dictatorship. But Shell is unlikely to pay anything. There have been other similar court decisions in Nigeria.

Then, another type of court case against Shell was accepted in 2009, this time in The Netherlands (Mcalister 2009). The plaintiffs, fishers and peasants of three communities, claim that Shell had not used international standards in its operations. Health has been affected by oil spills and gas flaring. The case at hand is an oil spill on 26th June 2005 in Oruma and spills in two other communities. The Shell company argued on 13 May 2009 that court had no jurisdiction on the case. But on 30th December 2009, the court accepted the case which is now making slow progress[4].

[4] For other cases on international environmental court decisions relevant to EJOs, see EJOLT report 4.

3.2.3 Retroactive environmental liabilities and climate justice

Although not directly relevant for a case in Ecuador or Nigeria, in the US a company like Chevron-Texaco would have been very much aware of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), also known as the Superfund. This Law was enacted on 11th December 1980 (just half way through Texaco's presence in Ecuador). It imposes retroactive obligations. Firms have to pay compensation for damages and they have to clean the pollution left behind. If firms no longer exist (and the polluted sites are 'orphan'), then compensation and remediation are to be financed by the Fund constituted by a charge or tax on the oil and chemical industries.

Claims for environmental liabilities of companies in overseas territories and also in the context of climate change and biodiversity loss, might be expressed sometimes in terms of monetary compensation

The increased social metabolism causes resource extraction conflicts, transport conflicts and waste disposal conflicts like those from water and oil pollution and gas flaring in Ecuador and Nigeria. The main waste disposal conflict is related to the excessive amounts of greenhouse gases. Who is the owner of the atmosphere and the oceans as dumping places for carbon dioxide? Who has appropriated for free such climate regulating services? How to achieve Climate Justice?

What does CERCLA have in common with the Climate Debt? In Copenhagen 2009 and in Cancun in 2010 some civil society groups and Southern governments pushed forward claims for the repayment of the 'ecological debt from North to South' (as again in Durban in 2011). Unexpected support for this position came from Jagdish Bhagwati (2010), from Columbia University. Leaving aside the activist literature on the Ecological Debt since 1991 (www.deudaecologica.org), Bhagwati wrote that the US, confronted with an internal legacy of pollution after the Love Canal scandal, enacted the 1980 Superfund legislation. This law implies 'strict' liability, applicable even when it was not known at the time that materials were toxic. According to Bhagwati, this principle should apply to excessive per capita carbon dioxide emissions also. The implication is that the monetary calculations that have been done on the climate debt (for instance, Srinivasan et al. 2008) could become useful arguments in international negotiations on climate change and even in a court of law. Something similar could apply to economic calculations of the value of biodiversity loss.

To conclude, claims for environmental liabilities of companies in overseas territories and also in the context of climate change and biodiversity loss, might be expressed sometimes in terms of monetary compensation. Other languages are also available, depending on the context. Instead, Lawrence Summers´ principle is applied as a matter of course to resource extraction or waste disposal[5] . The poor are cheap, and future generations and other species have no power.

5 In 1991, the then chief economist of the World Bank wrote or dictated a memo arguing that pollution should be sent to places where there are no people, or where the people are poor, since "*the measurements of the costs of health impairing pollution depends on the foregone earnings from increased morbidity and mortality. From this point of view a given amount of health impairing pollution should be done in the country with the lowest cost, which will be the country with the lowest wages. I think the economic logic behind dumping a load of toxic waste in the lowest wage country is*

For the analyst, if justice is not done, this would support the view that the economy regularly achieves cost-shifting successes. So-called 'externalities' should be the main topic of study for students of economics. What is not counted in money terms is possibly more important than what is counted in money terms.

According to standard economic theory, recognising that a good is scarce should result in a positive price. But this mechanism does not work if the demands of those persons — present or future — for whom scarcity means physical non-availability are not heard. Even less if the 'demands' in question come from other species. Pollutants or toxic wastes may be imposed at zero price in ways that degrade the living habitat of others who are unable to stop the event (O'Connor, 2000). Will Chevron Texaco or Shell (or the citizens of rich countries producing excessive per capita amounts of carbon dioxide), pay at the end of the day a zero price for the pollution caused?

3.3 TEEB: Monetary valuations are meant to increase the visibility of biodiversity loss

How much does it cost to protect ecosystems in comparison to the market and non-market benefits derived from them?

In 2005, the Supreme Court in India requested how the value of forest land diverted for non-forest use (like a dam or an open cast mine) could be worked out on economic principles (Chopra 2006). Could we calculate the Net Present Value (NPV) of keeping the forest compared to the NPV of the new industrial development, applying an appropriate discount rate and reaching a conclusion accepted by society? Which were the relevant values and for whom?

This idea of an increased visibility of biodiversity loss through economic valuation inspired the project 'The Economics of Ecosystems and Biodiversity' (TEEB) that began at a meeting in Potsdam in 2007 of the G-8, with support from Sigmar Gabriel, then Minister of the Environment in Germany, and the European Commission. Written between 2008 and 2011, the TEEB reports (www.teebweb.org) are published under the auspices of UNEP and the leadership of Pavan Sukhdev, an economist and a banker with a long-standing interest in the economics of nature conservation. The purpose was to collect studies showing to policy makers the economic benefits of ecosystem products and services, and therefore the costs to human wellbeing of the loss of such ecosystems. TEEB set out to ask, how much does it cost to protect ecosystems (mangroves, coral reefs, tropical rainforests, etc) in comparison to the market and non-market benefits derived from them? The expected answer was, 'very little'.

TEEB abounds in numbers in dollars of the benefits provided by different ecosystems in order to impress public administrators and firms with the importance of conservation. Such interesting if puzzling numbers are not always actual measurements (like species-richness or NPP). The benefits come from supporting or habitat services, provisioning services, regulating services, and

impeccable and we should face up to that". From a strictly economic viewpoint, he was right (The Economist, 8 February 1992).

cultural services. For instance, a wetlands in Australia's Northern Territory (ten Brink 2011: 55) was said to provide in 2008 the following benefits in Australian dollars per ha/year: cultural service (for tourists and fishermen's recreation), 57; regulation (water use, carbon sequestration), 298; productive services for crop growing, pastoralism and crocodile hunting, 31; and finally only 1 dollar as habitat for nature conservation.

TEEB presented a synthesis of methods of valuation of ecosystem products and services, which is interesting in its wide scope (**Fig. 5**). In practice, the TEEB reports left aside the Biophysical Approaches [from Ecology (resilience theory) and from Thermodynamics] and also the methods of valuation coming from Political Sciences.

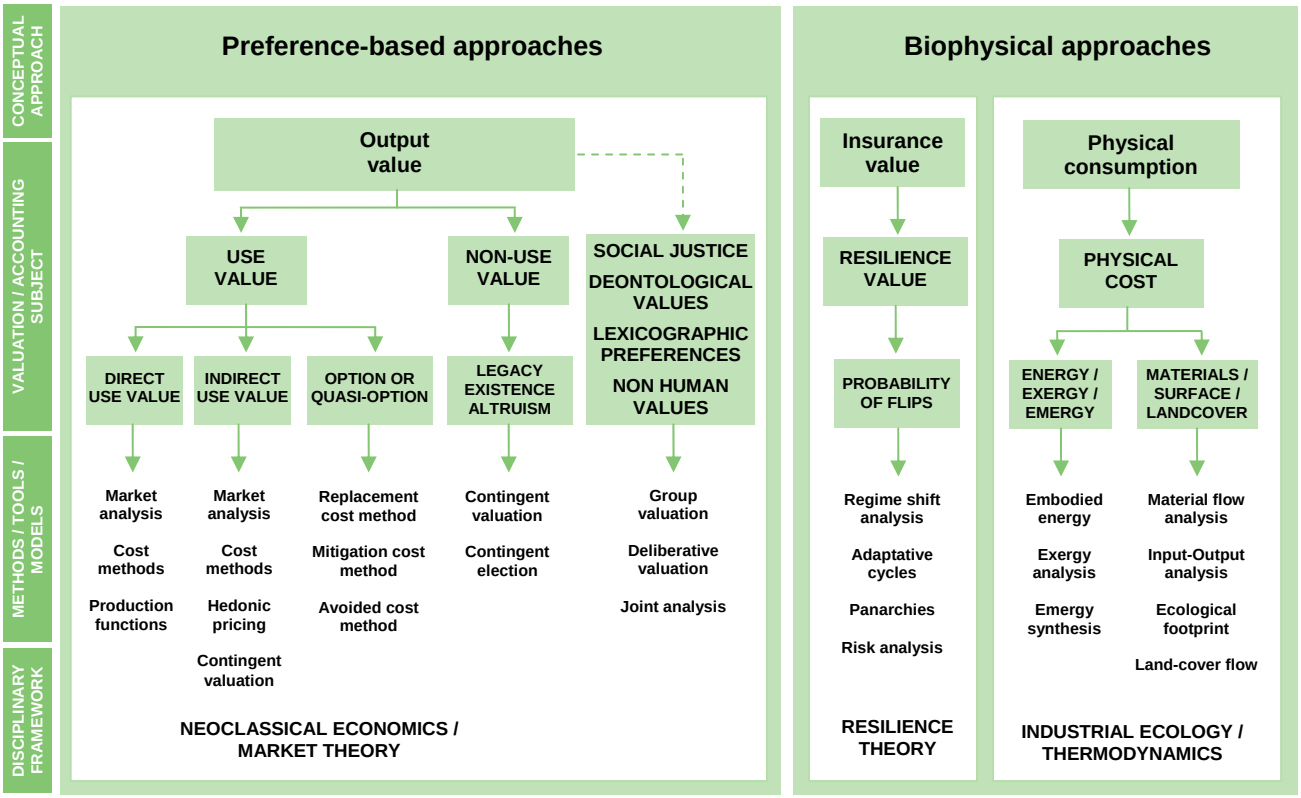

Fig. 5 TEEB, synthesis of valuation methods

Source: Kumar 2010: 191 quotes Gomez –Baggethun and De Groot

3.3.1 The notion of 'the GDP of the poor'

We focus here on one of the most innovative ideas from TEEB. The contribution of forests and other ecosystems to the livelihoods of poor rural households is large in terms of their wellbeing, and therefore there is a significant potential for nature conservation efforts to contribute to poverty reduction. TEEB tries to show that ecosystem services and other non-marketed natural goods account for 47 to 89 per cent of the so-called 'GDP of the poor' (i.e. the total sources of livelihoods of

The notion of 'the GDP of the poor' provides an interesting link to a critique of uniform economic development

rural and forest-dwelling poor households) in some large developing countries. Imagine a mining company in a tribal village in India that destroys the forests and pollutes the water. The local people have no money to compensate for such loss. Therefore, when poor or indigenous peoples see their livelihoods threatened by the encroachment of the extractive industries or the enclosures by tree plantations, they tend to complain in what has been called 'the environmentalism of the poor' (Martinez-Alier 2002).

Nature conservation is not a luxury of the rich but a necessity for everybody. The notion of 'GDP of the poor' is a new way of making the old distinction between-provisioning through the market and provisioning outside the market which Aristotle (in *Politics*) called respectively chrematistics and *oikonomia*. It seemed to Aristotle that there was a trend (which he disliked) towards provisioning through the market. This distinction between chrematistics and the real economy was later taken up by many writers including Karl Marx, Frederick Soddy, Karl Polanyi, Herman Daly. It was also the kernel in the 1920s of the Socialist Calculation Debate between Otto Neurath on the one side and Von Mises and Hayek on the other side who argued that without market prices there could not be a rational allocation of resources while Neurath pointed out to the radical uncertainties on future availability of resources and future pollution which made it impossible to value them convincingly in money terms. (Martinez-Alier and Schlüpmann 1987; O'Neill 1993). Neurath's point about the incommensurability of values and his proposal for accounting 'in kind' were generally lost to economists until he was rediscovered as a proto-ecological economist.

Similarly, the GDP of the poor should not be measured in money but in kind, in terms of contributions to livelihood. However, as explained above, TEEB made an attempt (**Fig. 6**) to translate livelihood values from ecosystem services, which have to do with the second and third approaches to valuation explained in this report, into monetary values to emphasize the importance of the GDP of the poor (ten Brink 2011:118), to some extent defeating its own purpose.

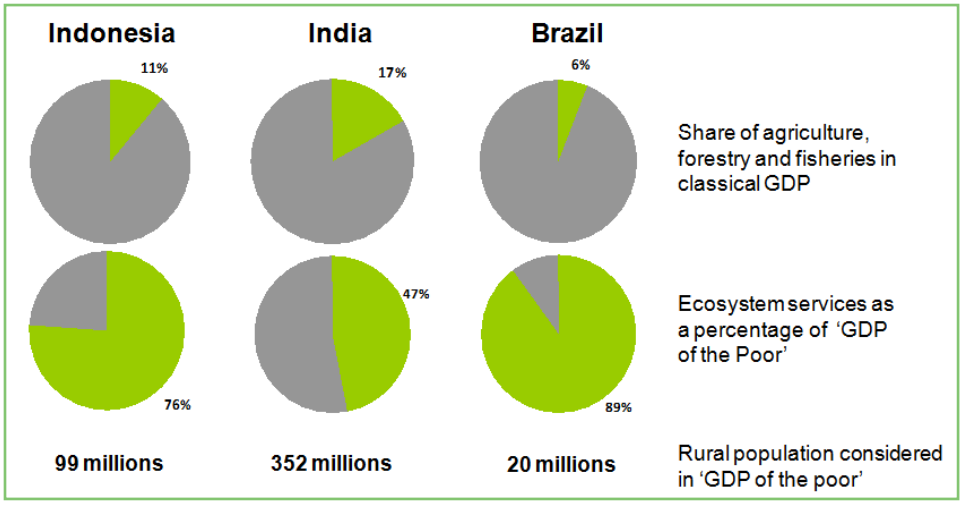

Fig. 6
The GDP of the poor
Source: Kumar 2010

Economic development often implies the destruction of natural capital, also of so-called human capital (including the many languages which are being lost). Economic development implies the loss of some capabilities, while others are gained. Being forcibly displaced without compensation by a new dam or a new mine, as so often happens, reflects a terrible lack of freedom. The balance should not be drawn in money terms as in a profit-and-loss account or a CBA. It requires a social multi-criteria approach or deliberative valuation able to cope with incommensurable values.

All such considerations were not developed in TEEB. However, the introduction of the notion of 'the GDP of the poor' provides an interesting link to a critique of uniform economic development. It also supports the movements of the 'environmentalism of the poor' in defence of biodiversity because this notion signals the importance of ecosystems as a resource base for livelihood.

3.3.2 Net positive impact: Substitute and compensate

While aware of the importance of the environment for the livelihood of indigenous and poor rural people, some of the TEEB recommendations 'greenwash' large mining corporations. There are close links between the IUCN (a strong backer of the TEEB initiative) and companies like Shell or Rio Tinto. John Muir would have been horrified. This aside, TEEB explicitly praised proposals (called "net positive impact" by Rio Tinto) to permit the destruction of a habitat if a certificate is presented confirming that an equivalent habitat has been 'created' somewhere else. Making the certificates tradable would supposedly create a global market, supporting a flexible and cost-effective biodiversity protection system. Rio Tinto is certainly not the only voice putting forward this proposal.

However, consider for instance mangrove destruction. Small countries like Ecuador or Honduras would quickly run out of mangroves to be preserved. It does not make sense to destroy ten hectares of mangrove forest in Muisne, Ecuador, and pay for the preservation of ten hectares of an 'equivalent' mangrove in Tanzania. Is there not a question of scale and limits?

In summary, this section has critically analysed some cases where monetary valuation of biodiversity loss (and also other environmental damages) is plausible. If the money returns from ecosystem products or services become the main logic of conservation, and if such returns are not high enough (for instance, by the application of relatively high discount rates), money valuation becomes counterproductive. Still, the context might require this kind of valuation, as in a court case on damages from mining or oil extraction. Or economists and politicians might think that monetary valuation will increase the social visibility of biodiversity loss, as in the TEEB reports

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4 Halting biodiversity loss through the protection of ecosystem functions and services?

In contrast to the attempts to value in money terms the positive contribution of ecosystems services to human well-being (or to value also in money terms some harms to nature and to humans), this section considers examples where the emphasis is given to the necessary actions to preserve functions of the environment.

This approach was brought with strength into conservation biology, human ecology and ecological economics by the Millennium Ecosystem Assessment (MA 2005), which not only provided the evidence of declining ecosystem services but demonstrated their links with the constituents and determinants of human wellbeing. Although humans could not survive without such services, they are not made available through the market except in some very special cases (payment for pollination services, for instance) (Gallai et al. 2009). Two schemes that make operative the concept of ES management without applying CBA are considered below.

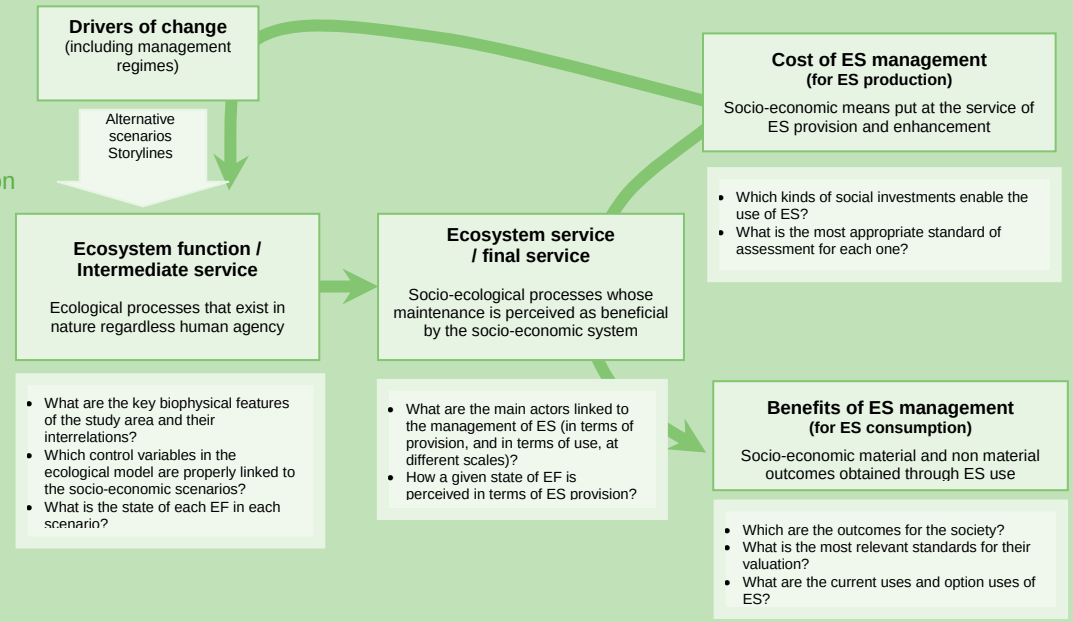
Box 1 Ecosystem functions and ecosystem services – working definitions

As Mooney and Ehlich (1997) review, the history of the notion 'ecosystem service' is far more ancient than its well known formalisation by Daily (1997). However, Daily's contribution, and many others' before and since, allowed a scientific agreement on the need of a standardised account of the human dependence of ecosystems. The Millennium Ecosystem Assessment (2003, 2005) was the celebrated outcome of such agreement. Among the attempts to enhance its policy relevance, economic valuation (as in the TEEB project) has been one of the preferred strategies (see Kumar, 2010).

Fisher et al (2009) argue that a meaningful ES classification system should be framed in the decision context in which the ES analysis shall be employed. From there it follows that a proper attention is needed on the ES definition, the understanding of the ecosystems under analysis and their services, and the specification of the motivation for assessing ES. In this respect, **Fig. 7** synthesises some key theoretical standpoints to understand ES and their relation with human agency. The final purpose of the methodological process is the recognition of the values for the different ES, including some research questions relevant for each one of the definitions provided. The conceptual framework here presented is rooted in that of the MA. However, it also takes into account h the concerns and conceptual proposals by Boyd and Bazhaf (2007) and Fisher et al. (2009), which systematise the various terms used in the literature to differentiate the functioning of ecosystems from its particular outcomes benefiting human interests.

Fig. 7
ES concepts and human agency

Source: own elaboration



Ecosystem functions (similar to intermediate services in the terminology of Fisher et al. 2009) are ecological processes that exist in nature beyond human agency. Examples of ecosystem functions are the processes within the water cycle, soil formation or the primary production. Although they exist without the need of human intervention, human decisions may affect such processes to great extent. Therefore, it is important to know how the state of such ecosystem functions responds to the diverse scenarios in the study area. Knowledge of ecosystem functioning comes from the bioscience domain, which will contribute to identify key biophysical features of the ecosystems and their interrelations. A good collaboration with the social science domain is required though, to focus the analysis in the ecosystem functions that are more directly related to selected ecosystem services. Ecological modelling can be used to illustrate the specific scenarios, and it is a basic tool to represent alterative states of the ecosystem functioning.

Ecosystem services (similar to final services in the in the terminology of Fisher et al. 2009) are socio-ecological processes the maintenance of which is perceived as beneficial by the socio-economic system. Different to ecosystem functions, they have a focus on human interests. That is, societies attribute preferences for each ecosystem service, or for a pack of them, and have therefore normative views about their development. Different levels of human involvement are then required for their existence, either cognitive, behavioural or through the application of different forms of human-made capital. Although it is easy to realise that they are mostly linked to material processes that occur in nature, the basic reason to focus on them is *because they are useful* to generate either goods (like food production) or services that allow further achievements (like soil fertility), this including the protection against undesired events (like most of regulating services). Useful is here understood in a broad sense, including cultural aspects.

From the methodological point of view this entails the identification of relevant ES in the study area, the actors that play as providers and users at different scales, and the means put at the services of their provision. It is also important to identify the relationships among ES (in terms of synergies and trade-offs). A basic check list of ES, mostly based on the MA classification, is displayed in the **Table 3**.

Category	Services	Examples
Provisioning	Food	Production of algae, invertebrates, fish, wild game, fruits, grains
	Fresh water	Storage and retention of water Provision of water for irrigation and for drinking
	Fibre and fuel	Production of timber, fuelwood, peat, fodder, aggregates
	Biochemical products	Extraction of materials from biota
	Genetic materials	Medicine Genes for resistance to plant pathogens
	Ornamental resources	Ornamental species
Regulating	Climate regulation	Regulation of GHG, temperature, precipitation, other climatic processes Chemical composition of the atmosphere
	Hydrological regimes	Groundwater recharge and discharge Storage of water for agriculture or industry
	Biological regulation	Resistance of species invasions Regulating interactions between different trophic levels Preserving functional diversity and interactions
	Pollution control and detoxification	Retention, recovery and removal of excess nutrients and pollutants (in air, water and soils)
	Erosion protection	Retention of soils and prevention of structural change (e.g. coastal erosion, bank slumping)
	Natural hazards	Flood control Storm protection
Cultural	Spiritual	Personal feelings and well-being Religious significance
	Cultural diversity	Inspiration for culture, arts and design Cultural heritage
	Recreational	Opportunities for tourism and recreational activities
	Aesthetic	Appreciation of natural features
	Educational and knowledge	Opportunities for formal and informal education and training Information for cognitive development
Supporting	Biodiversity	Habitat for resident or transient species Gene pool protection
	Soil formation	Sediment retention Accumulation of organic matter
	Nutrient cycling	Storage, recycling, processing, and acquisition of nutrients
	Pollination	Support for pollinators

Table 3 A check list of ecosystem services

Source: own elaboration based on MA (2003, 2005) and TEEB (Kumar, 2010)

ES provide humans with a variety of benefits. These can be measured or assessed through the specific goods and services that depend on one ES or a combination of them. Alternatively, we could also identify the dimensions of the efforts put by human societies in order to manage such ES. Both ways allow us *to ascertain the value of ES*.

We use the term **costs of ES management** to designate the socio-economic means put at the service of the desired performance of ES (or ES production). This can be done by inducing changes in the state of ecosystems in a way that a specific ES is boosted (e.g. soil conservation practices, aquifer replenishment), or by applying different forms of human-made capital to use an ES more efficiently (e.g. technical progress applied to hydropower production). We could also account for relevant opportunity costs when using a particular ES. This bring us to the idea that there could be trade-offs between ES uses. For example, agricultural practices can exploit more effectively the food production services at the cost of losses in the regulating services (in terms of water purification or soil retention). The trade-off can also be expressed over time, for instance in the case of overfishing, which reduces the feasibility of the food provision or angling recreation in the future. There are also possible synergies. Reducing pesticide use in low inputs agriculture increases pollination services.

It must be emphasized that not all cost must be estimated in money terms. Time allocation and energy analysis can be helpful to represent the way how societies organise their efforts for the management or ES. The account of labour or energy required to take advantage of a given ES can be used as a form of valuation, since indicates the investment that the society is willing to do for the ES provision.

The assessment of ES management costs entails identifying actions taken for the use of ES, which will differ in every society. These actions may encompass either diverse forms of time use, monetary expenses or other types of investments for the use of ES. It is also necessary to understand what the most appropriate measurement standard will vary according to the local conditions, and to differentiate the costs that can be monetised from those that cannot.

The benefits of ES management are the specific constituents of human well-being that are obtained through the use of ES (or ES consumption). They are socio-economic material and non material outcomes that are directly inputted into (market or non-market) consumption or production processes, and can be expressed through measurable indicators. Some of them can be transformed to monetary values, particularly those related to provisioning services. However, forcing the commensuration (i.e. the attribution of monetary values) of ES should not be a generalised strategy. As in the case of ES management costs, the local context should point out to the most appropriate measurement standard for such benefits.

Since we have associated the benefits of ES management with ES use, we shall accept that both current an option uses are similarly relevant. However, we recommend accounting for option uses that are plausible given the recognised driving forces in each research area. For example, if the aesthetic quality of an area makes it a good candidate for tourism development, we should properly look at the driving forces operating in that area to elucidate whether tourism is a reasonable option use in that case.

4.1 The Water Framework Directive in the EU

The Water Framework Directive (WFD, 2000/60/EC) sees water not only as a resource but as a basic element for the ecosystems. The idea is that a better state of the aquatic ecosystems will result in an increased quality and quantity of available water. For this reason, the Directive has become a driver of ecological restoration, setting specific normative objectives to be achieved according to a precise calendar. The WFD urges the states of the European Union to maintain and improve the ecological quality of water bodies, applying cost-effective measures.

This influential piece of legislation is relevant in the context of this report because it increased very much the social visibility of the environmental services provided by rivers and other water bodies. Rivers are not merely sources of money in the form of water abstraction, hydroelectricity, fisheries, sand, and commercial or recreational navigation. They have environmental functions and provide environmental services which go also much beyond the evacuation and dilution of waste.

The WFD's objective is the achievement of appropriate quality in rivers and water bodies regarding chemical pollution, hydro-morphological characteristics, and ecological or biological quality. How much will it cost to achieve or maintain such qualities, and who will pay for it?

For chemical pollution, there is already a tradition of setting norms. But ecological quality demands other characteristics not so easy to capture: preservation of biotic integrity, prevention of bioinvasions, or maintenance of environmental flows. As no absolute standards for biological quality can be set which apply across Europe, because of ecological variability, the norms must allow slight departures from the biological community which would be expected in conditions of 'minimal' anthropogenic impact. There is not a single figure that is both scientifically and socially validated and therefore stakeholders should have a role in determining how the objectives are expressed in practice.

Moreover, the WFD asks that the fees charged for water management are set according to 'full cost recovery' principle. In practice they must be sufficient to pay for the costs of water management so that the (roughly defined) objectives are achieved through consumers' payments. Each large river basin must come up with a management plan.

One of the authors of this report worked for four years in the government agency in charge of implementing the WFD in Catalonia. Social conflicts arise on the biological quality norms to be established (in a process of post-normal science, because there is no total scientific certainty on the relevant issues), also on the access to the available products and services (e.g. irrigation against hydroelectricity against urban water supply), on the geographical distribution of water (interlinking of river basins), and on the costs to be paid for by consumers

and the profit margins allowed for the private or public suppliers. The conflicts are on the 'property rights' on the access to water and its products and services.

According to the WFD, no economic comparison is involved between the values of the provisioning, recreational, cultural, and habitat services on the one hand, and the costs of keeping the water bodies and rivers in their appropriate state, on the other hand. The approach is that of cost-effectiveness, not that of CBA.

Fig. 8
The Ter River crossing Sant Quirze de Besora, Catalonia, Spain
Photo credit: David Gaya

4.2 The Yasuni ITT initiative in Ecuador. Keep the oil in the ground

The bad experience with oil extraction in the Amazon plus the debates on climate change, led the environmental justice organization *Acción Ecológica* and the Oilwatch network to propose a new initiative in Kyoto (Oilwatch 1997). It would be a good idea to leave oil in the ground in areas of high biological value and threatened indigenous populations. This was in the aftermath of Texaco's disastrous legacy in Ecuador and of the killing of Ken Saro-Wiwa and other Ogoni activists in Nigeria by the military dictatorship in 1995 because of their complaints and actions against Shell.

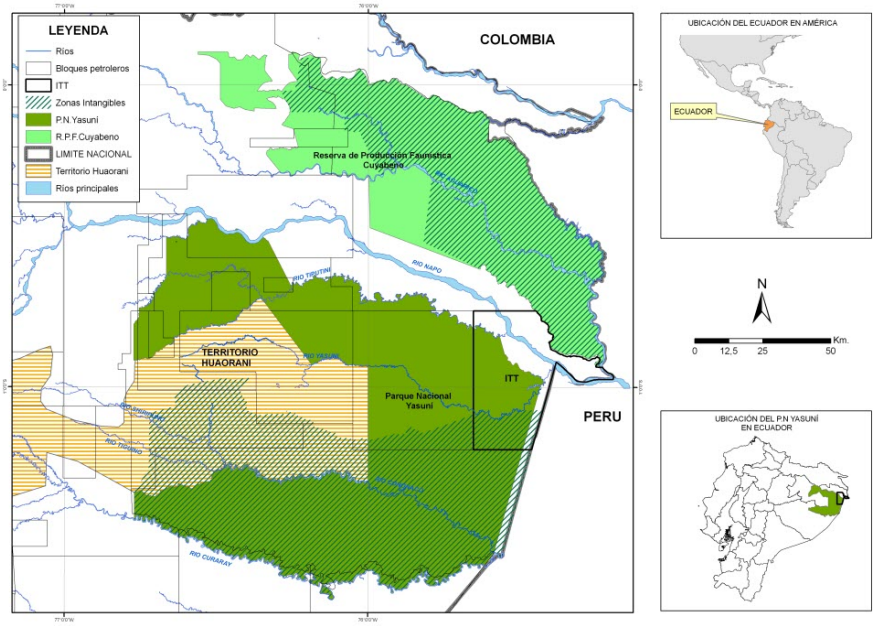
Coal, oil and gas cannot be extracted from the ground and burnt at the present speed because this causes climate disruption. In which areas should the fossil fuels be left in the ground? The answer is that in areas where the associated damage values (in their monetary or non-monetary expressions) are highest.

Leaving oil in the ground in the Yasuni ITT (Ishpingo-Tambococha-Tiputini) fields in Ecuador respects local indigenous rights, avoids deforestation and has a beneficial side-effect: preventing CO_2 emissions of about 410 million tons (similar to Spain's emissions for 2008). These emissions have no local effects, they would arise from the oil that would be burnt eventually.

The moratorium proposed by Oilwatch in 1997 was transformed into public policy after Rafael Correa became president of Ecuador in 2007. Two of his closest collaborators were Alberto Acosta, Minister of Energy and Mines (until June 2007, then President of the Constituent Assembly to the end of 2008), and Fander Falconí, Secretary for Economic Planning and then Minister for Foreign Relations (until January 2010). Acosta put forward officially the Yasuni ITT initiative in early 2007, against the idea of selling the approximately 850 million of barrels of heavy oil from the ITT fields. This represents one-fourth of Ecuador's oil reserves. The Yasuni is biologically an extraordinarily rich area, which as a National Park is excluded in principle from oil exploitation. It is also a refuge for some Waorani peoples in voluntary isolation, the Tagaeri and Taromenane.

Ecuador would keep the oil in the ground. Revenue from selling the oil, counted at present value, would perhaps reach USD 7,200 million. A Trust Fund under UNDP management and with Ecuador's representatives in the majority in the management council was set up on 3rd August 2010. Ecuador was ready to make this sacrifice but asked the outside world to contribute to it (USD 3,600 million, over 10 years) on the grounds that Ecuador is contributing to world objectives by this scheme. Ecuador is asking therefore for only half the estimated opportunity cost (Larrea and Warnars 2009; Rival 2010).

Fig. 9
Location of the Yasuni ITT initiative
Source: Yasuni ITT official web page (http://yasuni-itt.gob.ec)



Is the Yasuni ITT initiative an example of PES? An equivalence may be established between the outside compensation asked for, and the avoided carbon dioxide emissions from oil burning, from local gas flaring and from local

deforestation. Assuming outsiders to come in with USD 3,600 million, they could be considered to be buying (not transferable) 'carbon credits' in the 'voluntary market' at about USD 8 per ton of carbon dioxide from avoided oil and gas burning. (Aside, there are different estimates of the local deforestation avoided, oil companies claiming that forest destruction would be minimal). This is one of the points made, for instance by Vogel, 2010.

However, it is interesting that when the German parliament, the Bundestag, in June 2008 gave support to the Yasuni ITT proposal, it did not mention carbon credits. It mentioned biodiversity values and human rights. Ecuadorean environmentalists hate trade in carbon credits (from Ecuador's own experience with the Dutch FACE[6] project) (Acción Ecológica 2003), they do not want the Yasuni ITT to be interpreted as the buying of carbon credits. It is not to be seen either as the payment for a bundle of services provided by the Yasuni ITT "natural capital". They like to think that the outside contribution would be a payment on account of the rich countries' ecological debts, and also by virtue of the principle of co-responsibility enshrined in the 1992 Rio de Janeiro climate change treaty.

Whatever the final outcome, the idea itself could be applied elsewhere[7]. It has given rise to a new verb in Spanish, *yasunizar*. Environmentalists believe that this scheme should be replicated (for oil, for coal, also more recently for shale gas projects), as described in the slogans

> "*Leave the oil in the soil,*
>
> *leave the coal in the hole,*
>
> *leave the tar sands in the land*"
>
> (Nmimo Bassey, Klimaforum09)

In summary, the two cases in this section (which we follow closely together with EJOs involved) analyse the public policy measures taken to avoid the disruption of ecosystem functioning and ecosystem services provision. In both cases we see how economics has a role in biodiversity protection, but the economic analysis does not entail the commensuration of the benefits of biodiversity. Rather, a cost-effectiveness analysis is applied. By the same token, other possible methodological options that allow a representation of diverse biophysical flows involved would be multi-criteria evaluation (Munda 2008) or other forms of non-monetary assessment, like energy flows accounting. In any case, the objective of protection entails normative conventions on the state of the ecosystems.

Nevertheless in these contexts, as for instance in the Yasuni ITT initiative, the interpretation in terms of defence of ecosystem functioning and ecosystem services is contested by some of the main social actors (Acción Ecológica, 2003). They argue that the initiative is not so much geared to carbon absorption or

[6] Forest Absorption of Carbon Dioxide Emissions.

[7] As explained in EJOLT report 6.

biodiversity conservation as to respect for indigenous rights and also the Rights of Nature. This leads us to the third approach introduced in the next section.

5 The plurality of values in decisions on biodiversity

This section considers three instances where the destruction of the environment is challenged by local actors who argue in terms of livelihood needs and/or cultural values or who bring ancestral or new constitutional rights into the argument. Such values and rights cannot be traded off for money. One case features Afro-Ecuatorian communities defending their right to use the mangroves sustainably against shrimp farmers supported by the government. The second case is the famous conflict of the Dongria Kondh in Orissa against the Vedanta bauxite mining company. Finally, we consider a very recent legal case in Ecuador on the Rights of Nature as enshrined in the new Constitution of the country.

5.1 Back to the mangroves: shrimp farming vs livelihood

How to make the loss of mangroves more visible to the public at large and to public policy makers? Could mangroves be saved through chrematistic valuation and payment for environmental services as shown above in **Section 3**? Another type of comparison between mangrove conservation and shrimp farming could be carried out by multi-criteria evaluation, taking into account a variety of incommensurable dimensions expressed in quantitative units or qualitative descriptions. Such a multi-criteria assessment would include some monetary figures. However, would not the insistence on money valuation undermine other valuation languages? Who has the power to impose or to discard valuation languages?

A response to these questions came from a woman in Muisne, Ecuador, in 1998, quoted by Martinez-Alier (2002: ch. 5). She explained the reasons why the *concheras* (shell and crab collectors) and *carboneros* (charcoal makers) defended the mangroves against the *camaroneros* (shrimp farm owners).

"…*they want to humiliate us because we are black, because we are poor, but one does not choose the race into which one is born, nor does one choose not to have anything to eat, not to be ill. But I am proud of my race and of being conchera. Now we are struggling for something which is ours, our ecosystem, but not because we are professional ecologists but because we must remain alive, because if the mangroves disappear, a whole people disappears, we shall no longer be part of the history of Muisne…we shall eat garbage in the outskirts of the city of Esmeraldas or in Guayaquil, we shall become prostitutes…We think, if the camaroneros who are not the rightful owners nevertheless now prevent us and the carboneros from getting through the lands they have taken, not allowing us to get across the swamps, shouting and shooting at us, what will happen next, when the government gives them (legally) the lands, will they put up big 'Private Property' signs, will they even kill us with the blessing of the President?*"

The *conchera* did not use economic theory to defend the mangroves. Neither did she call explicitly for any kind of multi-dimensional assessment. She used the valuation languages relevant in her culture. She argued in terms of livelihood needs and of ancestral property rights. We could add that she argued in terms of what in the United States would be called environmental justice against 'environmental racism'. Notice that she did not say the mangroves were sacred in her culture, because they are not, and this is in contrast to the following case in Orissa in India.

Fig. 10
Shell collectors defend the mangroves against shrimp farming, Ecuador
Photo credits: Martina Leon

5.2 The defence of the Niyamgiri Hill

In the mountains of Orissa there are deposits of bauxite of a total present value said to exceed India's GDP for one year (Padel and Das 2010). Bauxite mining has also given rise to protests in countries such as Vietnam. Open cast mining is practiced. The ratio of bauxite to alumina is 3 to 1. In the Bayer process, bauxite is 'digested' by washing with a hot solution of sodium hydroxide. The other components of bauxite do not dissolve. The mixture of solid impurities is called red

Against the logic of money, the peasant and tribal languages of valuation go often unheeded

mud, and presents a disposal problem. Next, the aluminium hydroxide solution is cooled, and it precipitates as a white, fluffy solid. Then, when heated to 1050°C (calcined), the aluminium hydroxide decomposes to alumina: large inputs of electricity and water are required. The alumina so produced is then subsequently smelted to produce aluminium. The demand for aluminium is growing quickly in the world. India's per capita consumption is a little more than 1 kg per person/year while in the United States it is 25 kg person/ year (Padel and Das 2010).

In 2002 Sterlite-Vedanta (domiciled in London) started to acquire land in Lanjigarh (Kalahandi, Orissa). There were the first complaints by tribal peoples. The sacredness of the Niyamgiri hill with its beautiful sal (*Shorea robusta*) forest immediately became relevant. There was a Memorandum of Understanding between Vedanta and the government of Orissa. The Lanjigargh refinery would be built (and it was built), bauxite would come initially from distant mines by train and truck, but it was foreseen that bauxite from the nearby Niyamgiri would be exploited at the top of the mountain on 660 ha, to the tune of 3 million tons per year for 25 years. In 2006, after some displacement of local people and destruction of a small forest, Vedanta started operating the Lanjigargh refinery, dumping red mud as waste, using bauxite from far away. After court appeals and much social unrest, in August 2010, the then Minister of Environment and Forests, Jairam Ramesh, basing himself on the findings of the so-called Saxena Committee, decided against giving permission to Vedanta for mining bauxite from the nearby Niyamgiri hill. Specifically, it was argued by the Minister in a striking decision that tribal people's rights to previous consultation and consent for taking up their forests had not been respected and indeed had already been violated by Vedanta.

As Temper and Martinez-Alier (2007) argued, how many tons of bauxite is a tribe or a species on the edge of extinction worth? And how can you express the relevant values in terms that a minister of finance or a Supreme Court judge can understand? Against the logic of rupees or dollars, the peasant and tribal languages of valuation go often unheeded. These include the language of territorial rights against external exploitation, the ILO convention 169 which guarantees prior consent for projects on indigenous land, or in India the protection of the adivasi by the Constitution. Appeal could be made also to ecological and aesthetic values. The Niyamgiri hills are sacred to the Dongria Kondh. Emphasizing the incommensurability of values, we could shockingly ask them: How much for your God? How much for the blessings provided by your God?

5.3 The rights of Nature, a rising language

The widening of the Vilcabamba-Quinara road, in southern Ecuador, dumped large quantities of rock and excavation material in the Vilcabamba River (**Fig. 11**). For three years before 2011, this project promoted by the Provincial Government of Loja was underway without studies on its environmental impact, provoking a risk of disasters from the growth of the river with the winter rains.

Fig. 11
Materials dumped in the Vilcabamba River (2011), as shown in the court case
Source: Global Alliance for the Rights of Nature (http://therightsofnature.org)

Article 71 of the Ecuadorian Constitution of 2008 establishes that any person, community or nationality will be able to claim from the public authorities the respect to the rights of Nature. The environmentalists Richard F. Wheeler and Eleanor G. Huddle demanded the observance of this provision in the case of the Vilcabamba River. On March 30, 2011, the Provincial Court of Justice of Loja granted by first time a Constitutional injunction in favour of the plaintiffs, setting a historical precedent of the enforcement of the Rights of Nature (Greene 2011).

Note that in this case, the Ecuadorian constitution expresses a collective structure of preferences that in economics would be classified as lexicographic. This means that no amount of any other good or service can compensate for the loss of the Rights of Nature.

Notice that lack of “trade-offs” also applies to the 1973 Endangered Species Act of the United States requiring that Federal agencies insure that any action authorized, funded or carried out by them did not jeopardize the continued existence of listed species or modify their critical habitat. In principle, no monetary valuation was involved of the costs and benefits of such actions.

As Funtowicz and Ravetz (1994) wrote, the question is not whether economic value can be determined only in existing markets, inasmuch as economists have developed methods for the monetary valuation of environmental goods and services or of negative externalities outside the market (as abundantly shown in the TEEB reports). Judges also give monetary values when the context requires it as in the Chevron-Texaco case (relying sometimes on economists’ advice). Rather, the question is whether all evaluations in a given conflict where biodiversity and livelihoods are threatened (bauxite extraction in Orissa, mangrove destruction in Ecuador) can be made in a single dimension of value. This should be rejected favouring instead the acceptance of a plurality of incommensurable values. What the cases of the Dongria Kondh and the position of the *concheras* in Ecuador also show is that the local poor people (indigenous or not) are often on the side of conservation because of their livelihood needs and their cultural values.

6 Conclusions

Rather than an 'externality' that we could internalize into the price system, often we have cases of 'successful shifting of costs' to future generations and to other species, and to poor and indigenous people today

Conservationism as a social endeavour has a long history. Conservation Biology is a more recent field of science studying threats to biodiversity and the social institutions that are useful to preserve biodiversity, from 'sacred groves' to natural parks and lately to PES. Perhaps paradoxically, the conservation movement and the associated sciences have grown precisely as biodiversity has been lost over the last fifty years (Kumar and Martinez-Alier, 2011).

Which are the causes of biodiversity loss? For some analysts, the main point is that avoiding the loss of a public good requires the alignment of incentives and rewards among the different actors who play different games. For other analysts, the answer would parallel Nicholas Stern's famous description of climate change as 'the greatest market failure ever'. But rather than an 'externality' that we could internalize into the price system, what we have are cases of 'successful shifting of costs' to future generations and to other species, and to poor and indigenous people today. In our view, more attention should be placed on the driving forces than on the price pattern. Moreover, if the monetary returns of conservation are low in the short run, and if the logic of conservation becomes purely a chrematistic logic, conservation might be ever more threatened than before.

In this report we have discussed three approaches to make biodiversity loss more visible so as to better defend it. We have drawn upon recent cases in which we have been (to some extent) personally involved, to show how different social actors use or refuse one approach or the other according to the social context.

The first is the route of the CBA, as Edward Barbier has often tried to do when assessing the costs of mangrove destruction against the benefits of shrimp farming. This is very much featured in the TEEB reports that argue in favour of money valuation of losses of ecosystem services (at the margin) in order to impress policy makers with the importance of nature conservation. The main idea was less to put biodiversity in the market (although this is also part of TEEB, as in its praise for 'habitat trading') than to give notional monetary values to the loss of ecosystem services in order to make biodiversity socially more visible (to those who think mostly in terms of money). Why not? But is it technically feasible? And, could be it counter-productive? Which social organizations and forces (conservationists, environmental justice networks, business, governments) favour or oppose economic commensuration, and why?

The second path insists on the increasing importance (the "value") of the products and services provided by ecosystems. One could expect public policies to be guided by the desire to avoid loss of valuable ecosystems without need for money valuation. Shall we then assess the (actual and future) effects of preservation of biodiversity in a cost-effectiveness or multi-criteria framework?

The third approach consists in acknowledging the "bottom up" plurality of the values in the ecosystems, and applying deliberative techniques (which allow for decisions that acknowledge the incommensurability of values). Perhaps the approach that is the most effective to defend biodiversity is this appeal to the plurality of values. Moreover, environmental values are not more widespread in rich countries and among rich people than in poor countries and among poor people (Martinez-Alier 2002). Thus, the Dongria Kondh (provisional?) success (together with their allies) is only one more example of struggles in India and elsewhere in defence of Nature against mines, dams, tree plantations and agrofuels, by poor and/or indigenous peoples deploying non-monetary values such as livelihood, territorial rights, indigenous identity, local democracy, or sacredness of the land. Aesthetic and ecological values are also relevant. Similarly, the Rights of Nature may be brought into decision making.

In general the Conservation movement favours since 1992 and still today the monetary valuation of ecosystem products and services, while the Environmentalism of the Poor tends to appeal to non-economic values. However, as we have shown in this report, real life situations are not so clear cut. In a forensic context monetary valuation might become the common language to all parties. Climate justice activists are not against monetary calculation of the so-called "ecological debt". While the MA wisely refrained from adding money valuation to its outstanding descriptions of the state of the world's ecosystems, the TEEB report focused very much on money valuation but it also introduced the notion of the GDP of the Poor, whose significance is badly captured in monetary terms. An environmental justice organization may ask in the morning for a proper CBA to be carried out (perhaps applying Krutilla's rule that will favour conservation) while in the evening it will perhaps remember the sacredness of the forest or the river under threat.

To conclude, we may write, 'shrimp [or bauxite or oil] are valuable items of world economic production and trade', and also, 'valuable ecosystems and valuable local cultures are thereby destroyed'. Monetary valuation of all goods produced and environmental services lost (discounted at present value) as in CBA, may be recognized as one legitimate perspective among several, that reflects real power structures. But it is not the only legitimate perspective. Who has then the power to simplify complexity, imposing a particular standard and procedure of valuation? In this report we have presented instances that point at suitable uses of each one of the three approaches under consideration.

In a forensic context monetary valuation might become the common language to all parties. But poor and/or indigenous peoples may deploy non-monetary values such as livelihood, territorial rights, indigenous identity, local democracy, or sacredness of the land. Aesthetics, ecological values and the Rights of Nature are also relevant languages of valuation

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