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# 1 OPINION

## 2 Have Ecosystem Services been oversold?

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5 **The concept of ecosystem services (ES) neatly encapsulates the ways in which**  
6 **human society depends upon the existence and functioning of nature, but also draws**  
7 **power by chiming with dominant neoliberal ideology. Scientific paradigms such as**  
8 **this have an inherent tendency to stop adherents from recognising alternative**  
9 **approaches. It is high time to examine whether the concept is being oversold with**  
10 **potentially damaging consequences. Many authors have questioned the monetisation**  
11 **of ES, but the origin of the problem lies deeper in anthropocentrism. By illustration**  
12 **with alternatives, I attempt to show how the ES paradigm has constrained thought,**  
13 **particularly towards the monetisation and financialisation of nature, even when many**  
14 **ecologists and others oppose this trend.**

### 15 **From metaphor to tradable commodity**

16 Since 2005 when ecosystem services were given prominence in the Millennium Ecosystem  
17 Assessment [1], the concept has become the dominant paradigm framing research and  
18 policy making in biodiversity, ecology and conservation biology. At the same time, major  
19 nature conservation organizations have refocused their missions towards the needs of  
20 humans [2] and 'Nature' has now been redefined as 'Natural Capital' [3]. Scientific concepts  
21 change over time and it is instructive to look back at how 'ecosystem services' developed  
22 from Arthur Tansley's original idea of the 'ecosystem'. Tansley's 1935 paper [4] provided us  
23 with the abstract concept of nature that was necessary to start thinking about function (Table  
24 1). Once ecosystem functions were defined, they could become commodified, valued and  
25 then monetised. The idea that nature has a use value has historical roots in philosophy and

26 economics. Classical economists recognised nature as a source of use value, but attributed  
27 the exchange value belonging, for example, to a stand of trees as deriving from the  
28 ownership of the land on which the trees stood or to the labour involved in turning them into  
29 merchantable timber, not directly to the trees themselves [5]. In the same vein, when the  
30 term 'ecosystem services' was first employed for pedagogical purposes in the ecological  
31 literature of the 1980s, it was usually as a metaphor for the use value of nature. Valuing  
32 nature does not necessarily mean monetising it, but it seems that the two are hard to  
33 separate. Attempts had already been made in previous decades to place a monetary value  
34 on "nature's services" [6], for example in order to estimate the external cost of damage done  
35 by pollution [7].

36 Table 1 here

37 The transformation of ecosystem services into exchange values, which has now reached  
38 industrial proportions, continues to be motivated by the idea that nature will benefit if the  
39 external costs of actions that exploit or damage ecosystems are made explicit [8]. Nature will  
40 then 1) be preserved on account of its recognised true exchange value, 2) gain if the higher  
41 price in the market caused by including external costs reduces demand for the damaging  
42 activity and/or 3) be compensated to restore damage. This is the logic variously behind the  
43 Payment for Ecosystem Services programme of the Global Environment Facility [9], carbon  
44 and emissions trading [10], and the REDD+ programme (Reducing Emissions from  
45 Deforestation and Degradation) [11]. Once markets in a commodity exist, it is but a small  
46 and seemingly inevitable step to financialisation (Table 1), in which derivatives of the  
47 underlying ecosystem services become tradeable assets.

48 Table 2 here

49 A milestone in the monetisation of ES was reached in 1997 when Costanza *et al.* [12]  
50 published a dollar estimate of the value of the ecosystem services of the entire planet (Table  
51 2). Clearly anticipating that the validity of the exercise would be challenged, the authors  
52 contended that "although ecosystem valuation is certainly difficult and fraught with

53 uncertainties, one choice we do not have is whether or not to do it." This explicit statement  
54 illustrates how the Monetised Ecosystem Services (MES) paradigm seeks to define the  
55 legitimate boundaries of thought. Although Costanza et al. were heavily criticised and even  
56 derided [13], the paper went on to be cited more than 4,000 times and the global estimate  
57 was updated and the imperative to monetise was reiterated by Costanza et al. in 2014 [14].

## 58 **Alternatives**

59 Contrary to the claim that there is no choice about how we define nature, there are clear  
60 alternatives to each one of the conceptual developments that has taken place, from  
61 Tansley's initial abstraction to the current trend of financialisation (Table 1). Whether one  
62 believes that any of these conceptual developments is right or wrong, it is important to  
63 appreciate that all have involved choices that have, often invisibly, shaped our thinking about  
64 nature.

65 In his book *What Money Can't Buy* [15], political scientist and philosopher Michael Sandel  
66 argues that society can and does choose not to place a price on certain things and that it is  
67 morally right to reject market valuation in a range of important cases. For example, people  
68 are not allowed to sell their organs or their children. These have an intrinsic value that is  
69 beyond price. Sandel discusses how the political dominance of neoliberalism - the  
70 philosophy that seeks the de-regulation of markets and the privatisation of all possible goods  
71 and services - has caused market concepts and practices to enter more and more areas  
72 where once they were absent or even anathema. He argues that markets degrade certain  
73 goods and practices by turning them into commodities. For example, the possibility that  
74 nature has intrinsic, existential value of its own that is independent of its use to humans  
75 cannot be accommodated by the market since nature itself is not an actor in that market.  
76 Nature is devalued by monetisation. All non-commercial notions are invisible to "the one-  
77 eyed imperatives" of capital [16].

78 Box 1. Make-believe markets, about here

79 Ecological economists can go to great, one might even think absurd, lengths to try to make  
80 the invisible visible (See Box: Make-believe markets). Biodiversity and ecological complexity  
81 can easily become casualties of the market's need for a single number that represents  
82 value. In 2012, one of the lead authors of the Millennium Ecosystem Assessment  
83 complained in an article in this journal that the role of species in supplying the services that  
84 ecosystems provide was being obscured by a confusion between biodiversity and  
85 ecosystem services. Mace et al. [17] wrote that "In some cases, the two terms (biodiversity  
86 and ecosystem services) are used almost synonymously, implying that they are effectively  
87 the same thing and that if ecosystem services are managed well, biodiversity will be retained  
88 and vice versa." Addressing the same issue, Peterson et al. [18] argue that obscuring the  
89 role of the biota in ecosystems is a direct consequence of replacing the concept of  
90 ecosystem function with that of ecosystem services.

91 Sandel [15] demonstrates that the decision to attach a price to something is ultimately a  
92 moral choice, not a scientific, logical or even economic imperative. This is of course at  
93 variance with the MES paradigm that insists that we have no such choice [12]. The issue of  
94 whether monetisation is essential or not defines two different approaches to ecosystem  
95 services. On the one hand where monetisation is optional, it is used mainly as a metaphor,  
96 while on the other monetisation is the very purpose of redefining ecosystem functions as  
97 ecosystem services. If we follow Sandel's argument that monetisation is an option not an  
98 imperative, we can then ask when it is appropriate to monetise and then use the approach  
99 pragmatically [19].

## 100 **Do markets actually protect biodiversity and ecosystem function?**

101 The acid test of the MES paradigm is whether placing a price on biodiversity and ecosystem  
102 function actually leads to greater protection and improvement, or merely puts a price on  
103 destruction. The literature contains a great many examples of the monetary valuation of  
104 ecosystem services made in order to demonstrate ES value [20], but the evidence that this

105 monetisation has itself resulted in benefits that would not otherwise accrue is almost always  
106 missing. Perhaps the largest number of case studies has been collated by the TEEB project  
107 (The Economics of Ecosystems and Biodiversity) which has summaries of 122 MES  
108 initiatives from all over the world on its website [21]. Most of the TEEB case studies were  
109 compiled in 2010 when the main TEEB report was published [22] and very few contain any  
110 evaluation of whether the projects that are described improved biodiversity or ES. The  
111 purpose of TEEB was "to show how economic concepts and tools can help equip society  
112 with the means to incorporate the values of nature into decision making at all levels" [22].  
113 Evidence that doing this would actually benefit biodiversity is absent from the report and a  
114 recent update published in 2014 is similarly lacking [23].

115 A key idea in the Millennium Ecosystem Assessment (MEA) and in the promotion of the  
116 concept of ES was that because humans are dependent upon ES, actions that protect ES  
117 can also benefit humans. Howe *et al.* [24] conducted a meta-analysis of a sample of the  
118 ecosystem services literature to test whether win-wins of the kind envisaged in the MEA  
119 were common compared to trade-offs in which gains in human welfare were made at the  
120 expense of ES. They concluded that win-wins are the exception rather than the rule and that  
121 trade-offs are more likely in situations where private interests or markets are present.

122 Many of the TEEB case studies involve monetisation for accountancy purposes only and do  
123 not involve genuine markets. It ought to be easier to tell whether monetisation has benefits  
124 in situations where actual markets exist. Two clear examples involve (1) payment for  
125 ecosystem services (PES), and (2) wildlife trade. A review of PES published in 2014 found  
126 that there was insufficient evidence to decide whether it generally works as intended or not  
127 [25]. One reason for this is that PES markets tend to be highly artificial, often being  
128 designed, or morphing into, schemes to distribute government subsidies to farmers [26]. A  
129 recognised problem with PES as a global strategy is that it rewards property owners and  
130 thereby increases wealth inequalities [27, 28], which is contrary to the principles of  
131 sustainable development.

132 The wildlife trade is undoubtedly the most absolute form of market for biodiversity and  
133 should be the best test of what critics describe as the MES strategy of “selling species to  
134 save them” [29]. The international trade in wildlife is regulated by the Convention on  
135 International Trade in Endangered Species (CITES) which restricts or bans trade in more  
136 than 30, 000 species. In 1989 the 173 parties to CITES decided to protect African Elephants  
137 by closing the international market for ivory, with the result that numbers rose by an  
138 estimated 140,000 in the 8 years following the ban [30]. Unfortunately, domestic markets in  
139 ivory continued to operate within four African states, providing poachers in adjacent  
140 countries with an outlet under the cover of the legal market. Poaching and illegal trade have  
141 now reached devastating levels that are causing a global decline in African Elephants [31]. It  
142 could be argued that this is not the responsibility of markets *per se*, but of illegal trading.  
143 However, the evidence is that markets and illegal activity are bedfellows and that even when  
144 operating within the law, large corporations rig markets for their own benefit [10]. Since  
145 2008, it has become clear that the financial markets are not immune to illegal and risky  
146 behaviour on a scale that has threatened the stability of the entire global economy. Is it wise  
147 to stake the survival of 30,000 species on a bet that they can be saved by the market, legal  
148 or otherwise?

149 Indeed, even within the MES paradigm itself it is recognised that speculators could profit  
150 from the increasing rarity of valuable species as this would increase their price in the market  
151 [32]. There is a market in extinction. This has already brought Bluefin Tuna and Black Rhino  
152 to the brink and is possibly doing so now for African Elephants. Ultimately, if there is a  
153 market for a species, or if it occupies habitat where the land would be more valuable housing  
154 people or corporations, then market efficiency can dictate its extinction [33]. From a MES  
155 perspective, the logical answer to this situation would be for those who want to save  
156 threatened species to put their money where their mouths are and outbid the threat –  
157 effectively paying for the preservation of the desired ecosystem service (PES). This does  
158 occur when land for nature conservation is bought on the open market, but it happens out of

159 necessity and it is a tactic, not a sustainable global strategy. If it were to become a strategy,  
160 we should have to accept that nature is a private resource and not a public good and that we  
161 can only have the nature that we can personally afford. As ever with markets, the poor will  
162 be further impoverished [34].

163 There is another important difference between one-off tactical purchases of habitat to protect  
164 ES and strategic MES. Tactical purchases, for example to add land to a national park or  
165 protected area, can achieve permanent protection against present and future threats. In  
166 contrast, strategic MES can achieve short-term protection, but also exposes biodiversity and  
167 ES to the vagaries of the market. Some iconic examples of MES have fallen foul of this  
168 hazard. Mexican free-tail bats feed on aerial insects including pests of cotton in the  
169 southwestern United States. The value of pest-control by bats was estimated to be \$23.96  
170 million in 1990, but falls in the price of cotton and the introduction by farmers of bt-varieties  
171 that are engineered to be resistant to caterpillars combined to reduce the value of this  
172 service to only \$4.88 million in 2008 [35].

173 In Costa Rica, a study found that coffee plantations benefitted from lower levels of pests  
174 when surrounding bird habitats were preserved. Then, a fall in the market price of coffee  
175 caused farmers to switch to growing pineapples instead and forest habitats as well as coffee  
176 plantations were replaced with the more profitable crop [29]. There is a close parallel  
177 between MES today and the field of economic ornithology which flourished in the 1880s -  
178 1920s. This sought to monetise the value of wild birds in pest control and a wide range of  
179 other services, from use as carrier pigeons for the military to supplying the ingredients of  
180 birds' nest soup [36]. Unlike MES, economic ornithology explicitly recognised that wild birds  
181 could be economically injurious, for example in carrying disease. Economic ornithology had  
182 some success in controlling the wanton destruction of wild birds, but its main *raison d'être*  
183 was destroyed by the introduction of chemical pesticides. The clear lesson from both the  
184 historical and contemporary examples of MES is that relying mainly on monetised values  
185 puts biodiversity at the mercy of changeable markets and advancing technology.

186 These flawed attempts to use MES to justify the protection of biodiversity contrast with a  
187 recent success in forest protection in Britain. There, a popular mass-movement rejected the  
188 neoliberal policy of a government intent on privatising the nation's publically-owned forests,  
189 showing that democratic conservation action can get results where technocratic valuation  
190 fails (See Box 2).

191 [Box 2. Britain's forests: public or private? About here](#)

## 192 **Ecosystem Services without markets**

193 The concepts of ecosystem services and natural capital define nature in anthropocentric  
194 terms. Whether one subscribes to this anthropocentrism or not, it is important to realise that  
195 it is an ideologically-chosen standpoint and not one dictated by science, even though  
196 humans now undoubtedly dominate the planet [37]. As a development of anthropocentrism,  
197 monetisation of ES was introduced into ecological thinking as a means to connect with policy  
198 making, but it is clear that few outside the field of ecological economics believe that MES  
199 can adequately capture the multi-faceted sense in which people value nature [19, 29, 38-44].  
200 The widely-made assumption that monetisation and markets benefit biodiversity and ES has  
201 not been systematically tested against the evidence. I suggest that this fundamental tenet  
202 has remained untested because the MES paradigm holds that there is no alternative to  
203 monetising the value of nature [12, 14]. While this situation persists, the MES paradigm will  
204 remain immune to refutation and hence open to the charge that it is propaganda and not  
205 science.

206 The strong claim that we are compelled to put a monetary value upon ecosystem services  
207 [12] can and should be rejected along with the whole apparatus of make-believe markets  
208 (Box.1). If we choose to take the position, which is shared by many people, that some things  
209 in nature are without price, then it is possible to use the concept of ecosystem services in a  
210 more nuanced way to build upon the moral case for biodiversity conservation and not to  
211 displace or devalue it by monetisation [42]. Two recent surveys of the opinions of

212 professional conservationists towards ES monetisation and the market reported that most of  
213 them, including MES sceptics, were pragmatic about its use [43, 45]. From this perspective,  
214 there will be occasions when it is valid and useful to calculate the monetary value of a  
215 particular ecosystem service, but even in these cases it will be important to recognise that  
216 such valuation is contingent on market conditions. Such decisions need to be made  
217 democratically and should not be obscured by false quantification of value in markets that  
218 are at best fickle and at worst corrupt.

219 [2,982 words]

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338

339

## 340 Glossary

341 **Contingent Valuation (CV)** A method used in economics to place a monetary value upon  
342 non-market goods and services by asking people the hypothetical question of how much  
343 they would be willing to pay for them.

344 **Devaluing by monetisation** Reducing the intrinsic worth of nature by attaching a monetary  
345 value to it.

346 **Ecosystem function** The ecological processes that take place in an ecosystem, including  
347 photosynthetic fixation of CO<sub>2</sub>, decomposition, nutrient uptake and population processes at  
348 all trophic levels.

349 **Ecosystem Services (ES)** The goods and services of use to humans that are directly  
350 attributable to the ecological functioning of ecosystems.

351 **Exchange value** The price at which an item is bought and sold in the market.

352 **External cost** The cost to the environment of damage or exploitation that is not reflected in  
353 the market price of the goods or services produced. For example the price of aviation fuel  
354 does not reflect the environmental costs of burning it.

355 **Make-believe markets** All markets are social constructs, but make-believe markets exist  
356 only in the mind of the researcher who invents them to fit reality to their model instead of  
357 fitting their model to reality. Contingent Valuation is a tool that depends on make-believe  
358 markets.

359 **Monetised Ecosystem Services (MES)** Ecosystem services on which a price has been  
360 fixed.

361 **Natural capital** "Earth's lands and waters and their biodiversity." [3]

362 **Neoliberalism** A political and economic philosophy that seeks the de-regulation of markets  
363 and the privatisation of all possible goods and services. [46]

364 **Non-use value** The value of an item attributed to its existence, not to its use. E.g. the  
365 aesthetic pleasure given by wild birds. cf. Use value

366 **Payment for Ecosystem Services (PES)** A policy instrument that seeks to influence the  
367 supply of ecosystem services by payments from the beneficiaries to those controlling the  
368 supply.

369 **Public goods** Goods that are free to all and that can be consumed without reducing their  
370 benefit to others. For example, clean air and public sanitation.

371 **Revealed Preference** An indirect method of estimating the monetary value of an ecosystem  
372 service (e.g. woodland amenity) based upon how much people spend to access or travel to  
373 the site. Note that this method gives higher amenity value to a visitor who travels by car than  
374 someone who travels on foot or by bicycle, even though the former involves the least effort  
375 and is the most environmentally damaging.

376 **Use value** The qualitative value of an item due to its usefulness, as distinct from its  
377 monetary value in a free market. cf. exchange value.

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380 **Table 1**

381 Table 1. How the development of the Ecosystem Services paradigm has constrained thinking about nature and some alternatives to these  
 382 developments.

<b>Concept of nature (date of introduction)</b>	<b>Ontology</b>	<b>Transformation of the concept of nature</b>	<b>Constraint introduced by the transformation</b>	<b>Alternative</b>
Ecosystems (1935)	Ecosystem functions including nutrient stocks & cycles, energy flow.	Abstraction	Intrinsic value of biodiversity can become secondary to its generic roles in ecosystem function [18]. E.g. plants are treated merely as 'biomass'.	Explicit recognition and inclusion in ecological models & thinking of processes at the individual, population and community levels [17].
Ecosystem Services	Provisioning, regulating,	Commodification	A wholly	Conservation for

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(1980s)	cultural and supporting services [1]. See Table 1.		anthropocentric concept of nature [29].	biodiversity's sake [2].
ES Values (1990s)	Market prices, hedonic prices, travel costs, replacement costs, contingent valuation, discount rates [22]	Monetisation	Reduces the intrinsic worth of nature to that which can be monetised [39].	Broader concepts of the value of nature [42, 47].
ES Markets (2000s)	Markets in wildlife, emissions trading, Payment for Ecosystem Services, e.g. REDD+	Marketisation	Conceptualisation of environmental problems and their solution become focussed on markets, even when such markets are artificial [11].	Recognise that ES markets are rarely if ever a solution to conservation problems. Protect nature from market forces, not expose it to them.
ES-based Financial	Carbon permits,	Financialisation	Environmental	Public investment in

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instruments (2000s)	Biodiversity offsets, debt-for-nature swaps, green investment products.	objectives become secondary to financial ones [10] and control shifts from people to corporations [48].	conservation under democratic rather than market control.
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385 **Table 2.**

386 Summary of Monetised Ecosystem Services for the entire Earth calculated by Costanza et al.

387 1997 [12].

Ecosystem Service	Total global flow, \$yr <sup>-1</sup> X 10 <sup>9</sup>
Gas regulation	\$1,341
Climate regulation	\$684
Disturbance regulation	\$1,779
Water regulation	\$1,115
Water supply	\$1,692
Erosion control	\$576
Soil formation	\$53
Nutrient cycling	\$17,075
Waste treatment	\$2,277
Pollination	\$117
Biological control	\$417
Refugia	\$124
Food production	\$1,386
Raw materials	\$721

Silvertown\_EcosystemServices Revision 2-1

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388	Genetic resources	\$79
389	Recreation	\$815
390	Cultural	\$3,015
391	Total	\$33,268

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394 **Box 1. Make-believe markets**

395 A fundamental problem with ES monetisation is that there are no markets for many of the goods  
396 and services that ecosystems provide. The MES paradigm has essentially three solutions to  
397 this: 1. Invent a market, for example in carbon credits (licences to pollute), 2. Pretend there is a  
398 market and ask people how they would value ES in hypothetical situations (the Contingent  
399 Valuation method) and 3. Use a surrogate to value ES, for example the total cost to visitors of  
400 travelling by car to a natural area as the recreation value of that area (the Revealed Preference  
401 method). A significant portion of the literature on the valuation of ecosystem services is devoted  
402 to the technical issues that arise in make-believe markets [49].

403 Contingent Valuation (CV) is a method that has been widely used for decades, but its results  
404 are particularly subjective. The response of someone asked a typical survey question such as  
405 "How much would you be willing to pay towards a project that will increase the number of Red  
406 Kites in Scotland from 59 now to 200 in ten years time", not surprisingly depends upon how  
407 much time they are given to think about it [50]. It will also depend upon their disposable income  
408 and whether they can suspend disbelief in the fiction that has been presented to them. More  
409 than half the people interviewed in an Australian CV study said that they would not be willing to  
410 pay anything at all towards the protection of endangered birds, even though over 80% said they  
411 would be upset if a bird went extinct [51].

412 Such differences between people's feelings about extinction when expressed in monetary and  
413 non-monetary ways shows just how misleading ES monetisation can be. Far from protecting  
414 species by valuing them as is claimed, MES weakens the case for protection because it ignores  
415 the moral feeling people have against extinction unless they are rich and/or compliant enough to  
416 place a price upon this. A study that interviewed participants in a CV exercise after the survey  
417 had taken place found that respondents had a much more sophisticated and multi-dimensional  
418 sense of the value of nature than the Willingness-to-Pay questions that they were asked allowed

419 them to express [52]. The study authors reported that "There was a feeling of moral outrage...  
420 that a monetary sum was being used as a measure of what individuals saw as their ethical and  
421 moral values for nature." Participants rejected the idea that the CV exercise was a legitimate  
422 way in which to decide an environmental issue and wanted instead a process in which local  
423 people, scientists and policy makers could all participate through dialogue.

424 [440 Words]

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426 **Box 2. Britain's forests: public or private?**

427 Britain is one of the least wooded countries in Europe, with only 13% of land area under forest  
428 [53]. Over a quarter of this is owned or managed by the Forestry Commission which was set up  
429 in 1919 to ensure that the timber shortage that had threatened the war effort in the First World  
430 War would not recur. Large areas of land were acquired by the Commission and planted, mainly  
431 with non-native conifers. However, when the Second World War began in 1939, even the first of  
432 the new plantations were only 20 years old and the trees in them were not usable.

433 After WWII, planting continued on public and private land and felling was strictly regulated by  
434 licence in order to build up a strategic reserve of standing timber [54]. Ironically, as these  
435 plantations began to mature, the economics of forestry changed; the price of timber fell, the cost  
436 of labour increased and the need for a strategic reserve was challenged [55]. The Forestry  
437 Commission eventually altered its policy and began to manage forests for public amenity and  
438 nature conservation as well as for production. Economists used the indirect revealed preference  
439 method to monetise the amenity value of forests and found that visitors spent an estimated  
440 £53m on travelling by car to reach Forestry Commission sites compared to £71m earned by the  
441 organisation from timber in the same year [56].

442 In October 2010, the recently elected government in the UK announced that it intended to  
443 privatise the forests held by the Forestry Commission. New governments with a fresh mandate  
444 expect to have their own way, but by February 2011 a storm of public opposition and half a  
445 million signatures on a petition forced the government to abandon the policy [57]. In many ways,  
446 the two sides on this issue embody the difference between how the public values nature and  
447 how it is valued within the MES paradigm. On the one side, the public value forest for its  
448 aesthetic and non-use values and object to attempts at monetisation and privatisation (Box 1).  
449 On the other is a neoliberal government for whom the MES paradigm offers a technocratic  
450 rationale for the deployment of its natural capital. Several large nature conservation

451 organizations expressed themselves neutral on the issue of forest privatisation, taking the view  
452 that it is regulation and not ownership that matters. In fact neoliberal governments cut regulatory  
453 agencies, as the same UK government has done in the realm of nature conservation, preferring  
454 to cede control as well as ownership to private enterprise.

455 [422 words]

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